WOODLAND STEWARDSHIP PLAN

Prepared for:

Milaca School District – Milaca School Forest
500 5th Street SE
Milaca, MN 56353
320-982-7340

SW SW Section 23
NW NW Section 26
T.38N. - R.27W.
Mille Lacs County Minnesota

80 Stewardship Acres
80 Total Parcel Acres

Prepared by:

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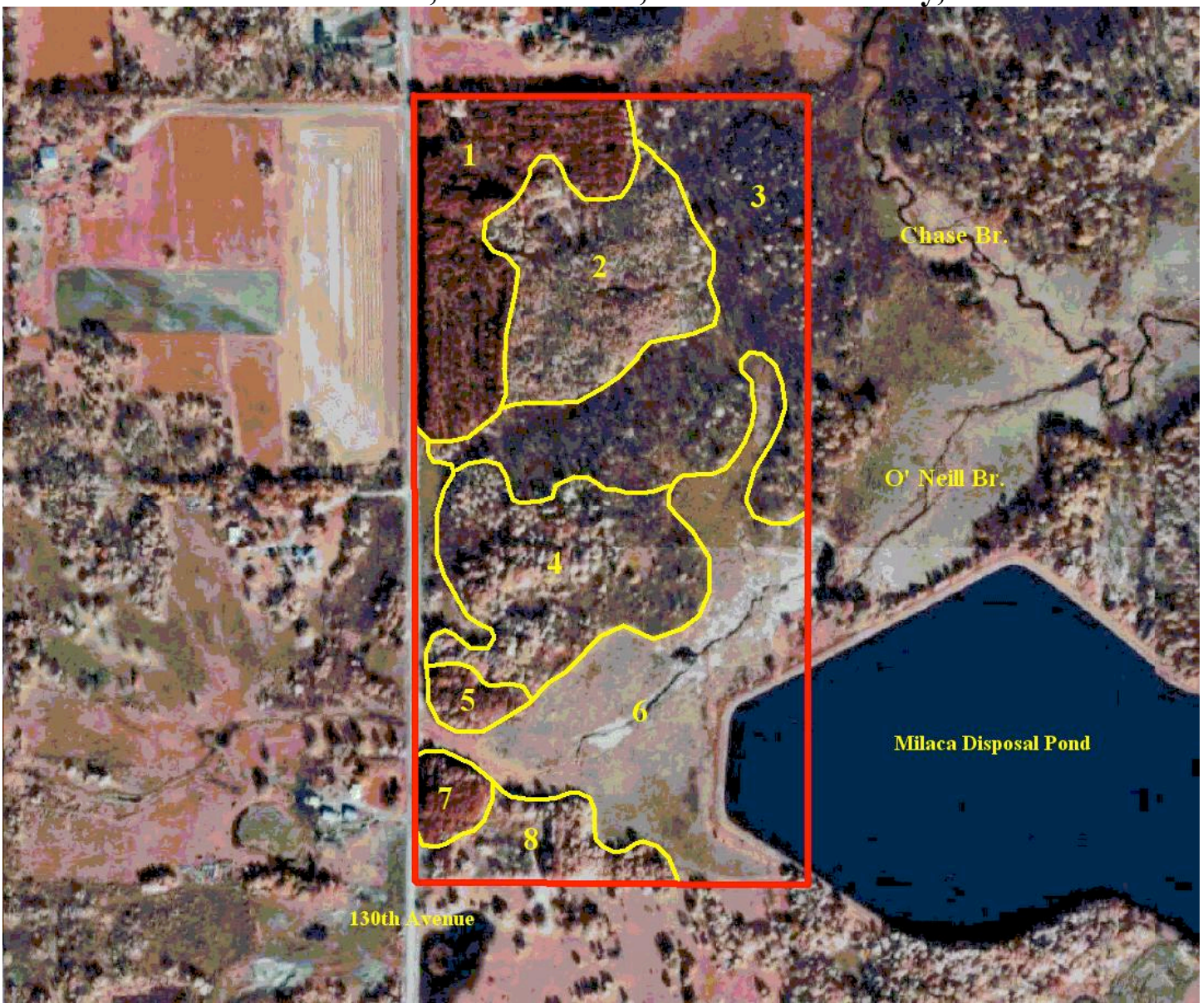
The stewardship goals you have identified for managing this property are:

- **Maintain the property to provide educational opportunities in forest management and forest ecology.**
- **Improve timber stands and encourage productive timber growth.**
- **Provide diverse habitat types.**

*The following woodland stewardship plan is designed to be a general guide to assist you with the management of the natural resources on your property. The plan is based on your goals and on the characteristics of the property. Project recommendations are offered only for your consideration. Wetlands described in the plan may not include all wetlands actually present on the property.

