

Forest Stewardship Plan

Prepared for

Township of Byram

10 Mansfield Drive
Stanhope, NJ 07874

Property location

Block 226 Lot 25.02; Block 222 Lot 1.00; Block 336 Lot 43; Block 335 Lot2; Block 337 Lot 9;
Block 360 Lots 39 and 42

Byram Township
Sussex County

973-347-2500

Total acreage: ~ 291.86 acres
Forest acreage: ~286.86 acres

Planning period: 10 years
Plan prepared for 2015-2024

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Property Location:

The Arnell and Owners Maintenance Properties are located on Andover Lake Mohawk Road. They can be reached from Sparta-Stanhope Road by turning right onto Amity Road (if you are heading south). Proceed for 0.3 miles on Amity Road and make a right onto Lee Hill Road. Follow Lee Hill Road for 1.5 miles and make a left onto Andover-Mohawk Road. Proceed 0.6 miles. The Arnell tract is on the left side of the road (there is a small pull out there) and Owners Maintenance is directly across the street.

The Beckmann/Kostrey parcel can be accessed from Route 206 South by turning left onto Tamarack Road. Go 500 feet and make a right onto Little Paint Way. Proceed 0.25 miles and turn left onto Rodger Drive for 700 feet (you will bear right) and take the first left. Proceed 300 feet to the small parking area on the right, prior to the private home on the dead end.

The Glenside Property parcel can be accessed from Sparta-Stanhope Road driving north by turning left onto Amity Road. After 0.3 miles turn right onto Lee Hill Road. Proceed 1.5 miles and turn right onto Glenside Trail. After 500 feet turn right onto Ranger Trail. The Glenside Property can be accessed at the end of the road. The property is located east of the water tower.

Johnson Lake East tract can be accessed from Route 206 by exiting onto Tamarack Road. Proceed 1.5 miles to the end. Turn left onto Roseville Road. The newly constructed driveway is 0.2 miles on the left across from C.O. Johnson Park.

Johnson Lake West tract can be accessed from Route 206 by exiting onto Tamarack Road. Proceed 0.6 miles. The driveway/access road is on the left just prior to reaching the lake.

Property Description:

These six properties combined consist of approximately 286.86 acres of forest. Owners Maintenance covers approximately 46 acres. The Arnell tract covers approximately 40 acres. The Beckmann/Kostrey tract covers approximately 61 acres. The Glenside Tract covers approximately 57 acres and is entirely forested. The Johnson Lake West Tract covers 13.5 acres while the Johnson Lake East Tract covers 69.36 acres of forest, 4.39 acres of lake and approximately 0.6 acres which

will be a future parking area. All of these properties, with the exception of Johnson East, are completely forested at this time. Each has variable terrain and five contain small pockets of wetlands. No wetlands were noted on the Owners Maintenance tract.

Forest History:

These properties have not been under extensive management in recent years. Some stumps were noted but most were cut some time ago. Historically most of these forests were likely cleared for fuel for the iron industry or charcoal production.

Boundary Delineation:

The property boundaries are not clearly marked currently with the exception of the Arnell Tract which has been marked with the exception of one corner that could not be located. Several corners on the owners Maintenance Tract have also been located.

Clearly delineated boundaries are a critical requirement to actively manage the land. Marked boundaries will prevent trespass and the possibility of encroachment and illegal dumping given the proximity of residential properties. In some cases adjacent privately owned land is clearly delineated. Encroachment is something that should be monitored over time utilizing updated aerial photography.

Landowner Profile:

The land is owned by a small Township. Forest management activities will be completed by the Township, in cooperation with the forester and potentially carried out by volunteers or contractors. The Township is enthusiastic about owning and managing their woodlot and being active stewards of the land while maximizing the potential of the land to meet recreational needs of the residents and provide the highest potential ecological services for the community.

Landowner Objectives:

The management objectives for the Byram Township properties are:

1. Maintain forest health and vitality through forest Stand improvement activities.

2. Manage these lands for multiple wildlife species.
3. Incorporate hiking trails and passive recreation on these properties.
4. Incorporate a deer reduction program to improve forest health conditions.
5. Control invasive species prior to further proliferation on these properties.
6. Clean up litter on the Arnell tract.
7. Monitor ATV trespass and enforce existing regulations.
8. Conserve soil and water resources by incorporating Forest Management Best Management Practices.

Soil Descriptions:

Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils – This soil is nearly flat. Ponding is frequent up to 1 foot in depth outside of the growing season. Depth to the water table is 0-6 inches. This soil has a very slow infiltration rate and a high potential for runoff.

Catden mucky peat, 0 to 2 percent slopes (CatbA) soils – This soil is flat. Ponding is frequent through the entire year with the exception of July through September. Depth to the water table is 0-6 inches. This soil has a very slow infiltration rate and a high potential for runoff.

Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes (ChkC) soils - This soil series is moderately sloped and rocky. Depth to the water table is greater than 80 inches. This soil has a very slow infiltration rate. Surface water runoff is high. Available water capacity is low.

Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils - This soil series is very steep. Depth to water table is greater than 80 inches. Available water capacity is low to very low. Potential of damage to soil by fire is moderate. This soil is poorly suited for log landings and roads.

Hibernia loam, 0 to 8 percent slopes, extremely stony (HhmBc) soils - This soil is level to slightly sloped. Depth to water table is 6-18 inches. This soil is somewhat poorly drained. This soil

has a slow infiltration rate when soils are wet. Runoff potential is very high. Available water capacity is very low.

Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils - This soil is moderately sloped. This soil is well drained. Depth to water table is about 18 to 40 inches. Available water capacity is low. This soil has a slow infiltration rate when soils are wet. Runoff rates are very high.

Rockaway loam, thin fragipan, 8 to 15% slopes, extremely stony (RoefCc) soils – This soil is moderately sloped. This soil is well drained. Depth to water table is greater than 80 inches. Runoff rates are very high. Available water capacity is low and there is no ponding or flooding frequency.

Rockaway loam, thin fragipan 15 to 35% slopes, extremely stony (RoefDc) soils – This soil is steep sloped. This soil is well drained. Depth to water table is greater than 80 inches. Runoff rates are very high. Available water capacity is low and there is no ponding or flooding frequency.

Rockaway Urban Land Complex, thin fragipans, 0 to 15% slopes (RooB) soils - This soil is slightly sloped. This soil is well drained. Depth to water table is greater than 80 inches. Runoff rates are very high. Available water capacity is low and there is no ponding or flooding frequency.

Table 1. Soil Information

Soil Symbol	Erosion Hazard	Equipment Limitation	Seedling Mortality	Windthrow Hazard	Site Index *	Species to Favor
AhcBc	Slight	Moderate	High	Moderate	Red Maple 50	Arborvitae, White Spruce
CatbA	Slight	Severe	High	Severe	Red Maple 56 SilverMaple 82	Arborvitae, White Spruce
ChkC	Moderate	Moderate	Low	Low	Red Oak 70 Sugar Maple 65 White Ash 75	White Pine, Norway Spruce, Red Pine
ChkE	Moderate	Severe	Low	Low	Red Oak 70 Sugar Maple 65 White Ash 75	White Pine, Norway Spruce, Red Pine
HhmBc	Slight	Severe	High	Moderate	White Pine 55 Red Oak 47 Sugar Maple 56	White Pine

RokD	Severe	Moderate	Low	Low	Upland Oaks 70 Tulip Poplar 75 White Ash 65	Austrian Pine, White Pine, Norway Spruce
RoefCc	Severe	Moderate	Low	Low	Upland Oaks 70 Tulip Poplar 75 White Ash 65	Austrian Pine, White Pine, Norway Spruce
RoefDc	Severe	Moderate	Low	Low	Upland Oaks 70 Tulip Poplar 75 White Ash 65	Austrian Pine, White Pine, Norway Spruce
RoobB	Severe	Moderate	Low	Low	Upland Oaks 70 Tulip Poplar 75 White Ash 65	Austrian Pine, White Pine, Norway Spruce

*** Site Index (SI)**

The collective influence of soil factors will determine the site index for a particular tree species on a given soil area. Site index is the total height to which dominant trees of a given species will grow on a given site at some index age, usually 50 years in the Northeast. Dominant trees are the tallest trees in the Stand. If it is stated that an area has a site index for Sugar Maple of 70 feet at 50 years, then we expect Sugar Maple seedlings planted on that area today to be 70 feet tall in 50 years. Index age and tree species must be stated when referring to site index because the site index of one species will be different from the site index of another species growing on the same area.

The following factors have a major impact on forest soil productivity and site index:

Topsoil Depth. The depth of the uppermost soil layer is a critical factor affecting tree growth.

Topsoil is highest in organic matter and nutrients, is usually well aerated and drained, and allows maximum root growth and root penetration.

Soil Texture. The proportion of sand, silt and clay in the topsoil and subsoil layers is called texture.

Sandy soils are normally very well drained and often lack nutrients due to constant leaching loss. At the other end of the spectrum are the pure clay soils comprised of very small, fine soil particles.

Subsoil Consistence Class. Consistency of the subsoil layer is another important factor in forest soil productivity. The combination of soil-sized particles and the physical and chemical properties of each individual particle type in a given soil determine the soil's consistence class.

Limiting Layers. A layer which restricts the downward penetration of a tree's root system will reduce tree growth in direct relation to the depth of layer. In rare instances, a limiting layer may increase site productivity, such as below sandy soils where the layer may retard leaching of nutrients and increase available moisture.

Fertility. Fertilization is normally not recommended early in the rotation except in the case of a critical deficiency of a major nutrient such as phosphorus. A soil test prior to site preparation will alert a landowner to critical deficiencies.

Research has shown conflicting results in forest tree response to nitrogen fertilization, particularly early on. Growth may be suppressed if the fertilizer increases the growth of competing weeds. Best planting success results from early fertilizer use arise in combination with herbicide or mechanical control of competing vegetation. Fertilization will not be required for reforestation efforts on these properties.

Internal Drainage. Few tree species can grow in soils which are constantly wet. Drainage can be improved in some cases by tilling, ditching, or adding bedding as a site preparation method.

Measuring Site Index can be determined by two methods: One method is to locate on the area in question several dominant trees of the species of interest or a species with a known conversion factor to the species of interest. Using accurate age and height measurements, read the site index from a graph showing height over age curves for that species.

Site quality index listed in Table 1 above can be represented as Poor, Fair, Good, Very Good and Excellent as follows:

< 50	Poor
51-60	Fair
61-70	Good
71-80	Very Good
>81	Excellent

Stand Descriptions:

Stand 1 (Owners Maintenance)

Stand 1 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. This Stand is located on the southeastern portion of the Owners Maintenance tract and has a southern aspect.

Stand 1 is a timber-sized Upland Oak Stand covering approximately 10.88 acres. Dominant tree species in this Stand are Black, Chestnut and Red Oak. White Oak, Sugar Maple and Pignut Hickory are minor understory components. The sub-canopy includes Red Maple, Sugar Maple, Beech, Amelanchier, Grape and Hophornbeam. The overstory covers about 45% of this Stand while the sub-canopy covers about 40% of this Stand.