Cover Type Map
Milaca School Forest Woodland Stewardship Plan
Sections 23 &26, T38N-R27W, Mille Lacs County, MN



Map Legend

Property boundary

Cover type boundary

1	**Red Pine/Mixed Conifer (11 acres)**
2	**Aspen (10 acres)**
3	**Lowland Hardwoods (18 acres)**
4	**Aspen/Oak (11 acres)**
5	**White Spruce (1.25 acres)**
6	**Marsh (23 acres)**
7	**Red Pine/White Pine (1.5 acres)**
8	**Young Mixed Forest (4.25 acres)**

Scale: 10” = 1 Mile

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GENERAL PROPERTY DESCRIPTION

Location and Access:
The Milaca School Forest is located in central Mille Lacs County, approximately one mile northwest of Milaca. Primary access is from 130th Avenue which boarders the west edge of the property. Some secondary access has been developed, consisting of short stretches of logging road and considerable lengths of recreational trail. Wet areas are common and may impose some limitation on management activities.

Vegetation:
Forest cover dominates the property at roughly seventy percent, with the remaining thirty percent made up of the low marsh along O' Neill brook. Forest types are somewhat diverse including conifer plantations, aspen, oak, and lowland hardwoods. Native vegetation prior to the settlement of this area was primarily hardwood forest of oak, maple, basswood, and hickory. Conifer swamps and bogs were scattered throughout the area and a transition to white pine/hardwood forest occurred just to the north. For management purposes the property is compartmentalized as labeled on the cover type map. Cover types are delineated according to vegetation type, stand structure, and recommended treatment.

Soils and Physical Setting:
Terrain is generally level to slightly rolling with some wet depressions. Soils grade from poorly-drained silt loam to well-drained loamy sand. Variability in soil/site conditions provides opportunities to encourage a variety of tree species. Equipment use may be limited in some areas due to low soil strength. The property lies within the Rum River Watershed. For further reference a soil map is included at the end of your plan.

Interaction With Nearby Properties:
Active woodland management not only impacts your own property, but also surrounding properties. Likewise, adjacent ownerships and their management practices should be considered when developing your management plans. It can be beneficial to develop a dialog with neighboring property owners to be aware of their plans and perhaps even coordinate management efforts. By examining the arrangement of forest types and other habitat components in the surrounding area you can develop better strategies to improve forest diversity and enhance wildlife habitat.

Surrounding properties are private ownerships under various uses including agriculture, widely scattered housing development, woodlands, and numerous wetland areas. Forest types in the area are generally mixed hardwood stands of oak, maple, basswood, and aspen. Timber harvest activities are not uncommon in the area.

Wetlands are a prominent feature on the surrounding landscape and cover much of your property. It is important to remember that land management activities have the potential to affect water quality far beyond property boundaries and should be carried out with this in mind.

Cultural and Natural Heritage Information:
The State of Minnesota maintains statewide inventories of documented cultural heritage resources (historic buildings, archaeological sites, cemeteries, and traditional use areas) and natural heritage resources (rare, endangered, or otherwise significant plant and animal

species/communities). An inquiry with the Office of the State Archeologist indicated no recorded cultural features on the school forest. Results of an inquiry with the Minnesota DNR Natural Heritage Information System (NHIS) also indicated that no rare or otherwise significant natural features are listed for this, or nearby, properties.

Since neither the NHIS nor the databases of the state archeologist are the product of exhaustive inventories, lack of data does not necessarily mean that no rare features are present. If you believe the property has such natural or cultural features, please feel free to contact me about the process of further survey work.

The Landscape Region: Mille Lacs Uplands

The Minnesota map included with this plan shows our ecological landscape regions (or subsections). The actual boundaries are not as sharp as the lines might imply. In fact there can be islands of one landscape region inside another. However, there are basic ecological differences between the units.

The Milaca School Forest is primarily within the region named above and is described in more detail in the following section. The purpose of providing this "landscape region" information is to help you assemble a picture of how your land and your activities fit into the larger landscape. The conservation issues of concern are of particular note. It is likely that at least some of your activities will affect these larger scale issues.

Mille Lacs Uplands Subsection:

Discussion

The most prominent feature of this region is Mille Lacs Lake, well known for walleye fishing. Presently, forestry, recreation and some agriculture are the most common land uses.

Climate

Total annual precipitation in this subsection ranges from 27 to 30 inches, with growing season precipitation averaging 12 inches. Growing season length is quite variable, ranging from 97 to 135 days, with the longest growing season in the south and the shortest on the outwash plains at the northern edge of the subsection.

Landforms

Gently rolling till plains and drumlin fields are the dominant landforms in this eco-region. The depressions between drumlin ridges contain peatlands with shallow organic material. There is a large end moraine that was the dam for the formation of Mille Lacs Lake. In the northeast, there is another series of end moraines, which mark later advances and retreats of the Superior Glacial Lobe.

Hydrology

Major rivers running through this subsection include the St. Croix, which forms part of the eastern boundary, Kettle, Snake, Rum, and Ripple Rivers. The drainage network is young and undeveloped, with extensive areas of wetlands present. There are 100 lakes

that are greater than 160 acres in size. Most are found on end moraines.

Presettlement Vegetation

The original vegetation consisted of a mosaic of forest types. Along the southern boundary, maple-basswood forests were prevalent. The rest of the subsection was a vast mix of conifer, hardwood and mixed conifer-hardwood forests. Peatland areas were inhabited by sedge-fen, black spruce-sphagnum, or white cedar-black ash communities.

Natural Disturbance

Both fire and windthrow were important in determining the vegetation of the subsection. Windthrow was and is common because of the subsection nature. A dense layer occurs in the soil at depths of 20 to 40 inches throughout most of the subsection. Because of this, rooting depths for trees are shallow and they are subject to windthrow.

Present Vegetation and Land Use

Agriculture is concentrated in the western and southern portions of this subsection. Forestry and recreation are the most important land uses in the central and eastern part. There are large areas in eastern Pine County that are still heavily forested and relatively undisturbed, although there are no significant examples of large white pine stands remaining.

Rare Animals and Plants

Peregrine falcon, Loggerhead shrike, Bald eagle, Gray wolf, Wood turtle, and Blanding's turtle are rare animals found in this subsection. Rare plants include Ross's sedge, Ram's head lady's-slipper, Tubercled Rein-orchid, Bog bluegrass, Carey's smartweed, and Rough-seeded fameflower.

Conservation Concerns

Native American fishing and hunting rights is a major conservation issue that has received considerable attention. Other conservation concerns include tourism, timber harvesting, old-growth forest, and water quality.

STEWARDSHIP COVER TYPES

Cover Type 1 – Red Pine/Mixed Conifer

Land Area: 11.0 Acres

Cover Type Description:
This cover type is conifer plantation dominated by red pine but also includes white pine, white spruce and Northern white cedar. The trees were originally plated in the mid 1940's. Average dbh[1] of the red pine is approximately 12 inches; the white pine is slightly larger. Tree health is generally good, but there is some sign of blister rust on the white pine. Understory vegetation ranges from moderately dense to somewhat heavy. Dominant species include hazel, red elderberry, and common buckthorn. Soils grade from somewhat poorly drained sandy loam to poorly drained clay loam. The terrain is generally level. Several thinning projects have been done on this stand since it was established and tree stocking is generally good, but there are isolated areas that are too crowded.

Timber Summary				
Stand Age:	60 years	**Species**	**Avg. DBH**	**Basal Area**
Size Class:	Small Sawtimber	Red Pine	12"	85
		White Pine	14"	25
Growth Potential:	Good (R. Pine site index[2] 62)	Other	6"	3
Tree Density/Stocking:	Good (Basal area[3] 113)			
Timber Quality:	Good			

Cover Type Objective:
Retain and manage the red pine cover type; promote stand health and vigorous tree growth. This will promote your goal of timber stand improvement and productive tree growth. The desired future condition is mature pine forest.

Recommended Management Activities:
Management Options:

1. Manage the pine overstory by thinning to maintain proper density and improve average tree quality. Periodic thinning will sanitize, reduce fire fuels, and generally improve stand conditions by removing trees that are damaged, attacked by insects, infected by disease, or are of poor form or low vigor. Remaining trees benefit from the additional growing space, improving their vigor and making them less susceptible to insect and disease problems. Red pine stands are commonly managed by thinning on roughly a ten-

[1] Diameter Breast High (dbh): the diameter of a tree at 4.5 feet above average ground level.
[2] Site index: an expression of forest site quality based on the expected height of dominant trees at 50 years of age.
[3] Basal area: Of a tree - the cross-sectional area of the trunk at breast height (4.5 feet). Of an acre of forest - the sum of basal areas of the individual trees on the acre.

year cycle beginning at about age 25. Maturity is typically reached at an age between 80 and 120 years, depending on stand and site characteristics.

2. Manage the understory to enhance species and structural diversity. By cutting competing trees and bush away from selected young trees you can influence the species and quality of the trees that are available to grow into forest gaps created by the death or removal of overstory trees.
3. Allow natural succession to shape this stand with little or no management activities. Changes in forest composition, barring any natural disturbance like wind or fire, would occur very slowly over time, generally favoring shade tolerant species. Trends you could expect to see on this cover type would include some red pine mortality with a slowly developing hardwood understory of maple, basswood, and ash.