The shrub layer covers <5% of this Stand. Shrub species found here include Japanese Barberry and Huckleberry on the ridges. Floor species include Christmas Fern, Pennsylvania Sedge, Partridgeberry, White Snakeroot, Wintergreen, White Ash, White Wood Aster and Garlic Mustard. Floor species cover about 50% of this Stand.

Tree quality is good in this Stand with potential sawtimber found in the Black, Red and Chestnut Oak at this time. Forest Stand improvement activities will focus on removing some of the unacceptable growing stock. This can be done through girdling to create wildlife habitat or removal of poorly formed trees for firewood. Removing poorly formed trees will increase the vigor and growth rates of the remaining trees in this Stand.

Trees removed during forest Stand improvement may also be felled and left on the forest floor to provide downed woody debris for wildlife habitat and foraging areas and soil protection. Others may be girdled and left to provide standing dead trees for foraging and nesting habitat for numerous birds. All forest management activities will be completed while maintaining species diversity in this Stand. While there is good subcanopy, there are very few tree seedlings noted on the forest floor. It is important to improve growth in the shrub layer in this Stand.

Lack of cover in the shrub layer may be due to excessive deer populations or due to the density of the canopy and subcanopy and the lack of light reaching the forest floor. Gypsy Moth populations should be monitored, particularly early in this planning period and deer populations should be monitored long term, as high populations will impede tree growth and facilitate invasive species spread.

The average basal area of this Stand is 90 square feet per acre with about 71 trees per acre. Stand 1 has an average diameter at breast height (dbh) of about 15 inches. Current acceptable growing stock in this Stand is about 7,440 board feet/acre while unacceptable growing stock is about 5.08 cords/acre. This Stand is currently fully stocked. Trees in this Stand are 60-80 years in age.

Site quality is good in this Stand. The presence of disease or insect infestation was not noted in this Stand during the forest inventory. Deer browse appears to be moderate to heavy in this Stand. Tree tops may be piled in brush piles to provide wildlife habitat and to protect seedlings from deer browse allowing them to grow into the sapling stage while not being browsed by deer. Deer populations must be closely monitored, as they can alter the forest ecosystem and affect habitat for other wildlife species. The possibility of hunting may be limited to bow hunting due to the size of the property and the residential development bordering the property.

Without active management, this Stand will convert to a Northern Hardwood Stand over time and lose the Oak dominated canopy.

Stand 1 Forest Management Recommendations

The primary goals for this Stand are to remove the Japanese Barberry, increase native shrub growth and improve growth rates of the remaining trees, while protecting the soil resource on steep slopes. Gypsy Moth populations and deer browse pressure should be monitored.

Once the Japanese Barberry has been removed, the canopy may be opened by removing poorly formed trees for firewood. If removal of firewood by residents is not possible the canopy shall be opened by girdling or felling and leaving on site, poorly formed and hazard trees of all species to maintain species diversity in this Stand. The soil should be protected during any activity on this

property. Aesthetics near home sites will be maintained. By opening the canopy, forest regeneration and native shrub growth will be improved.

Removal of competition will improve the growth rates of remaining trees as well as the vigor of the entire Stand. Tops of trees removed should be left on site in brush piles. Brush piles will be created so as to not affect aesthetics of this Stand, particularly in areas visible from neighboring homes.

This Stand is the access point for hiking trails through this property and the adjacent Arnell tract due to access to the road and to the pull off site. Trail maintenance will be completed in conjunction with the NY-NJ Trail Conference or the Consulting Forester.

Recommendations for Stand 1

- 1. Remove any resprouting Japanese Barberry.**
- 2. Maintain and improve forest regeneration while maintaining aesthetics as viewed from neighboring homes.**
- 3. Trees removed may be used as firewood, girdled or felled and left on site as wildlife habitat.**
- 4. Protect soil quality in this Stand.**
- 5. Monitor deer browse pressure and Gypsy Moth populations.**
- 6. Work with the NY-NJ Trail Conference or the Consultant Forester on trail maintenance.**
- 7. The Forester will mark all trees to be removed from this site.**

Stand 2 Owners Maintenance Tract

Stand 2 is a Northern Hardwood Stand located on 4.56 acres. This Stand is located on the western edge of Owners Maintenance tract, south of the powerline cut. Stand 2 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 2 has a slight northwestern aspect.

Stand 2 is a pole-sized Stand. The overstory of this Stand is dominated by Sugar Maple, Chestnut Oak and White Ash. Minor overstory components include White Oak, Black Birch, Pignut Hickory, Cherry and Poison Ivy. The understory includes Amelanchier, Sugar Maple, White Ash and Black

Cherry. The overstory covers about 45% of this Stand while the understory covers about 55% of this Stand.

The shrub layer is virtually absent from this Stand, although there is some Huckleberry noted. Floor species include White Snakeroot, Pennsylvania Sedge, Sassafras, Partridgeberry and Wintergreen. Shrub species cover 0% of this Stand while floor species cover 40% of this Stand.

Tree quality is good in this Stand with potential future timber found in Sugar Maple, Hickory and Oak. Forest Stand improvement activities will focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining trees to mature further. The large amount of dead Red Cedar on the forest floor and stone walls provides signs that this Stand was cleared at one time and is proceeding through forest succession.

The average basal area of Stand 2 is 110 square feet per acre, with 215 trees per acre. Stand 2 has an average diameter at breast height (dbh) of 9.5 inches. This Stand is currently fully stocked. Acceptable growing stock is 4,590 board feet per acre while unacceptable growing stock is about 8.41 cords per acre. Trees in this Stand are about 50-70 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red Oak and 43 cubic feet per acre for Sugar Maple and White Ash.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Vertical diversity and species diversity in this Stand are good with the exception of the shrub layer, which is absent. No forest insect or disease infestations were noted in this Stand during the forest inventory.

The boundary in this Stand is currently clearly marked with flagging but should be marked with paint and posters before the flagging is lost.

Stand 2 Forest Management Recommendations

This Stand is moving through forest succession into a Northern Hardwood Stand, which would be expected in a Stand with a northwestern aspect. Poorly formed trees in this Stand can be girdled and left Standing. Access would be an obstacle to removing any biomass from this Stand.

The boundary of this Stand and of this entire property should be clearly delineated during the early planning period. No invasive species were noted in this Stand. This Stand should be monitored for deer browse pressure and invasive species.

Activity in this Stand can occur late in the planning period, with the exception of the boundary delineation.

Recommendations for Stand 2

- 1. Remove poorly formed trees from this Stand to improve vertical structure.**
- 2. Monitor this Stand for invasive species and deer browse pressure.**
- 3. All trees will be marked by the Forester for removal.**

Stand 3 Owners Maintenance Tract

Stand 3 is located on the Owners Maintenance tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. This Stand is located in the center of the property.

This Stand is the powerline cut and has no canopy or subcanopy. It covers 2.09 acres. The shrub layer consists of Japanese Barberry, Red Cedar and Wineberry. One shrub was not identified. Floor species include Hayscented Fern, Little Bluestem, White Snakeroot, Tulip Poplar seedlings and Goldenrod.

There is an ATV trail located through this Stand that will provide ATV access to the remainder of the property and that will lead to soil erosion and possibly the dispersion of invasive species.

The Japanese Barberry should be removed from this Stand early in the planning period to reduce the chances of it moving into the adjacent forest. Current Township regulations prohibit ATV use. ATV access should be monitored and Township rules concerning use on public land should be enforced. Portions of this Stand are extremely steep.

An agreement should be worked out with the power utility to assure that the clearing of this line will be maintained exclusively through mechanical removal, rather than herbicide application, and that this Stand will be allowed to grow into early successional forest habitat and cut only every 5 years or so. By doing this important wildlife habitat will be created and soils, particularly on the steepest slopes, will be protected as the roots from shrubs and trees will remain in place long term.

This area can also provide a vista for a stop along a hiking trail.

Stand 3 Forest Management Recommendations

ATV activity should be monitored and Township prohibitions on ATV use on public land enforced. Invasive species should be removed early in the planning period. This will prevent their further spread through this Stand and the adjacent forest.

An agreement with the power utility should be formalized to assure that vegetation is removed mechanically from this Stand, which will provide valuable early successional wildlife habitat, reduce the use of herbicides and protect soil in this Stand.

Recommendations for Stand 3

- 1. Follow up on the agreement with the power utility to mechanically remove vegetation from this Stand every five years its line maintenance program and treat invasive species.**
- 2. Remove the invasive species (Japanese Barberry and Wineberry) from this Stand.**
- 3. Monitor the ATV activity in this Stand and enforce the Township prohibition against ATV use on Township owned lands.**
- 4. Monitor soil erosion in this Stand.**

Stand 4 Owners Maintenance Tract

Stand 4 is an Oak Hickory/Northern Hardwood Stand located on 2.36 acres. This Stand is located on the western edge of the Owners Maintenance Tract, just north of the powerline cut. Stand 4 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE

soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 4 has a slight southeastern aspect.

Stand 4 is a pole-size Stand covering 11.86 acres. This Stand is dominated by Mockernut Hickory and White Ash. Red Oak and Chestnut Oak are minor overstory components. The sub-canopy includes Maple, Amelanchier, Hickory, Flowering Dogwood and Crab Apple. The overstory covers about 40% of this Stand while the sub-canopy covers about 60% of this Stand.

The shrub layer covers <5% of this Stand. The only shrub species noted here was Japanese Barberry (invasive species), which should be removed promptly prior to any other forest management activities being conducted. Floor species include White Snakeroot, Pennsylvania Sedge, Garlic Mustard and Bedstraw species. Floor species cover about 10% of this Stand. The Garlic Mustard is found along the stone wall and is in a small enough population to be hand pulled by volunteers.

Tree quality is good at this time. Active management is not advised at this time until the Japanese Barberry and Garlic Mustard have been removed. Once these populations are controlled, poorly formed trees should be removed from this Stand or girdled in an effort to improve native plant growth in the shrub layer and on the forest floor.

The average basal area of Stand 4 is 100 square feet per acre, with 163 trees per acre. Stand 4 has an average diameter at breast height (dbh) of 8.5 inches. This Stand is currently fully stocked. Acceptable growing stock is 4,890 board feet per acre while unacceptable growing stock is about 1.32 cords per acre. Trees in this Stand are about 70 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red Oak and 43 cubic feet per acre for Sugar Maple and White Ash.

Trees may also be cut and left on the forest floor to provide downed woody debris for wildlife habitat and foraging areas and soil protection. Others may be girdled and left, to provide standing dead trees for foraging and nesting habitat for numerous birds. All forest management activities will be completed while maintaining species diversity in this Stand and protecting the wet soils and stream. Site quality is good to very good in this Stand.

Two deer were noted in this Stand. Deer populations and browse pressure should be monitored, as active forest management and invasive species control is difficult to impossible without a reduction program.

Stand 4 Forest Management Recommendations

The primary goal for this Stand is to improve vertical structure, promote native plant regeneration and remove invasive species. Japanese Barberry and Garlic Mustard should be removed from this Stand early in the planning period prior to these species going to seed. Neither species is found in overbearing populations at this time, and thus control is possible.

Deer populations should be monitored and controlled, as there is very little shrub layer and floor species are sparse. Forest Stand improvement activities will also include removing poorly formed trees at the end of this planning period and only after the invasive species have been removed.