Recommendation:

Option 1 and 2 in combination would work toward your goal of timber stand improvement and habitat diversity. Currently the overall stand density is at a good level but there are some portions of the stand that are too crowded and could be thinned. As the pine is thinned and more openings are created, the understory will rapidly fill in with young trees and brush; you can see this on parts of the stand that have already been thinned more heavily. This new growth provides an opportunity to diversify the composition and structure of the stand by favoring selected tree species. The primary objective is to release[4] the best trees or trees with good potential. Oak is a good choice to favor first because oaks, in general, are only moderately tolerant of shade. White pine would be another good species to favor as they grow fairly well in moderate shade. Avoid favoring red pine seedlings in the understory because they require more sunlight for good growth. Species such as basswood and maple can be selected for release but they are more tolerant of shade and will need less help to survive.

Other recommended activities:

- **Handle pine slash properly to reduce the potential for bark beetle damage.** Activities such as thinning and pruning can produce a significant amount of waste debris, or slash, which can become breeding material for pine bark beetles. Avoid creating pine slash from April through August unless you remove and/or destroy all slash greater than 3 inches in diameter within 3 weeks of cutting.
- **Monitor your white pine for white pine blister rust infection.** White pine blister rust is a fungal disease that causes branch death, stem cankers, and can be fatal to the tree. Pruning the lower branches of young trees has been shown to significantly reduce infection rates. Pruning infected branches can sometimes prevent the infection from spreading to the main stem, in many cases saving the tree. See attached reference material for more information on white pine blister rust and white pine management.
- **Prune to improve wood quality and remove ladder fuels.** Pruning is one of the best ways to improve the quality of sawtimber. Pruning crop trees[5] can be limited to selected trees (generally less than 100 trees/acre) that have the potential to become high quality

[4] Release: To free trees from competition by cutting or otherwise removing or killing nearby vegetation and branches.

[5] Crop tree: A tree that is selected to be grown to maturity; usually selected on the basis of its species, location with relation to other trees, and quality.

sawlogs. For best results, prune in two or more stages, starting when the trees reach 4" diameter and continuing until at least the first 17 feet of bole is clear. The "rule of thumb" is to remove no more than 25% of the live crown at any one pruning and to maintain a 50% live crown/bole ratio. Other trees should be pruned to a height 10 feet (or one-half the height, whichever is least) to remove branches that can act as ladder fuels which convert a ground fire into a canopy fire. Pay particular attention to areas where trees are near tall grass or adjacent to roads.

Stewardship Binder References:

Tab	*Reference Name*
Tree Species	Red (Norway) Pine
	Eastern White Pine
Regeneration	White Pine: How to Prune for Blister Rust
Forest Stand Improvements	Coniferous

STEWARDSHIP COVER TYPES

Cover Type 2 - Aspen

Land Area: 10.0 Acres

Cover Type Description:
Twenty-five to thirty year old aspen dominates this cover type with other hardwood species also present. Other common but less numerous species include bur oak, black cherry, ash, basswood, red oak, and butternut. Tree health is generally good, but there are minor indications of hypoxylon canker on some of the aspen. Understory vegetation consists of light to moderate brush including hazel, dogwood, and common buckthorn. Soils are primarily a somewhat poorly drained silt loam and the terrain is generally level. This stand was clear-cut in the late 1970's.

Timber Summary				
Stand Age:	28 years	**Species**	**Avg. DBH**	**Basal Area**
Size Class:	Pole-timber	Aspen	6"	80
Growth Potential:	Good (aspen site index 73)			
Tree Density/Stocking:	Good (basal area 80)			
Timber Quality:	Fair			

Cover Type Objective:
Maintain the aspen cover type but also encourage other tree species to retain them as a component on this stand. This will promote your goals of timber stand improvement and habitat diversity. The desired future condition is a mature aspen stand with inclusions of alternate species.

Recommended Management Activities:
Management Options:

1. Allow aspen to develop on its own with little or no management. This is a typical approach to aspen management because aspen will self-thin as dominant stems out-grow and crowd-out slower growing stems. This can result in a nearly pure aspen stand because other slower-growing hardwoods cannot tolerate the strong competition.
2. Maintain aspen but select and release crop trees of other hardwood species. Basswood, red oak, bur oak, ash and maple would all be good species to favor on this site.
3. Introduce conifers to this cover type. White pine and white spruce are potential choices as both can tolerate moderate shade. Keep in mind that any seedlings planted will need a fair amount of on-going protection and release maintenance.

STEWARDSHIP COVER TYPES

Recommendation:
All three options, applied in combination or exclusively, are reasonable approaches to the management of this cover type. Each option (1 – 3) requires an increasing amount of effort to implement but will add an increasing amount of diversity to the stand. The stand is in relatively good condition now and if you choose to manage for aspen it will be 20-30 years until another harvest will be needed. If you chose to favor other hardwood or conifer species an aspen clear-cut should not be applied in the future; instead the aspen should be removed or allowed to die gradually as favored species develop.

Stewardship Binder References:

Tab	*Reference Name*
Tree Species	Aspen
Timber Stand Improvement	Deciduous

STEWARDSHIP COVER TYPES

Cover Type 3 - Lowland Hardwoods

Land Area: 18 Acres

Cover Type Description:
This cover type is dominated by black ash along with other tree species commonly found on lowland sites such as elm, basswood, aspen, red maple, and yellow birch. Tree health is generally good, but there is some dye-back on the ash and minor indications of hypoxylon canker on the aspen. Understory vegetation consists of light to moderate brush including dogwood, alder, and ash saplings. The soil is poorly drained silty-clay-loam and the terrain is level.

Timber Summary				
Stand Age:	Unknown	**Species**	**Avg. DBH**	**Basal Area**
Size Class:	Pole-timber - Small Sawtimber	Black ash	10”	70
		Aspen	8”	10
Growth Potential:	Fair (black ash site index 50)	Other	8”	4
Tree Density/Stocking:	Good (Basal area 84)			
Timber Quality:	Poor			

Cover Type Objective:
Maintain forest cover on this site, improving stand quality when/where possible. Reduce the dominance of black ash to diversify tree species composition. The desired future condition is a mixed hardwood lowland forest.

Recommended Management Activities:
Management Options:

1. Allow natural process shape this stand with little or no management activities. Changes in forest composition would consist of minor fluctuations in the abundance of secondary species such as basswood, elm, aspen, and maple, with little change in the dominance of black ash. Significant tree regeneration would occur only in pockets of disturbance created by windthrow or mortality.
2. Periodically cut selected individual trees and/or small groups of trees to favor superior trees and promote species other than ash. Selective removal of trees will allow you to encourage gradual changes in forest composition and improve average tree quality. Favoring species other than ash will prompt a gradual reduction in ash dominance and enhance forest diversity.
3. Regenerate the stand by harvesting the majority of the site. This is one of the typical approaches to managing lowland hardwoods. Clearcuts and larger patch-cuts can be effective regeneration methods but there are risks involved on lowland sites. On this type of site, soils are generally weak and wet and tree roots are shallow and sensitive; these

conditions make it critical to operate only on frozen ground to avoid significant damage to the site and to root systems. It is also possible to lose the site to rising water levels due to the removal of tree cover and the loss of transpiration the trees provide.

Recommendation:

Option 2 would work toward your goals of improving tree quality and habitat diversity. The mounting treat of the emerald ash borer makes enhancing species diversity increasingly important. In the event of an emerald ash borer infestation, and the subsequent loss of ash trees, improved species diversity will temper the impact on the forest. The removal of individual trees and small groups of trees for timber stand improvement can be applied gradually over time. It is a project that is particularly well suited to firewood cutting and can be very effective if you select your trees carefully. Care should be taken on this site to operate heavy equipment only on frozen ground to avoid soil and root system damage.

Stewardship Binder References:

Tab	*Reference Name*
Tree species	Lowland Hardwoods
Forest Stand Improvement	Improve Your Woodlot by Cutting Firewood

STEWARDSHIP COVER TYPES

Cover Type 4 – Aspen/Oak

Land Area: 11.0 Acres

Cover Type Description:
Declining aspen and lower quality oaks are dominant on this stand. The oak is a mix of bur oak, red oak and northern pin oak. Other common but less numerous species include ash and black cherry. Tree health is generally good, but much of the aspen component is mature and declining. Understory vegetation consists mainly of a thick shrub layer of hazel along with seedlings and saplings of ash, black cherry, oak and aspen. The soil is well-drained loamy sand. The terrain is slightly rolling with a few short slopes.

Timber Summary				
Stand Age:	Unknown	**Species**	**Avg. DBH**	**Basal Area**
Size Class:	Sm. Sawtimber	Aspen	11”	48
		Oak	10”	10
Growth Potential:	Poor (oak site index 48) Better for conifers	Other	6”	2
Tree Density/Stocking:	Low (Basal area 60)			
Timber Quality:	Poor-Fair			

Cover Type Objective:
Timber stand improvement with regard to stand density, species composition, and average tree quality. The desired future condition is a mixed oak/conifer forest.