Recommendations for Stand 4

- 1. Remove Garlic Mustard and Japanese Barberry from this Stand early in the planning period.**
- 2. Monitor or reduce deer population to improve native species regeneration and improve vertical structure.**
- 3. Once invasive species are under control, the canopy may be opened in an effort to improve vertical structure of the forest.**
- 4. The Forester will mark all trees to be removed from this site.**

Stand 5 Owners Maintenance Tract

Stand 5 is an Oak-Hickory Stand located on 12.70 acres. Stand 5 is located on the Owners Maintenance tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 5 has a slight to very steep southern aspect.

Stand 5 is a small pole-sized Oak-Hickory Stand. The overstory of this Stand is dominated by Pignut Hickory, Red Oak, Black Oak and Chestnut Oak. Sugar Maple is a minor overstory component. The understory includes Sugar Maple, Amelanchier and Sumac in canopy openings. The overstory covers about 50% of this Stand while the understory covers about 40% of this Stand. Over time, without active management, this Stand will likely convert to a more shade tolerant northern hardwood dominated Stand.

The shrub layer is virtually absent from this Stand. Floor species include Pennsylvania Sedge, Wintergreen and Partridgeberry. Shrub species covered 0% of this Stand while floor species covered 45% of this Stand.

Tree quality is good in this Stand, with potential future timber found in Hickory and Oak species. Forest Stand improvement activities in this Stand will focus on removing poorly formed or dying trees from this Stand. Trees with good form will be left to serve as the seed source for the future forest and to improve growth rates of the remaining crop trees.

The average basal area of Stand 5 is 110 square feet per acre, with 259 trees per acre. Stand 5 has an average diameter at breast height (dbh) of 8.5 inches. This Stand is currently fully stocked. Acceptable growing stock is about 6,120 board feet per acre while unacceptable growing stock is about 4.33 cords per acre. This Stand is approximately 70-90 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red Oak and 65 cubic feet per acre for Sugar Maple and White Ash.

Site quality is good to very good in this Stand. Deer browse appears to be heavy in this Stand. Gypsy Moth populations were moderate to heavy in this Stand and should be closely monitored. An ATV trail was noted in this Stand and should be monitored and possibly mapped, should enforcement become necessary.

Stand 5 Forest Management Recommendations

Gypsy Moth populations must be closely monitored in this Stand. Populations were currently moderate to high during the forest inventory. While Gypsy Moth impact on this forest area may

improve vertical structure and native regeneration, they may also provide a source of defoliation downwind in residential areas of Byram Township. If population densities are high enough the Township should consider participating in the State spray program, which is generally initiated in May while planning should occur much earlier.

If Gypsy Moth populations are controlled, native regeneration should be improved with the canopy openings being created through girdling as long as deer populations and invasive species are kept in check.

The ATV trail through this Stand should be monitored and possibly mapped to aid enforcement. Posting the property would make the riders aware that they are trespassing and that ATV use is prohibited on Township-owned parcels.

Recommendations for Stand 5

- 1. Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
- 2. Monitor and possibly GPS the ATV trail through this Stand.**
- 3. Control deer in this Stand.**
- 4. Work should commence to improve native plant regeneration and improve vertical structure.**
- 5. All trees will be marked by the Forester for girdling/removal.**

Stand 6 Owners Maintenance Tract

Stand 6 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. This Stand is located on the southern portion of the Owners Maintenance tract just south of the powerline cut and has an extremely steep southern aspect.

Stand 6 is a small pole-sized Red Cedar Stand covering approximately 2.55 acres. Dominant tree species in this Stand are Red Cedar and Pignut Hickory. Chestnut Oak is a minor understory component. The sub-canopy includes Pignut Hickory and Red Oak. The overstory covers about 35% of this Stand while the sub-canopy covers about 20% of this Stand.

The shrub layer covers <5% of this Stand. Shrub species found here include Huckleberry and Red Cedar. Floor species include Pennsylvania Sedge, Cinquefoil, Cedar seedlings and some Garlic Mustard. There was an unusual fern on this site that was not identified. Floor species cover about 65% of this Stand.

The average basal area of this Stand is 70 square feet per acre with about 257 trees per acre. Stand 6 has an average diameter at breast height (dbh) of about 7 inches. Acceptable growing stock is about 140 board feet/acre while unacceptable growing stock is about 5.77 cords/acre. This Stand is currently fully stocked.

A Ribbon Snake was noted sunning in this Stand and numerous birds were noted in the cedar trees.

Stand 6 Forest Management Recommendations

No forest management activities are recommended in this Stand. The Garlic Mustard should be removed if possible, without disrupting the very thin soil here. Given the extreme slope and limited soils of this site, any hiking trails should be kept away from this Stand.

This Stand may contain some unique plants, which could be surveyed at a later date. A possible experiment could be to fence a small portion of this Stand to gauge the affect of deer browse on wildflowers.

Recommendations for Stand 6

- 1. Remove Garlic Mustard without disturbing the thin and limited soils on this site.**
- 2. Keep hiking trails away from this Stand due to the extreme slope and limited soils.**
- 3. Possibly fence a small portion of this site to measure the affect of deer browse on wildflowers.**
- 4. Survey the wildflowers that may be found on this site.**

Stand 7 Arnell Tract

Stand 7 is found on Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The AhcBc soils have site index of 50 for Red Maple. This Stand is located along the roadway on the northern portion of the Arnell tract. This Stand is very wet and has no aspect.

Stand 7 is a small pole-sized Maple Ash swamp covering approximately 4.03 acres. Dominant tree species in this Stand are Red Maple and White Ash. Basswood, Swamp White Oak, Yellow Birch, Hemlock and Red Oak are minor overstory components. The sub-canopy includes Musclewood, Witch Hazel, Beech and Hophornbeam. The overstory covers about 40% of this Stand while the sub-canopy covers about 35% of this Stand.

The shrub layer covers 10% of this Stand. Shrub species found here include Japanese Barberry, Asiatic Bittersweet and Japanese Knotweed (along the road). Floor species include Japanese Stilt Grass, Skunk Cabbage, Virginia Smartweed, Spotted Touch Me Not, False Nettle, Poison Ivy, Spicebush, Halbert-leaf Tearthumb, Partridgeberry, Virginia Creeper, Jack in the Pulpit, Christmas Fern, White Snakeroot and Tussock Sedge. Floor species cover about 85% of this Stand.

Tree quality is moderate in this Stand, with potential sawtimber found in the White Ash at this time. However, a timber sale is not an option in this Stand due to the very wet soil. Forest Stand improvement activities will focus on removing invasive species and cleaning up the large amount of roadside litter.

During forest Stand improvement, trees may be girdled and left to provide standing dead trees for foraging and nesting habitat for numerous birds. In time they will drop woody debris and provide wildlife habitat and foraging areas and soil protection. Creating canopy openings in concert with invasive species removal and deer reduction, native shrub species will be encouraged. Currently there are no native species noted in the shrub layer.

The average basal area of this Stand is 90 square feet per acre with about 351 trees per acre. Stand 7 has an average diameter at breast height (dbh) of about 7 inches. Acceptable growing stock is about

1,430 board feet/acre while unacceptable growing stock is about 1.11 cords/acre. This Stand is currently fully stocked. Trees in this Stand are 60-80 years in age.

Site quality is poor in this Stand. The presence of disease or insect infestation was not noted in this Stand during the forest inventory. Deer browse appears to be moderate to heavy in this Stand. Tree tops may be left in brush piles to provide wildlife habitat and to protect native seedlings from deer browse, allowing them to grow into the sapling stage. Deer populations must be reduced and closely monitored, as they can alter the forest ecosystem and affect habitat for other wildlife species. The possibility of hunting maybe limited to bow hunting due to the location of this Stand near homes bordering the property.

Without active management, this Stand will become dominated by Asiatic Bittersweet and Japanese Knotweed and provide limited habitat for wildlife and native plant species.

Stand 7 Forest Management Recommendations

The primary goals for this Stand are to remove the Japanese Knotweed, Japanese Barberry and Asiatic Bittersweet and increase native shrub growth while maintaining the excellent floor species diversity noted here. The Knotweed may require herbicide treatment. Japanese Barberry needs to be removed from the wetland area nearest the road. Deer browse pressure should be closely monitored and a control program implemented.

Litter from neighboring homes needs to be cleaned up. The soil should be protected during any activity on this property. In time, native shrub growth will be improved. Spicebush is currently found on site but is being heavily browsed.

This Stand would be the start of any hiking trails through this property and the adjacent Owners Maintenance, tract due to access to the road and to the pull off site. Trail maintenance should be completed every two to three years. Clearing debris and remarking the trail.

Recommendations for Stand 7

- 1. Remove remaining or resprouting Japanese Knotweed, Japanese Barberry and Asiatic Bittersweet.**
- 2. Maintain and improve native shrub regeneration by reducing deer browse pressure.**
- 3. Clean up the litter near the road and from neighboring homes.**
- 4. Protect soil quality in this Stand.**
- 5. Maintain the hiking trails, cleaning up debris and remarking the trails.**
- 6. The Forester should coordinate invasive species removal from this site.**

Stand 8 Arnell Tract

Stand 8 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils and Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. The AhcBc soils have site index of 50 for Red Maple. This Stand is located on the northeastern corner of the Arnell tract and has a northwestern aspect.

Stand 8 is a large pole-sized Northern Hardwood Stand covering approximately 6.19 acres.

Dominant tree species in this Stand are Yellow Birch, Beech and Red Maple. White Oak, Chestnut Oak and Hickory are minor understory components. The sub-canopy includes Witch Hazel, Highbush Blueberry, Yellow Birch, Musclewood, Beech and Black Birch. The overstory covers about 55% of this Stand while the sub-canopy covers about 35% of this Stand.

The shrub layer covers 0% of this Stand. Floor species include Partridgeberry, Christmas Fern, Wintergreen, Red Maple and Beech seedlings. Floor species cover about 15% of this Stand.

Tree quality is good in this Stand, with potential sawtimber found in the Yellow Birch, White and Chestnut Oak at this time. Forest Stand improvement activities will focus on removing increasing vertical structure and encouraging growth in the shrub layer. This can be done through girdling to create wildlife habitat or removal of poorly formed trees for firewood, if access across Stand 7 can be created without damaging the soils there. Removing poorly formed trees will increase the vigor and growth rates of the remaining trees in this Stand.

Trees removed during forest Stand improvement may also be felled and left on the forest floor to provide downed woody debris for wildlife habitat and foraging areas and soil protection. Others may be girdled and left to provide standing dead trees for foraging and nesting habitat for numerous birds. All forest management activities will be completed while maintaining canopy and subcanopy species diversity in this Stand and while improving growth in the shrub layer with native species.

Lack of cover in the shrub layer may be due to excessive deer populations or due to the density of the canopy and subcanopy and the lack of light reaching the forest floor. Gypsy Moth populations should be monitored, particularly early in this planning period as they were moderate to heavy during the inventory. Deer populations should be monitored and reduced long term, as high populations will impede tree growth and potentially facilitate invasive species spread from Stand 7.

The average basal area of this Stand is 110 square feet per acre with about 187 trees per acre. Stand 8 has an average diameter at breast height (dbh) of about 10.5 inches. Acceptable growing stock is about 3,330 board feet/acre while unacceptable growing stock is about 9.27 cords/acre. This Stand is currently fully stocked.

Site quality is poor to very good in this Stand, depending on the soil. Flat areas are likely poor, while sloped portions of this Stand on the slope will be very good. Tree tops may be piled in brush piles to provide wildlife habitat and to protect seedlings from deer browse, allowing them to grow into the sapling stage.

Stand 8 Forest Management Recommendations

The primary goals for this Stand are to increase native shrub growth and improve growth rates of the remaining trees, while protecting the soil resource on steep slopes. Gypsy Moth populations and deer browse pressure should be closely monitored.

Once the invasive species have been controlled in Stand 8, the canopy may be opened by removing poorly formed trees for firewood. If removal of firewood by residents is not possible, the canopy shall be opened by girdling or felling and leaving on site poorly formed and hazard trees of all

species to maintain species diversity in this Stand. By opening the canopy, forest regeneration and native shrub growth will be improved.

Recommendations for Stand 8

- 1. Monitor deer browse pressure and Gypsy Moth populations.**
- 2. Improve forest regeneration and native species growth in the shrub layer.**
- 3. Trees removed may be used as firewood, if access is possible; if not, trees will be girdled or felled and left on site as wildlife habitat.**
- 4. Protect soil quality in this Stand.**
- 5. No activity shall commence until invasive species from Stand 7 have been removed and controlled.**
- 6. The Forester will mark all trees to be removed from this site.**

Stand 9 Arnell Tract

Stand 9 is a Northern Hardwood Stand located on 6.08 acres. This Stand is located in the center of the Arnell property. Stand 9 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils and Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. The AhcBc soils have site index of 50 for Red Maple. Stand 9 has a northwestern aspect.

Stand 9 is a pole-sized Stand. The overstory of this Stand is dominated by Sugar Maple, Black Birch, Yellow Birch and White Ash. Minor overstory components include Red Oak, Bigtooth Aspen and White Oak. The understory includes Witch Hazel, Yellow Birch, Hornbeam and Musclewood. The overstory covers about 40% of this Stand while the understory covers about 65% of this Stand.

The shrub layer is virtually absent from this Stand, although there is some Japanese Barberry, which should be removed. Floor species include Partridgeberry, White Snakeroot, Pennsylvania Sedge, Christmas Fern, Wintergreen, Hay-scented Fern, Violet, Indian Pipe and another fern species. Shrub species cover <5% of this Stand while floor species cover 35% of this Stand.

Tree quality is good in this Stand, with potential future timber found in Red Oak, Sugar Maple and White Ash. Forest Stand improvement activities in this Stand will focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining tree to mature further. This Stand should be managed for its old growth character.

The average basal area of Stand 9 is 100 square feet per acre, with 576 trees per acre. Stand 9 has an average diameter at breast height (dbh) of 5.5 inches. This Stand is currently fully stocked. Acceptable growing stock is 7,240 board feet per acre while unacceptable growing stock is about 7.16 cords per acre. This Stand was harvested in the past, and some extremely large trees were removed.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Two deer were noted during the forest inventory. Vertical diversity and species diversity in this Stand is good, with the exception of the shrub layer, which is absent. There was a light infestation of Gypsy Moth in this Stand.

The boundary in this Stand is currently clearly marked by the adjacent property owner, but the Township should mark the boundary with paint and posters as well.

Stand 9 Forest Management Recommendations

This Stand has been harvested in the past. This Stand should be managed for its potential for old growth character. There are large trees in this Stand, a good understory, and good species diversity. Old growth character can be enhanced by creating canopy openings by cutting or girdling trees in groups to maximize the amount of light reaching the forest floor. Native regeneration and the shrub layer are noticeably absent from this Stand.

Deer browse appears to be heavy in this Stand and control measures should be investigated. Japanese Barberry should be removed from this Stand prior to any work being completed. There is an old logging road through this Stand from a previous harvest.

As Emerald Ash Borer moves closer to Sussex County the Township may choose to remove it in coordination with the adjacent landowner.

Recommendations for Stand 9

- 1. Monitor Japanese Barberry in this Stand, remove if noted.**
- 2. Manage this Stand toward old growth character by removing trees in groups and encouraging the development of native tree saplings.**
- 3. Implement a deer management program to reduce the population.**
- 4. Remove White Ash as the Emerald Ash Borer moves closer to Sussex County.**
- 5. Properly maintain the old logging road to prevent serious erosion.**
- 6. All trees will be marked by the Forester for removal.**

Stand 10 Arnell Tract

Stand 10 is an Oak-Hickory Stand located on 16.38 acres. Stand 10 is located on the Arnell tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils and on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. Stand 10 has a variable but mainly northeastern aspect.

Stand 10 is a timber-sized Oak-Hickory Stand. The overstory of this Stand is dominated by Red Oak, Chestnut Oak and Sugar Maple. White Oak, Mockernut and Pignut Hickory and Black Birch were minor overstory components. The understory includes Black Birch, Sugar Maple, Amelanchier, Shagbark Hickory, Red Oak and Hemlock. The overstory covers about 50% of this Stand while the understory covers about 35% of this Stand. Without active management, over time this Stand will likely convert to a more shade tolerant northern hardwood dominated Stand.

The shrub layer is virtually absent and covers <5% of this Stand. The only species noted was Japanese Barberry. Floor species include Partridgeberry, Pennsylvania Sedge, Wintergreen and Rattlesnake Plantain. Floor species covered 55% of this Stand.

Tree quality is good in this Stand, with potential future timber found in Hickory and Oak species. Forest Stand improvement activities will focus on removing poorly formed trees from this Stand. Trees with good form will be left to serve as the seed source for the future forest, thus improving growth rates of the remaining crop trees.

The average basal area of Stand 10 is 100 square feet per acre, with 111 trees per acre. Stand 10 has an average diameter at breast height (dbh) of 13 inches. This Stand is currently fully stocked. Acceptable growing stock is about 9,670 board feet per acre while unacceptable growing stock is about 3.12 cords per acre. This Stand is approximately 70-90 years of age. Potential growth rates in this Stand are 57 cubic feet per acre for Red, Black, White and Scarlet Oak and Tulip Poplar.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Gypsy Moth populations were moderate in this Stand and should be closely monitored. There is an old logging road which should be GPS'd and mapped for future forest management activities. One deer was noted in this Stand during the forest inventory

Stand 10 Forest Management Recommendations

Monitor Japanese Barberry that may resprout and remove it if found from this Stand prior to opening the canopy, as its population is limited at this time. Gypsy Moth populations must be closely monitored in this Stand. If population densities are high enough, the Township should consider participating in the State spray program.

Native regeneration should be improved by creating canopy openings being created through girdling, if Gypsy Moth populations are controlled and deer populations and invasive species are kept in check.

The old logging road through this Stand should be mapped to aid in completing future forest management activities. If biomass is to be removed from this Stand, the road would have to be mapped and maintained.

Recommendations for Stand 10

- 1. Monitor resprouting Japanese Barberry from this Stand.**
- 2. Closely monitor Gypsy Moth populations and spray if necessary.**
- 3. Monitor and GPS the old logging road through this Stand.**
- 4. Assess the impact of deer in this Stand on native regeneration.**
- 5. All trees will be marked by the Forester for girdling/removal.**

Stand 11 Arnell Tract

Stand 11 is found on Catden mucky peat, 0-2% slopes (CatbA) soils. The CatbA soils have site index of 56 for Red Maple and 83 for Silver Maple. This Stand is located along the southernmost portion of the Arnell tract. This Stand is very wet and has no aspect. Access into this Stand is virtually impossible, due to the Standing water and mucky soils.

Stand 11 is a Maple Ash swamp covering approximately 1.65 acres. Canopy tree species in this Stand are Red Maple, Swamp White Oak, Blackgum and Black Birch, with Tulip Poplar along the edges of the wetland. The sub-canopy is absent in this Stand. The overstory covers about 20% of this Stand.

The shrub layer covers 75% of this Stand. Shrub species found here include Spicebush, Highbush Blueberry, Sweet Pepperbush and Greenbriar. Floor species include Tussock Sedge, Sensitive Fern, Iris, Violet, Tickseed and False Nettle. Floor species cover about 30% of this Stand.

Stand 11 had a basal area of 20. There were about 26 trees per acre. This Stand is severely understocked (which would be expected in soils this wet). The average dbh was 12 inches in this Stand. There were 4.26 cords per acre of unacceptable growing stock. There is no potential sawtimber noted in this Stand.

Forest management activities are extremely limited in this Stand. This Stand should be monitored for rare plants, invasive plants and potential as a vernal pool breeding area for reptiles and amphibians.

Site quality is poor in this Stand. The presence of disease or insect infestation was not noted during the forest inventory. Deer browse appears to be heavy.

Stand 11 Forest Management Recommendations

The primary goals for this Stand are to monitor for rare plants and invasive species. If invasive species are noted, they should be removed promptly. This Stand should also be monitored for its potential to serve as a large vernal pool. A pool this size could provide critical habitat for reptiles and amphibians.

Recommendations for Stand 11

- 1. Monitor this Stand for invasive species and remove them promptly.**
- 2. Given the possibility for rare plants to be found, this Stand, should be evaluated during the growing season.**
- 3. There may be a very large vernal pool, in this Stand which should be evaluated for breeding habitat for reptiles and amphibians.**

Stand 12 Arnell Tract

Stand 12 is a Hemlock Stand located on 0.86 acres. This Stand is located on the northwestern edge of the Arnell property. Stand 12 is found on Alden mucky silt loam, gneiss till substratum, 0 to 8 percent slopes, extremely stony (AhcBc) soils. The AhcBc soils have site index of 50 for Red Maple. Stand 12 has an eastern aspect.

Stand 12 is a pole-sized Stand. The overstory of this Stand is dominated by Hemlock and Black Birch. Minor overstory components include Black Oak, Sugar Maple, Red Maple, Tulip Poplar and Hickory. The understory includes Witch Hazel, Yellow Birch and Musclewood. The overstory covers about 40% of this Stand while the understory covers about 55% of this Stand.

The shrub layer is virtually absent from this Stand, although there is some Japanese Barberry, which should be removed. Floor species include Christmas Fern, Wintergreen, White Pine seedlings, Violet, Partridgeberry, a Fern species and Canada Mayflower. Shrub species covered <5% of this Stand while floor species covered 25% of this Stand.

Tree quality is fair to good with potential future timber found in Black Oak and Sugar Maple. Other than removing the Japanese Barberry and monitoring Hemlock Woolley Adelgid there is no management activity required at this time.

The average basal area of Stand 12 is 120 square feet per acre, with 707 trees per acre. Stand 12 has an average diameter at breast height (dbh) of 5.5 inches. This Stand is currently over stocked. Acceptable growing stock is 6,790 board feet per acre while unacceptable growing stock is about 15.88 cords per acre.

Site quality is good in this Stand. Deer browse appears to be heavy. There was a large number of squirrels noted and a light infestation of Gypsy Moth in this Stand. Vertical diversity and species diversity in this Stand is good, with the exception of the shrub layer, which is absent. This is to be expected from a Hemlock Stand which is only lightly infested with the Woolley Adelgid.