Recommended Management Activities:
Management Options:

1. Allow natural succession to continue on this site. The heavy shrub competition will persist and have a significant impact on seedling growth. Seedlings and saplings of oak, ash, aspen, and maple will be present but development will be slow and tree quality may be compromised. You could expect to see a slow and gradual increase in overall tree stocking in conjunction with declines in aspen, persistence of oak, and increases in ash and maple.
2. Release saplings and seedlings to accelerate stand development. By cutting competing trees and bush away from selected young trees you can influence the species and quality of the trees that are available to grow into forest gaps. The primary objective is to release the best trees or trees with good potential (also called “crop trees”). Oak is a good choice to favor first because oaks, in general, are only moderately tolerant of shade, and young oaks need ample sunlight to survive and outgrow their competitors; this is also applies to black cherry. With out help oak may not be a part of this stand in the future. Species such as ash, basswood and maple can be selected for release but they are more tolerant of

shade and will need less help to survive.

3. Introduce a conifer component. Site conditions indicate that this may be a good site to grow conifers. Planting white pine and white spruce would be a good option as these species grow well under moderate shade. However, thick understory vegetation will be a problem, so any planting will need to be maintained by periodic brush release.

Recommendation:

My recommendation would be to incorporate options 2 and 3. This would work toward your goal of timber stand improvement and forest type diversity, as well as helping to maintain oak as a habitat component for wildlife. These projects can be completed gradually over time and are well suited to hand tools and student groups. Prior to any planting and/or release project you should seek the assistance of a forester to help you prepare a project plan that addresses issues such as selecting and ordering trees, site preparation, tree planting arrangements, release practices, and seedling protection.

Stewardship Binder References:

Tab	*Reference Name*
Tree Species	Aspen
	Oaks
	Eastern White Pine
	White Spruce
Forest Stand Improvements	Timber Stand Improvement (Deciduous)
	Improve Your Woodlot by Cutting Firewood

STEWARDSHIP COVER TYPES

Cover Types 5 & 7 - Conifer Plantations

Land Area: 2.75 Acres (White spruce 1.25 ac.)
(Red Pine & White Pine 1.5 ac.)

Cover Type Description:
Cover type 5 is a conifer plantation dominated by white spruce but also includes white pine that makes up about 10 percent of the stand. Cover type 7 is a conifer plantation dominated by an even mix of red pine and white pine along with some white spruce that makes up about 10 percent of the stand. The trees were originally plated in the mid 1940's. The average dbh is approximately 11 inches with individual trees as large as 16 inches. Tree health is generally good, but there is indication of blister rust on the white pine and some bark beetle damage on the red pine. Understory vegetation is light to moderate with red elderberry the most common shrub species. The soil is well-drained loamy sand and the terrain slightly sloping.

Timber Summary				
Stand Age:	60 years (est.)	**Species**	**Avg. DBH**	**Basal Area**
Size Class:	Small Sawtimber	White spruce (Cover type 5)	10"	165
		White pine (Cover type 5)	10"	15
Growth Potential:	Very good White spruce site index 70 Red pine site index 65 White pine site index 60	Red pine (Cover type 7)	11"	81
		White Pine (Cover type 7)	11"	81
Tree Density/Stocking:	Too high (Basal area 180)	White spruce (Cover type 7	9"	18
Timber Quality:	Good			

Cover Type Objective:
Retain and manage the spruce-pine cover type; promote stand health and vigorous tree growth. This will promote your goal of timber stand improvement and productive tree growth. The desired future condition is mature conifer forest.

Recommended Management Activities:
Management Options:

1. Manage the conifer overstory by thinning to maintain proper density and improve average tree quality. Periodic thinning will sanitize, reduce fire fuels, and generally improve stand conditions by removing trees that are damaged, attacked by insects, infected by disease, or are of poor form or low vigor. Remaining trees benefit from the additional growing space, improving their vigor and making them less susceptible to insect and disease problems.

STEWARDSHIP COVER TYPES

2. Allow natural succession to shape this stand with little or no management activities. Changes in forest composition, barring any natural disturbance like wind or fire, would occur very slowly over time, generally favoring shade tolerant species. Trends you could expect to see on this cover type would include scattered mortality among all species, most likely red pine, and growth rates that limited by the high tree density of the stand.

Recommendation:
Option 1 would work toward your goal of timber stand improvement. Currently the overall stand density is too high and thinning should be considered. As the conifers are thinned and more openings are created, a more diverse understory will begin to form.