Stand 12 Forest Management Recommendations

This Stand should be managed to maintain the Hemlock cover. This may be difficult if the Hemlock Woolley Adelgid population increases significantly. Areas as remote as this are impossible to treat. If the Hemlocks begin to die off, actions should be taken to protect the soils on the slopes.

The Japanese Barberry should be removed as it makes up only a small portion of this Stand at this time. Gypsy Moth populations were low and would never cause dramatic defoliation here due to the species make up of this Stand.

Recommendations for Stand 12

- 1. Remove the Japanese Barberry from this Stand.**
- 2. Monitor the Hemlock Woolley Adelgid populations in this Stand.**
- 3. Fell trees parallel to the slope should the Hemlocks begin to die in large numbers.**

Stand 13 Beckmann/Kostrey Tract

Stand 13 is an Oak-Hickory Stand located on 19.38 acres. Stand 13 is located on the Beckmann/Kostrey tract on the northernmost portion of the property. It is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils, Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils and on Hibernia loam, 0 to 8% slopes, extremely stony (HhmBc) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. HhmBc soils have a site index of 55 for White Pine, 56 for Sugar Maple and 47 for Red Oak. Stand 13 has a very steep northwestern aspect.

Stand 13 is a sapling-sized Oak-Hickory Stand. In the recent past, this Stand was a Hemlock dominated Stand which succumbed to Hemlock Wolley Adelgid. The overstory of this Stand is made up of Chestnut Oak and Red Oak. Scarlet Oak, Black Birch, Beech and Hickory were minor overstory components. The understory includes Black Birch, Red Maple, Hemlock, Red Oak, Chestnut sprouts and Hophornbeam. The overstory covers about 20% of this Stand while the understory covers about 80% of this Stand. Over time this Stand will likely convert to a more shade tolerant northern hardwood dominated Stand, unless the Eastern Hemlock recovers, which is unlikely at this time.

The shrub layer covers 10% of this Stand. Species noted in this layer included Multiflora Rose, Huckleberry and Beech. Floor species include Hemlock seedlings, White Oak seedlings, Sugar Maple seedlings, White Snakeroot, Goldenrod and Partridgeberry. Floor species covered 35% of this Stand.



Tree quality is moderate in this Stand with potential future timber found in Chestnut and Red Oak species. Forest Stand improvement activities in this Stand will focus on maintaining forest cover and protecting soils on these steep slopes. This can be completed by removing poorly formed trees, which should be felled parallel to the slope and left on site. Trees with good form will be left to

serve as the seed source for the future forest. The felling of poorly formed trees will result in improve growth rates of the remaining crop trees.

The average basal area of Stand 13 is 70 square feet per acre, with 1413 trees per acre. Stand 10 has an average diameter at breast height (dbh) of 3 inches. This Stand is currently fully stocked. Acceptable growing stock is about 1,830 board feet per acre while unacceptable growing stock is about 17.08 cords per acre.

Site quality is good in this Stand. Deer browse appears to be light in this Stand. Gypsy Moth populations were light to moderate in this Stand and should be closely monitored. Much of this Stand is good early successional habitat, due to the death of the Hemlock canopy and dense growth of saplings.

Stand 13 Forest Management Recommendations

Multiflora Rose should be removed from this Stand although the density of the subcanopy may shade it out in a relatively short period. Gypsy Moth populations must be closely monitored in this Stand. If population densities are high enough, the Township should consider participating in the State spray program. Loss of the already thin canopy could lead to soil loss and erosion from this site.

There is a moderately sized American Chestnut near the parking area which should be monitored for its potential use as a breeding tree for the American Chestnut Foundation.

Recommendations for Stand 13

- 1. Remove the Multiflora Rose.**
- 2. Monitor Gypsy Moth populations in this Stand and spray if necessary.**
- 3. Monitor tree growth and soil erosion.**
- 4. All trees will be marked by the Forester for girdling/removal.**

Stand 14 Beckmann/Kostrey Tract

Stand 14 is an Oak-Hickory-Hemlock Stand located on 10.52 acres. Stand 14 is located on the Beckmann/Kostrey tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils and Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. Stand 14 has a moderate to very steep northwestern aspect.

Stand 14 is a large pole-sized Stand. In the recent past, this was a Hemlock dominated Stand which is quickly succumbing to the Hemlock Woolley Adelgid. The overstory of this Stand is dominated by Chestnut Oak and Hemlock. Red Oak and Pignut Hickory were minor overstory components. The understory includes Black Birch, Amelanchier and Red Oak. The overstory covers about 50% of this Stand while the understory covers about 40% of this Stand.

The shrub layer covers 30% of this Stand. Species noted in this layer included Black Birch and Huckleberry. Floor species include Pennsylvania Sedge, Chestnut Oak seedlings and an unknown fern species. Floor species covered 20% of this Stand.



Tree quality is moderate in this Stand, with potential future timber found in Chestnut and Red Oak species. Forest Stand improvement activities in this Stand will focus on protecting soils on these steep slopes. Trees with good form will be left to serve as the seed source for the future forest and culling of poorly formed trees will result in improved growth rates of the remaining crop trees. It may be possible to underplant conifers in this Stand, possibly White Pine, to maintain the conifer cover in this area long-term. Portions of this Stand have been decimated by the Hemlock Woolley Adelgid.

The average basal area of Stand 14 is 90 square feet per acre, with 125 trees per acre. Stand 14 has an average diameter at breast height (dbh) of 11.5 inches. This stand is currently fully stocked.

Acceptable growing stock is about 1,480 board feet per acre while unacceptable growing stock is about 12 cords per acre.

Site quality is good in this Stand. Deer browse appears to be moderate. Gypsy Moth populations were moderate to heavy and should be closely monitored. The double infestation of Woolley Adelgid and Gypsy Moth could have a devastating long-term effect on this Stand. The tick population in this Stand is extremely high.

Stand 14 Forest Management Recommendations

This Stand should be monitored for the Woolley Adelgid populations, which are already devastating the canopy. Treatment in an area with such steep slopes would be difficult to impossible. Gypsy Moth populations must also be closely monitored. Populations were moderate to heavy during the forest inventory. If population densities are high enough, the Township should consider participating in the State spray program. These two insects together can wipe out the canopy of this Stand.

Monitor the planted trees planted in an attempt to maintain conifer cover in this Stand, as it provides habitat for different species of wildlife than the deciduous forest which dominates the landscape in this area. White Pine may not duplicate the exact habitat but would provide winter cover.



Recommendations for Stand 14

- 1. Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
- 2. Under plant this Stand with a conifer, likely White Pine.**
- 3. Monitor tree survival and soil erosion in this Stand.**
- 4. Possibly girdle poorly formed trees, as long as the canopy is not devastated by Gypsy Moth.**
- 5. All trees will be marked by the Forester for girdling/removal.**

Stand 15 Beckmann/Kostrey

Stand 15 is an Oak-Hickory savannah type Stand located on 11.71 acres. Stand 15 is located on the Beckmann/Kostrey tract and is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils, Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes (ChkC) soils and Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple, while the RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. ChkC soils have a site index of 75 for White Ash, 70 for Red Oak and 65 for Sugar Maple. Stand 15 has a slight western aspect.



Stand 15 is a large sapling Stand. Most trees in this Stand are stunted, due to the shallow soils on this ridge top. The overstory of this Stand is dominated by Red Oak. Chestnut Oak, Pignut Hickory, Hophornbeam and Pitch Pine were minor overstory components. The understory does not exist in this Stand. The overstory covers about 25% of this Stand.

The shrub layer covers 5% of this Stand. Species noted in this layer included Red Cedar, Huckleberry, Black Birch and Wineberry. Floor species include Pennsylvania Sedge, Wintergreen, Cinquefoil, Little Bluestem, Aster species and an unknown fern species. Floor species covered 65% of this Stand.

Tree quality is poor in this Stand with no future timber. The soils are very thin and the large majority of the trees are stunted, being mostly 25-30 feet in height. This savannah-type ecosystem is likely very fire prone. It may be possible to plant Pitch Pine to increase its prevalence here. This Stand is drought prone and would be affected early on during dry spells.

The average basal area of Stand 15 is 60 square feet per acre, with 398 trees per acre. Stand 15 has an average diameter at breast height (dbh) of 5.5 inches. This Stand is currently fully stocked.

There is no acceptable growing stock, while unacceptable growing stock is about 3.45 cords per acre.

Site quality is good in this Stand (according to soil maps). Deer browse appears to be moderate to heavy. Gypsy Moth populations were moderate during the forest inventory and should be closely monitored.

This Stand would make an excellent vista for a hiking trail. This activity could increase the risk of fire, depending upon the frequency and type of use.

Stand 15 Forest Management Recommendations

Gypsy Moth populations must be closely monitored in this Stand. Populations were moderate during the inventory. If population densities are high enough, the Township should consider participating in the State spray program.

This Stand's savannah-type habitat should be maintained. Controlled fire may be a possible if limited management tool to maintain the character in this Stand. It could also be under-planted with Pitch Pine. There are a few Pitch Pine growing in this Stand already.

This Stand also provides an excellent vista for a hiking trail. This will likely be a destination for any trails created on this property. Deer browse pressure should also be monitored in this Stand. A small area could be fenced to study the affect of deer on wildflowers.



Recommendations for Stand 15

- 1. Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
- 2. Monitor this Stand where Pitch Pine was planted.**
- 3. Maintain the savannah-type character of this Stand.**
- 4. All trees will be marked by the Forester for girdling/removal.**

Stand 16 Beckmann/Kostrey Tract

Stand 16 is an Upland Oak-Hickory Stand located on 8.40 acres. Stand 16 is located on the easternmost portion of the Beckmann/Kostrey tract. It is found on Chatfield-Hollis-Rock outcrop complex, 0 to 15 percent slopes (ChkC) soils and Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The RokD soils have site index of 70 for Upland Oaks, 75 for Tulip Poplar and 65 for White Ash. ChkC soils have a site index of 75 for White Ash, 70 for Red Oak and 65 for Sugar Maple. Stand 16 is mainly flat but has variable aspects.

Stand 16 is a large-sapling Stand. The overstory of this Stand is dominated by Chestnut and Black Oak and Black Birch. Red Oak, White Oak, Swamp White Oak, Hemlock, Pin Oak and Silver Maple are minor overstory components. The understory included Amelanchier, Black Birch, Highbush Blueberry and Sugar Maple. The overstory covers about 45% of this Stand while the understory covered about 25% of this Stand.

The shrub layer covers 10% of this Stand. Species noted in this layer included Huckleberry, Highbush Blueberry and Greenbriar. Floor species include Chestnut Oak, Huckleberry, Black Oak seedlings, Pennsylvania Sedge and an unidentified Moss species. Floor species covered 45% of this Stand.



Tree quality is good in this Stand, with future timber found in Chestnut and Red Oak at this time. The average basal area of Stand 16 is 80 square feet per acre, with 400 trees per acre. Stand 16 has an average diameter at breast height (dbh) of 6 inches. This Stand is currently fully stocked. Acceptable growing stock is 1,900 board feet per acre while unacceptable growing

stock is about 4.72 cords per acre.

Site quality is good in this Stand. Deer browse appears to be moderate to heavy. Gypsy Moth populations were heavy and should be closely monitored.

This Stand has multiple vernal pools and should provide very good habitat for amphibian and reptile species that may frequent these areas. Wetland type trees such as Swamp White Oak, Pin Oak and Silver Maple are found within and along the vernal pools. These vernal pools should be monitored for herptile species and possibly the New England Bluet Damselfly.



The vernal pools may be an area for hiking trails to avoid, depending upon whether any threatened or endangered species are located there.

Stand 16 Forest Management Recommendations

Gypsy Moth populations must be closely monitored in this Stand. Populations were high during the inventory. If population densities are high enough the Township should consider participating in the State spray program.

The vernal pools in this Stand should be monitored for amphibian and reptile species which may breed in them, as well as for unusual wildflowers and the New England Bluet Damselfly. There is potential future timber in this Stand, but access would be difficult unless access from the east.

Deer browse pressure should also be monitored in this Stand. A small area may be fenced to study the effect of deer on wildflowers.

Recommendations for Stand 16

- 1. Closely monitor Gypsy Moth populations in this Stand and spray if necessary.**
- 2. Monitor the vernal pools for threatened and endangered species which may reside in this Stand. A herptile survey should be conducted.**
- 3. Any forest management activities would protect these vernal pools.**
- 4. Try to keep hiking trails away from the vernal pools in this Stand.**
- 5. All trees will be marked by the Forester for girdling/removal.**

Stand 17 Beckmann/Kostrey Tract

Stand 17 is an Upland Oak Stand located on 10.50 acres. This Stand is located in the southwest corner of the Beckmann/Kostrey property. Stand 17 is found on Chatfield-Hollis-Rock outcrop complex, 35 to 60 percent slopes (ChkE) soils. The ChkE soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 17 has a steep western aspect.



Stand 17 is a small timber-sized Stand. The overstory of this Stand is dominated by Chestnut Oak and Red Oak. Minor overstory components include White Oak, Black Birch, Red Maple and Sugar Maple. The understory includes Red Maple, Black Birch, Sugar Maple, Sassafras and Hophornbeam. The overstory covers about 45% of this Stand while the understory covers about 25% of this Stand.

The shrub layer is covers about 10% this Stand. Shrub species noted include Witch Hazel, Black birch, Blackberry, Poison Ivy, Sugar Maple and Amelanchier. Floor species include Huckleberry, Chestnut Oak, Ferns, Red Maple and Christmas Fern. Floor species covered 20% of this Stand.

Tree quality is good, with potential future timber found in Chestnut and Red Oak. This Stand will move toward a more shade tolerant Northern Hardwood forest over time. If the Oak dominance is to be maintained, the canopy should be opened to promote regeneration of Oak species. This would require a shelterwood type cut.



Forest Stand improvement activities at this time should focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining trees to mature further. Access to this Stand will be difficult due to the steep slopes to the west. If access can be worked out from the neighboring property to the east materials could be extracted from this Stand.

The average basal area of Stand 17 is 100 square feet per acre, with 86 trees per acre. Stand 17 has an average diameter at breast height (dbh) of 14 inches. This Stand is currently fully stocked. Acceptable growing stock is 5,460 board feet per acre while unacceptable growing stock is about 11.83 cords per acre.

Site quality is good to very good in this Stand. Deer browse appears to be moderate. Gypsy Moth populations should be closely monitored as succession toward a northern hardwood Stand could be speeding up if the oak species are killed by a repeated heavy defoliation.

The boundary in this Stand should be clearly marked, with paint and posters as it is adjacent to numerous homes to the southwest. This area should also be monitored for encroachment from neighboring properties.

Stand 17 Forest Management Recommendations

Due to the steep slopes, this Stand should be managed to protect the soils resources. There is also a stream at the bottom of the hill. This Stand should be monitored for Gypsy Moth, whose infestation will be moderate to heavy.

If it is decided that oak dominance will be maintained in this Stand, active management must be undertaken otherwise this Stand will slowly convert to a northern hardwood Stand, given the species found in the understory. A shelterwood type situation should be created to promote oak species growth. There is some potential timber noted in this Stand, but access would be the obstacle towards conducting a harvest here.

Deer browse appears to be moderate, in this Stand and control measures should be investigated. No invasive species were noted but if they are found they should be removed promptly.

Recommendations for Stand 17

- 1. Monitor for Gypsy Moth populations.**
- 2. Protect the soils in this Stand and the stream at the base of the hill.**

- 3. Clearly delineate the property boundary.**
- 4. If Oak dominance is preferred, active management must be implemented.**
- 5. All trees will be marked by the Forester for removal.**

Stand 18 (Glenside Woods)

Stand 18 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The RokD soils have site index of 70 for Northern Red Oak, 65 for White Ash and 75 for Tulip Poplar. This Stand is located on the western portion of the Glenside Woods tract (in the area of Ranger Road and the water tower) and has flat to slightly northern aspect.

Stand 18 is a small polesized Red Maple Blackgum stand covering approximately 12.41 acres. Dominant tree species in this stand are Red Maple and Blackgum. White Ash, Elm and Black Birch are minor understory components. The sub-canopy includes Red Maple, Elm, Blackgum and Yellow Birch. The overstory covers about 30% of this Stand while the sub-canopy covers about 50% of this stand.

The shrub layer covers 40% of this stand. Shrub species found here include Highbush Blueberry, Spicebush and some Japanese Barberry. Floor species include Skunk Cabbage, Jack in the Pulpit, Tussock Sedge, Poison Ivy, Sphagnum Moss, False Nettle, Sensitive Fern and Japanese Stilt Grass. Floor species cover about 70% of this stand.

Tree quality is poor in this stand with no potential sawtimber found here mainly due to the wetness of the soil in this area. Forest stand improvement activities will focus on removing some of the unacceptable growing stock and Japanese Barberry. This can be done through girdling some of the poorly formed Red Maples to create wildlife habitat.

Lack of cover in the shrub layer may be due to excessive deer populations or due to the density of the canopy and subcanopy and the lack of light reaching the forest floor. Deer populations should be monitored long term, as high populations will impede tree growth and facilitate invasive species spread. Three deer were noted in this stand during the forest inventory.

The average basal area of this stand is 60 square feet per acre with about 1087 trees per acre. Stand 18 has an average diameter at breast height (dbh) of about 3.5 inches. Current acceptable growing stock in this stand was 0 board feet/acre while unacceptable growing stock is about 12.76 cords/acre. This stand is currently fully stocked.

Site quality is good in this stand. The presence of disease or insect infestation was not noted in this stand during the forest inventory. Deer browse appears to be moderate to heavy in this stand. Tree tops may be piled in brush piles to provide wildlife habitat and to protect seedlings from deer browse allowing them to grow into the sapling stage while not being browsed by deer. Deer populations must be closely monitored, as they can alter the forest ecosystem and affect habitat for other wildlife species. The possibility of hunting may be limited to bow hunting due to the size of the property and the residential development bordering the property.

Without active stewardship and deer hunting this stand native shrubs will lose ground to Japanese Barberry and habitat quality will be degraded.

Stand 18 Forest Management Recommendations

The primary goals for this stand are to remove the Japanese Barberry and increase native shrub growth, while protecting the soil resource. Deer browse pressure should be monitored.

Poorly formed and hazard trees of all species to maintain species diversity in this stand. The soil should be protected during any activity on this property. Aesthetics near home sites will be maintained. Trails should be maintained and kept clear of fallen trees and debris.

This stand is the start of the hiking trail through this property and is the best site for access to the property due to the small parking area near the water tower. The property boundary should be clearly delineated and the property monitored through the planning period to gauge encroachment by adjacent landowners.

Recommendations for Stand 18

- 1. Remove Japanese Barberry.**
- 2. Monitor over time any potential encroachments onto the property.**
- 3. Protect soil and water quality in this stand.**
- 5. Monitor deer browse pressure and populations while implementing a hunting program.**
- 6. Work to maintain the trail and keep it clear of fallen trees and debris.**
- 7. The Forester will mark all trees to be removed from this site.**

Stand 19 (Glenside Woods)

Stand 19 is an Upland Oak Stand located on 30.29 acres. This stand is located on the western portion of the Glenside Woods property. Stand 19 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The RokD soils have site index of 70 for Northern Red Oak, 65 for White Ash and 75 for Tulip Poplar. Stand 19 has a slight northwestern aspect.

Stand 19 is a timber-sized Upland Oak Stand. The overstory of this Stand is dominated by Chestnut Oak. Minor overstory components include White Oak, Red Oak and Black Oak, Black Birch, Red Maple and Tulip Poplar. The understory includes Black Birch, Witch Hazel, Amelanchier, Red Oak, Beech, Musclewood, Sugar Maple and an American Chestnut. The overstory covers about 45% of this stand while the understory covers about 40% of this stand.

The shrub layer is covers about 30% this stand. Shrub species noted include Huckleberry and Mountain Laurel. Floor species include Huckleberry, Canada Mayflower, Partidgeberry, Virginia Creeper, Indian Pipe, Tulip Poplar and White Pine seedlings. Floor species covered 25% of this Stand. There are numerous blowdowns in this stand.

Tree quality is good, with potential future timber found in Chestnut and other Oak species and Tulip Poplar. This stand will move toward a more shade tolerant Northern Hardwood forest over time. If the Oak dominance is to be maintained, the canopy should be opened to promote regeneration of Oak species. This would require a shelterwood type cut.

Forest Stand improvement activities at this time should focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining trees to mature further. Access to this Stand will be difficult due to the wet areas to the west. It may be possible to allow some of the neighbors to remove some of the blowdowns for firewood..

The average basal area of Stand 19 is 170 square feet per acre, with 165 trees per acre. Stand 19 has an average diameter at breast height (dbh) of 14 inches. This stand is currently overstocked. Acceptable growing stock is 15,880 board feet per acre while unacceptable growing stock is about 18.49 cords per acre.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Seven deer were noted in this stand during the inventory. There was no sign of infestation by Gypsy Moth in this stand during the inventory. This should be closely monitored in this stand due to the amount of oak in this stand.

The boundary in this stand should be clearly marked, with posters as it is adjacent to numerous homes to the north. This area should also be monitored for encroachment from neighboring properties.

Stand 19 Forest Management Recommendations

Due to the steep slopes, this Stand should be managed to protect the soils resources. There is also a stream at the bottom of the hill. This Stand should be monitored for Gypsy Moth, whose infestation will be moderate to heavy.

If it is decided that oak dominance will be maintained in this stand, active management must be undertaken otherwise this Stand will slowly convert to a northern hardwood Stand, given the species found in the understory. A shelterwood type situation should be created to promote oak species growth only after deer populations have been dealt with. It would not be the most aesthetically pleasing condition but could be used as an educational tool and ecologically pertinent. There is potential timber noted in this stand, but access would be the obstacle towards conducting a harvest here.

Deer browse appears to be moderate, in this Stand and control measures should be investigated. No invasive species were noted but if they are found they should be removed promptly.

Recommendations for Stand 19

- 1. Implement a deer management strategy.**
- 2. Monitor for Gypsy Moth populations and non-native species.**
- 3. Clearly delineate the property boundary.**
- 4. If Oak dominance is preferred, active management must be implemented.**
- 5. All trees will be marked by the Forester for removal.**

Stand 20 (Glenside Woods)

Stand 20 is an Oak Hickory Stand with a northern hardwood component located on 30.29 acres.