Other recommended activities:

- **Handle pine slash properly to reduce the potential for bark beetle damage.** Activities such as thinning and pruning can produce a significant amount of waste debris, or slash, which can become breeding material for pine bark beetles. Avoid creating pine slash from April through August unless you remove and/or destroy all slash greater than 3 inches in diameter within 3 weeks of cutting.
- **Monitor your white pine for white pine blister rust infection.** White pine blister rust is a fungal disease that causes branch death, stem cankers, and can be fatal to the tree. Pruning the lower branches of young trees has been shown to significantly reduce infection rates. Pruning infected branches can sometimes prevent the infection from spreading to the main stem, in many cases saving the tree. See attached reference material for more information on white pine blister rust and white pine management.
- **Prune to improve wood quality and remove ladder fuels.** Pruning is one of the best ways to improve the quality of sawtimber. Pruning crop trees can be limited to selected trees (generally less than 100 trees/acre) that have the potential to become high quality sawlogs. For best results, prune in two or more stages, starting when the trees reach 4" diameter and continuing until at least the first 17 feet of bole is clear. The "rule of thumb" is to remove no more than 25% of the live crown at any one pruning and to maintain a 50% live crown/bole ratio. Other trees should be pruned to a height 10 feet (or one-half the height, whichever is least) to remove branches that can act as ladder fuels which convert a ground fire into a canopy fire. Pay particular attention to areas where trees are near tall grass or adjacent to roads.

Stewardship Binder References:

Tab	*Reference Name*
Tree Species	Red (Norway) Pine
	Eastern White Pine
	White Spruce
Forest Stand Improvements	Timber Stand Improvement-Coniferous

STEWARDSHIP COVER TYPES

Cover Type 6 - Wetlands

Land Area: 23.0 Acres

Cover Type Description:
This cover type includes all the wetlands on the property, which consist mostly of the broad lowlands adjacent to O'Neill Brook. These areas contain lowland grass, shrub swamp dominated by willow and alder, and some open water. Please refer to the reference listed below for more information on wetlands and wetland management.

Cover Type Objective:
Maintain wetland for aesthetic, wildlife, and water quality values.

Recommended Management Activities:
No management activities are necessary. Wetlands are a very important part of the natural landscape. They filter pollutants, help prevent flooding, recharge groundwater, and provide habitat for plants and wildlife. Typically, the best management approach is to avoid disturbance.

If you have an interest in completing wetland management projects, technical assistance is available through the Minnesota DNR Division of Waters at 320-616-2470.

Other recommended activities:

- **Install artificial nest structures.** Cavity-nesting waterfowl, particularly wood ducks and hooded mergansers, can be attracted to artificial nest boxes attached to trees or posts near wetlands. Raised platforms work well as nesting sites for Canada geese and mallards. A comprehensive guide to the construction and placement of wildlife shelters is *Woodworking for Wildlife* by Carrol L. Henderson; you can purchase a copy from Minnesota's Bookstore at 800-657-3757.

Stewardship Binder References:

Tab	*Reference Name*
Water and Wetlands	All

STEWARDSHIP COVER TYPES

Cover Type 8 – Young Mixed Forest

Land Area: 4.25 Acres

Cover Type Description:
This cover type consists of a somewhat disturbed site that includes an old disposal area. Many trees have invaded and a young forest has started to develop on much of the site; some trees are as old as about 20 years. Tree species include aspen, birch, ash, red oak, elm, box elder, white pine, red pine, and white spruce. Site conditions are similar to cover types 5 and 7, suggesting that growth potential for pine and spruce would be good. The terrain is somewhat sloping and the soil is loamy sand.

Cover Type Objective:
Encourage and enhance the development of the young trees on this site. The desired future condition is a mixed hardwood/conifer forest.

Recommended Management Activities:
Management Options:

1. Periodic selective cutting of individual trees to release crop trees. The primary objective is to release trees with the best growth potential, based on species, tree quality, or location. Crop tree release will increase growth rates and average tree quality, and allow you to produce a gradual impact on forest composition and structure. Also cut to remove trees that are damaged, attacked by insects, infected by disease, are of poor form or low vigor, or an undesirable species.
2. Supplement tree stocking by planting seedlings to fill the open areas on this site. These gaps will fill naturally over time but a successful planting will accelerate this by many years.
3. Allow natural succession to control the forest development on this site. Changes in forest structure, composition, and extent will occur slowly over time, and tree growth rates will not be maximized. However, watching a forest invade and develop on a disturbed site may provide learning opportunities in forest ecology and the establishment of pioneer forests.

Recommendation:
Any of the above options, alone or in combination, seem to be reasonable management choices. If you choose to release crop trees favor pine, spruce, oak and birch first, keeping in mind that red pine will need more direct sunlight than the other species. Remove box elder whenever possible; box elder is a native species but its form is generally poor and has limited value. It also has the potential to spread rapidly and become a nuisance. White pine, red pine and white spruce would be the best choices for supplemental planting.