This stand is located on the eastern portion of the Glenside Woods property. Stand 20 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The RokD soils have site index of 70 for Northern Red Oak, 65 for White Ash and 75 for Tulip Poplar. Stand 20 has a slight northwestern aspect but is variable due to the topography.

Stand 20 is a timber-sized Oak Hickory Stand. The overstory of this stand is dominated by Red Oak and Sugar Maple. Minor overstory components include White Oak and Black Oak, Black Birch, Tulip Poplar, Yellow Birch and Pignut Hickory. The understory includes Hornbeam, Hophornbeam, Amelanchier, Basswood, Sugar Maple, Grape and American Chestnut. The overstory covers about 60% of this stand while the understory covers about 25% of this stand.

The shrub layer is covers less than 5% this stand. Shrub species noted include Japanese Barberry and Witch Hazel. Floor species include Tulip Poplar and Sugar Maple seedlings, Canada Mayflower, White Snakeroot, Partidgeberry, Christmas Fern, Wintergreen, Pennsylvania Sedge, Virginia Creeper, Indian Pipe, Maple-leafed Viburnum and Sweet Fern, near the stream. Floor species covered 20% of this Stand. There are numerous blowdowns in this stand.

Tree quality is good, with potential future timber found in Oak species, Sugar Maple and Tulip Poplar. This stand will move toward a more shade tolerant Northern Hardwood forest over time. This stand should be allowed to move toward the northern hardwood suite of species.

Forest Stand improvement activities at this time should focus on removing unacceptable growing stock, mainly poorly formed Sugar Maples and Black Birch, while allowing the remaining trees to mature further. Access to this stand will be difficult due to the wet areas to the west near the best road access. It may be possible to allow some of the neighbors to remove some of the blowdowns for firewood.

The average basal area of Stand 20 is 160 square feet per acre, with 145 trees per acre. Stand 19 has an average diameter at breast height (dbh) of 15 inches. This stand is currently overstocked. Acceptable growing stock is 26,700 board feet per acre while unacceptable growing stock is about 5.35 cords per acre.

Site quality is good to very good in this Stand. Deer browse appears to be heavy. Several deer were noted in this stand during the inventory. There was no sign of infestation by Gypsy Moth in this stand during the inventory. This should be closely monitored in this stand due to the amount of large oak in this stand.

The boundary in this stand should be clearly marked, with posters as it is adjacent to numerous homes to the north. This area should also be monitored for encroachment from neighboring properties.

Stand 20 Forest Management Recommendations

Deer management will be important in this stand. Maple-leaved Viburnum is all browsed heavily and hasn't made it into the shrub layer yet. Japanese Barberry should be removed as it is not found in excessive amounts at this point. Any other invasive species that pop up should be removed as well. Poorly formed Sugar Maple and Black Birch could be girdled or cut down to allow more sun to reach the forest floor once deer are in control.

There is potential timber noted in this stand, but access would be the obstacle towards conducting a harvest here. Hazard trees should be removed from areas near the trail.

Recommendations for Stand 20

- 1. Implement a deer management strategy.**
- 2. Remove Japanese Barberry.**
- 3. Monitor for Gypsy Moth populations.**
- 4. Remove potential hazard trees near the hiking trail.**
- 5. Clearly delineate the property boundary.**
- 6. All trees will be marked by the Forester for removal.**

Stand 21 (Johnson Lake West)

Stand 21 is a Northern Hardwood Stand located on 2.5 acres. This stand is located in the southern end of the Johnson Lake West property. Stand 21 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The RokD soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 21 has a moderately steep northeastern aspect.

Stand 21 is a timber-sized stand. The overstory of this stand is dominated by Beech, Black Birch and White Oak. Minor overstory components include Red Oak, Red Maple, Tulip Poplar and Sugar Maple. The understory includes Red Maple, Beech, Hemlock and Sassafras. The overstory covers about 40% of this Stand while the understory covers about 20% of this stand.

The shrub layer is covers about 35% this stand. Shrub species noted include Maple-leaved Viburnum, Witch Hazel, Black Cherry and Hickory. Floor species include Wintergreen, Canada Mayflower and Partridgeberry. Floor species covered 15% of this stand.

Tree quality is good, with potential future timber found in Oak species and Sugar Maple. Forest Stand improvement activities at this time should focus on maintaining good forest cover to prevent soil erosion and more nutrients from reaching the lake. There are several large blowdowns and good native species regeneration.

The average basal area of Stand 21 is 90 square feet per acre, with 78 trees per acre. Stand 21 has an average diameter at breast height (dbh) of 15 inches. This stand is currently fully stocked. Acceptable growing stock is 8,650 board feet per acre while unacceptable growing stock is about 14.9 cords per acre.

Site quality is good to very good in this Stand. Deer browse appears to be moderate to low based on the native shrub layer that is growing on the site. The boundary in this stand should be clearly marked, with paint and posters as it is adjacent to a home to the southwest. There are currently posted signs facing out from the Township owned land to the driveway which give the impression that it is private property.

Stand 21 Forest Management Recommendations

Due to the steep slopes, this stand should be managed to protect the soils resources and water quality. Deer browse appears to be low to moderate, in this stand and control measures should be continued on this property. No invasive species were noted but if they are found they should be removed promptly.

Recommendations for Stand 21

- 1. Protect the soils in this stand and ultimately the water quality in Johnson Lake at the base of the hill.**
- 2. Create a clear trail/path to the water for fishing access to prevent damage to vegetation on the steeper slopes.**
- 3. Clearly delineate the property boundary.**
- 4. All trees will be marked by the Forester for removal.**

Stand 22 (Johnson Lake West)

Stand 22 is an Oak Hickory stand located on 11.0 acres. This stand is located in the northern end of the Johnson Lake West property. Stand 22 is found on Rockaway-Chatfield-Rock outcrop complex, 15 to 35 percent slopes (RokD) soils. The RokD soils have site index of 70 for Northern Red Oak,

75 for White Ash and 65 for Sugar Maple. Stand 22 has a steep southeastern aspect and moderately steep northwestern aspect.

Stand 22 is a timber-sized stand. The overstory of this stand is dominated by Chestnut Oak. Minor overstory components include Black, Red and White Oak and Mockernut Hickory. The understory includes Chestnut Oak, Black Oak and Red Cedar. The overstory covers about 55% of this stand while the understory covers about 35% of this stand.

The shrub layer is covers about 40% this stand. Shrub layer species noted include Chestnut Oak, Hickory spp., Huckleberry, Hemlock, Cedar, Amelanchier and Sassafras. Floor species include Pennsylvania Sedge, Cinquefoil, Red Maple and Oak seedlings and Sweet Fern. Floor species covered 15% of this stand.

Tree quality is poor, with very limited potential future timber found in Chestnut Oak. Forest Stand improvement activities at this time should focus on maintaining good forest cover to prevent soil erosion and more nutrients from reaching the lake. There are several large blowdowns and good native species regeneration.

The average basal area of Stand 22 is 70 square feet per acre, with 989 trees per acre. Stand 22 has an average diameter at breast height (dbh) of 3.5 inches. This stand is currently fully stocked. Acceptable growing stock is 700 board feet per acre while unacceptable growing stock is about 1.33 cords per acre.

Site quality is fair to good in this stand. Deer browse appears to be moderate to low based on the native shrub layer that is growing on the site. The boundary in this stand should be clearly marked, with paint and posters as it is adjacent to a home to the southwest. There are currently posted signs facing out from the Township owned land to the driveway which give the impression that it is private property.

Stand 22 Forest Management Recommendations

Due to the steep slopes, this stand should be managed to protect the soils resources and water quality. Deer browse appears to be low to moderate, in this stand and control measures should be continued on this property. No invasive species were noted but if they are found they should be removed promptly. Tree fall across the trail should also be monitored. Trees that fall across the trail could be moved to be parallel to the slope to prevent soil erosion.

Recommendations for Stand 22

- 1. Protect the soils in this stand and ultimately the water quality in Johnson Lake at the base of the hill.**
- 2. Orient fallen trees and debris parallel to the slope to prevent soil erosion.**
- 3. Clearly delineate the property boundary.**
- 4. All trees will be marked by the Forester for removal.**

Stand 23 (Johnson Lake East)

Stand 23 is an Oak Hickory Stand located on 63.33 acres. This stand is located in the eastern end of the Johnson Lake East property. Stand 23 is found on Rockaway loam, thin fragipan, 8 to 15% slopes, extremely stony (RoefCc) soils. The RoefCc soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 23 has a moderate eastern aspect.

Stand 23 is a small timber-sized stand. The overstory of this stand is dominated by Pignut Hickory, White Oak and Red Oak. Minor overstory components include Black Birch, Sugar Maple, Red Maple, White Ash, Tulip Poplar, Yellow Birch and Grape. The understory includes Witch Hazel, Sugar Maple, Sassafras and Hornbeam. The overstory covers about 55% of this stand while the understory covers about 30% of this stand.

The shrub layer is covers about 5% this stand. The only shrub species noted was Japanese Barberry. Floor species include Ash Hickory and Maple seedlings, White Snakeroot, Rough Bedstraw, Sassafras, Hay scented Fern, Wintergreen, Pennsylvania Sedge, Jack in the Pulpit, Garlic Mustard and some Asiatic Bittersweet. Floor species covered 20% of this stand.

Tree quality is good, with potential future timber found in Oak species, Hickory and White Ash. Forest stand improvement activities at this time should focus on maintaining good forest cover and removing the invasive species before they proliferate particularly in the area of the parking lot construction where the canopy has been opened. There is good native species regeneration but it is not growing into the shrub layer or canopy.

The average basal area of Stand 23 is 150 square feet per acre, with 201 trees per acre. Stand 23 has an average diameter at breast height (dbh) of 12 inches. This stand is currently fully stocked. Acceptable growing stock is 8,870 board feet per acre while unacceptable growing stock is about 47.27 cords per acre.

Site quality is good to very good in this Stand. Deer browse appears to be moderate to heavy based on the fact that native plants are found on the forest floor but none are growing into the shrub layer. The boundary in this stand should be clearly marked, with Byram signs as it is adjacent to a numerous homes to the north. There are is also some tree debris across the hiking trail through this area. Some has been cut up by atv riders but other areas remain.

A deer management strategy should be incorporated on this property to assist native regeneration. Invasive species should be removed beginning in the area of the parking lot construction to prevent further spread into the adjacent forest.

Stand 23 Forest Management Recommendations

Deer browse appears to be moderate to heavy, in this stand and control measures should be instituted on this property. Fallen trees on the trail should be removed from the trail. Invasive species should be removed, Japanese Barberry, Asiatic Bittersweet and possibly Garlic Mustard. Atv use should be monitored as they appear to be utilizing the hiking trail at this time.