STEWARDSHIP COVER TYPES

Other recommended activities:

- **Monitor your white pine for white pine blister rust infection.** White pine blister rust is a fungal disease that causes branch death, stem cankers, and can be fatal to the tree. Pruning the lower branches of young trees has been shown to significantly reduce infection rates. Pruning infected branches can sometimes prevent the infection from spreading to the main stem, in many cases saving the tree. See attached reference material for more information on white pine blister rust and white pine management.

Stewardship Binder References:

Tab	*Reference Name*
Tree Species	Paper birch
	Oaks
	Red (Norway) Pine
	Eastern White Pine
	White Spruce
Regeneration	White Pine: How to Prune for Blister Rust
	Tree Planting
Forest Stand Improvements	Timber Stand Improvement – Deciduous
	Timber Stand Improvement – Coniferous

PROPERTY-WIDE PROJECTS

These are activities that don't conveniently fit into a cover type or can be applied across cover types.

Recreational trail: The trail system that is present on the property could be upgraded to become an interpretive trail. Interpretive stations could be established along the trail illustrating forest management practices, the various forest types, wildlife habitat, and many other features. Maintaining this type of trail would be a valuable asset allowing students to use and learn from the School Forest without being part of a school sponsored event.

Control common buckthorn. Common (or European) buckthorn is a non-native shrub that can spread rapidly crowding or shading out native forest plants. Buckthorn is present on many parts of the property and consideration should be given to its control. Additional information is included in your plan binder as referenced below.

Install a variety of nest boxes: Nest boxes are helpful for many cavity-nesting species; there are roughly 40 species of birds in Minnesota that nest in tree holes. Nest boxes can be designed for specific species such as bluebirds, wood ducks, and bats. They are particularly helpful in areas that lack large, hollow trees for nesting. Nest boxes can enhance existing wildlife habitat while adding opportunities for you to see and enjoy wildlife. The publication "Woodworking for Wildlife" by Carrol L. Henderson is an excellent guide to construction and placement of nest boxes.

Maintain snags and cavity trees. Snags, which are standing dead or partially decayed trees, provide ideal conditions for wildlife requiring perches, tree cavities, and bark-foraging sites. If you have some standing dead trees it is not necessary to remove them, they are valuable to wildlife. Snags can be created by girdling the base of trees, which will eventually kill them. Oak, maple, basswood, white and red pine trees over 12" in diameter make the best snags. Six snags per acre is the recommended minimum, but try to leave as many large, dead trees as possible. Keep in mind that in some situations retaining pine snags can contribute to a bark beetle build-up.

Maintain coarse woody debris on the forest floor. Coarse woody debris provides cover, food, habitat structure, and growing sites for many different animals and plants. Create at least two to five bark-on downed logs greater than 12 inches in diameter per acre, if fewer than this number already exist. In choosing candidates for leave logs, consider the following:

- Hollow butt sections or other defective lengths of at least six feet are preferred.
- Sound logs and six- to 12-inch diameter logs may be used if they represent the best available candidates.
- Hardwood logs have more hollows or cavities, and are favored by certain amphibians.
- Conifer logs decay more slowly, thus remain present as structure on a site longer than hardwoods.
- Using pines as downed logs, especially in summer, increases the risk of bark beetle damage to adjacent healthy pines.

Forest Management Guidelines: The Minnesota Forest Resource Council has developed a guidebook that provides an extensive framework of concrete “how-to’s” for sustainable forest management. *Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest Management*

PROPERTY-WIDE PROJECTS

Guidelines is a collection of flexible, voluntary guidelines for use when conducting forest management activities. I highly recommend incorporating applicable guidelines into your management projects. A booklet introducing the guidelines is included in your plan binder (referenced below).

Stewardship Binder References:

Tab	*Reference Name*
Ecology	Buckthorn
Wildlife	Landscaping Woodlands for Wildlife
	Habitat Components For Wildlife
Recreation	Woodland Trail Construction
Harvest	Guidelines for Forest Management

STEWARDSHIP PROJECT SUMMARY

Priority	Cover Type	Project	Acres/Units
1	5, 7	Conifer Thinning	2.75 acres
1	1-5, 7-8	Buckthorn Control	57 acres
2	1	Conifer Thinning	11 acres
2	1, 5, 7	Conifer Pruning	13.75
2	2, 4, 8	Crop Tree Release	25.25 acres
3	2, 4	White Pine/White Spruce Under-Planting	21 acres
3	8	Pine/Spruce Supplemental Planting	4.25
4	3	Selective/Improvement Cutting	18 acres
4	1	Understory Brush Release (after thinning)	11 acres
	All	Interpretive Upgrades to Trail	
	All	Install Nest Boxes	