Recommendations for Stand 23

- 1. Implement a deer management strategy.**
- 2. Remove the invasive plants, Japanese Barberry, Asiatic Bittersweet and Garlic Mustard, if possible.**

- 3. Create a clear trail of fallen tree debris some areas appeared to be cleared by atv riders while other areas have not.**
- 4. Hiking trail should be remarked once parking lot construction is completed since numerous trees with tags have been cut down.**
- 5. Clearly delineate the property boundary.**
- 6. All trees will be marked by the Forester for removal.**

Stand 24 (Johnson Lake East)

Stand 24 is an Oak Hickory Stand located on 6.03 acres. This stand is located in the eastern end of the Johnson Lake East property. Stand 24 is found on Hibernia loam, 0 to 8 percent slopes, extremely stony (HhmBc) soils. The HhmBc soils have site index of 47 for Red Oak, 55 for White Pine and 56 for Sugar Maple. Stand 24 has a flat aspect.

Stand 24 is a pole-sized stand. The overstory of this stand is dominated by Red Maple. Minor overstory components include Red Maple and Blackgum. The overstory covers about 45% of this stand.

The shrub layer is covers about 35% this stand. The shrub species noted Highbush Blueberry, Alder and Spicebush. Floor species include Sensitive Fern, Sphagnum Moss, Tussock Sedge, Skunk Cabbage and Ash seedlings. Floor species covered 40% of this stand.

Tree quality is poor, with no potential future timber found in this stand due to the poor soil quality. No activity is required here. Numerous Wood Frogs were noted in this stand which indicates vernal pool habitat is nearby likely the deeper areas of the wetland area that holds water long enough for the frogs to survive the larval stage.

The average basal area of Stand 24 is 90 square feet per acre, with 781 trees per acre. Stand 24 has an average diameter at breast height (dbh) of 4.5 inches. This stand is currently over stocked. Acceptable growing stock is 0 board feet per acre while unacceptable growing stock is about 2.05 cords per acre.

Site quality is poor in this stand. Deer browse appears to be moderate to heavy particularly on the edges of the wetland where Spicebush is heavily browsed.

No invasive species were noted but if they are they should be removed soon after being noted and prior to seeding and further spread.

Stand 24 Forest Management Recommendations

Deer browse appears to be moderate to heavy, in this stand and control measures should be instituted for the entire property. No other activity is required at this time although this area should be monitored for invasive species.

Recommendations for Stand 24

- 1. Implement a deer management strategy.**
- 2. Remove the invasive plants if any are noted.**
- 3. All trees will be marked by the Forester for removal.**

Stand 25 Johnson Lake East

Stand 25 is Birch Aspen stand located on 2.62 acres. This stand is located in the western edge of this property. Stand 25 is found on Rockaway loam, thin fragipan 15 to 35% slopes, extremely stony (RoefDc) soils. The RoefDc soils have site index of 70 for Northern Red Oak, 75 for White Ash and 65 for Sugar Maple. Stand 25 has a slight western aspect despite the fact that the soils in this area are listed as steep sloped.

Stand 25 is a large sapling-sized stand. The overstory of this stand is dominated by Gray Birch and Red Maple. Minor overstory components include Red Oak and Quaking Aspen. The understory includes Black Cherry, Black Oak, White Ash and Beech. The overstory covers about 45% of this stand while the understory covers about 15% of this stand. This stand was cleared at one point and is dominated by early successional trees which first populate disturbed and dry sites.

The shrub layer is covers about 50% this stand. Shrub species noted include Huckleberry, Oak seedlings, Sassafras, Hawthorn, Russian Olive, Raspberry and Japanese Barberry. Floor species

include Pennsylvania Sedge, Lycopodium, Red Maple, Oak seedlings, Wintergreen, Asiatic Bittersweet, Cinquefoil and Rough Bedstraw. Floor species covered 90% of this Stand.

Tree quality is poor, with no potential timber found in this stand. This stand should be allowed to move through succession over time while removing the invasive species. This stand could also be maintained as an early successional stand by cutting every ten years or so.

Forest stand improvement activities at this time should focus on removing invasive species and possibly cutting the Red Maple trees which have numerous trunks.

The average basal area of stand 25 is 60 square feet per acre, with 935 trees per acre. Stand 25 has an average diameter at breast height (dbh) of 3.5 inches. This stand is currently fully stocked. Acceptable growing stock is 0 board feet per acre while unacceptable growing stock is about 3.09 cords per acre.

Site quality is good in this stand. Deer browse appears to be moderate. A determination should be made as to whether to maintain this stand as an early successional stand over time.

Stand 25 Forest Management Recommendations

Remove the invasive species including Russian Olive, Japanese Barberry and Asiatic Bittersweet. Remove the Red Maple which are growing in large clumps which in time will become hazard trees due to the poor branching and growth pattern of the trees noted.

Recommendations for Stand 25

- 1. Remove invasive species.**
- 2. Remove the Red Maple from this stand and either allow it to proceed through succession or maintain it as early successional habitat.**
- 3. All trees will be marked by the Forester for removal.**

Forest Health

Several forest health issues were noted during the forest inventory. Insect infestations included Gypsy Moth and Hemlock Woolley Adelgid. The Adelgid was noted in Stands 12, 13 and 14 and has had a significant impact on all three. The Gypsy Moth was noted in Stands 1, 5, 8, 9, 10, 13, 14, 15, 16 and 17. Properties should be monitored for Gypsy Moth annually or biennially. Heavy Gypsy moth populations were noted this winter in Hampton on ridges and will likely spread east.

Non-native invasive species control should be conducted in Stands 1, 3, 4, 6, 7, 9, 10, 12, 13, 19, 20, 23 and 25. Stands with light infestations can be attacked first and most effectively as well as Stand 7 which is heavily infested with invasive species.

Given the make-up of these stands on these properties there are potential forest health problems, including but not limited to the problems discussed below. These insect or disease outbreaks may be hastened by trees under stress due to competition, age and drought. These properties should be inspected yearly to gauge forest health. Any decline in forest health, should be immediately brought to the attention of the Forester.

Gypsy Moth

The gypsy moth is native to Europe and Asia and is the major introduced pest of eastern United States hardwood forests. The gypsy moth is found mainly in the temperate regions of the world, including central and southern Europe, northern Africa, central and southern Asia, and Japan. In the U.S., the gypsy moth was originally introduced into Medford, Massachusetts in 1869 by Leopold Trouvelot, a French astronomer with an interest in insects. Trouvelot wanted to develop a strain of silk moth that was resistant to disease, as part of an effort to begin a commercial silk industry. However, several gypsy moth caterpillars escaped from Trouvelot's home and established themselves in the surrounding areas. Surprisingly, it wasn't until 20 years later that the first outbreak occurred. Despite all control efforts since its introduction, the gypsy moth has persisted and extended its range.

Gypsy moth caterpillars hatch from eggs during bud-breaking, which occurs in mid-spring. Although the caterpillars are capable of feeding on over 300 species of trees and shrubs, they prefer oaks. The male and female caterpillars typically pass through five and six instars (stages), respectively, before they enter the pupal (resting) stage in early to mid-summer (June-July). They remain in the pupal stage for approximately two weeks and the male moths emerge one or two days before the females. The adult male and female gypsy moths are easily distinguished from one another; the males are brownish-gray, whereas the females are white with black markings and slightly larger. Unlike the males, the females are incapable of flight.

After emerging from the pupal stage, female moths emit a pheromone (chemical) which attracts males from moderate distances and mating then occurs. The females then lay oval shaped egg masses, which are covered with hairs from her body. The buff-colored egg masses contain 100 to 1,500 eggs and are laid on the underside of tree limbs, bark, rocks, and structures, including buildings, campers, mobile homes, etc. Long distance spread of the gypsy moth occurs when egg masses are unknowingly transported from infested areas on vehicles. Short distance spread (up to a couple of miles) results when small caterpillars are blown by the wind, a process known as ballooning.

Repeated defoliation stresses trees and can lead to death. During outbreaks in residential areas, gypsy moth caterpillars are an extreme nuisance. Trees lose their foliage, caterpillars crawl everywhere, and their droppings rain from the trees.

Various control measures are available for use against the gypsy moth. However New Jersey's efforts are mainly aerial applications of Bt (*Bacillus thuringiensis*) by the NJ Department of Agriculture in cooperation with the New Jersey Forest Service. Bt is a naturally occurring disease that only kills caterpillars. Bt is applied only in areas of heavy infestation, which are detected by field surveys conducted in fall and winter. These open space properties should be inspected regularly to detect and manage infestations early.

Hemlock Woolley Adelgid

The Hemlock Woolley Adelgid, *Adelgid tsugae*, has been in the United States since 1924. It is a native of Asia and is a serious pest of Eastern Hemlock. A fully-grown adult is about the size of a period on this page. The best sign of an infestation is white cottony sacs at the base of needles. Adelgids are present throughout the year but are most prominent in the spring. They are dispersed by wind, birds, mammals and humans moving infested plants or limbs.

The Adelgid feeds during all seasons of the year. The insect prevents tree growth by sucking sap from young growth. This feeding causes discoloration of the needles from deep green to grayish green and eventually the drop of the needles. The loss of new growth significantly weakens the tree and death can result in a few years.

An integrated pest management approach is best in reducing infestation. Practices to enhance tree vigor, frequent visual inspections of Hemlock trees, and chemical and biological controls have shown the best results. Infestations often begin on large Hemlocks, which intercept prevailing winds or are particularly attractive to birds and other wildlife. Health can be improved via forest Stand improvement activities, reducing water stress, and pruning. Fertilization, particularly with nitrogen, has been shown to enhance the Adelgid's survival and reproduction.

Psuedoscymnus beetles have been released as natural predators of the Adelgid and have shown good results in test studies. Applications of dormant oils or insecticidal soaps in late April or early May, late summer and again in June have also proven effective but are not feasible in a forested situation. Soil injections of Merit in spring and fall have also shown positive results.

Forest Tent Caterpillar

The Forest Tent Caterpillar is a native insect that occurs throughout most of the United States and Canada. This caterpillar feeds on a wide variety of hardwoods. In the north and west, Trembling Aspen is preferred. Forest, orchard, and ornamental trees are also acceptable; and several extensive outbreaks of the insect have occurred in the past.

Eggs are laid in masses containing 100 to 350 eggs. The mass is a cylindrical band, ring like in shape and 25 to 37 mm (1 to 1.5 in.) wide, that encircles the twig. The ends of the mass are square, and the whole mass is coated with a dark-whole mass is coated with a dark colored, glue-like substance. Winter is spent in the egg stage, and hatching occurs in the spring about the time the tree buds begin to swell.

Young larvae feed on the expanding buds; the older ones eat the foliage. Young larvae from one egg mass feed together as a group on a leaf or leaf cluster. As the larvae grow and mature, the group breaks up and each larva feeds alone on the foliage. Full-grown larvae are about 50mm (2 in.) long with a light bluish-black head and a few scattered white hairs. The back of the body is marked lengthwise with a row of whitish-yellow, keyhole-shaped spots. The remainder of the body is various shades of gray.

Larvae lay down strands of silk as they move about. They also form silk mats on the trunks and branches on which they collect in groups to rest between feedings. Contrary to the common name, a tent is not constructed by the larvae. As they approach maturity, they wander about individually in search of food or places to pupate.

Pupation occurs in pale-yellow cocoons about 25 mm (1 in.) long that are spun in folded leaves, bark crevices, and other protected sites. Depending on the geographic location, the appearance of adults occurs from late May in the South to early July in the north. The stout-bodied, light buff-brown adults have a wingspread of 25 to 37 mm (1 to 1.5 in.).

There was no sign of tent caterpillars found during the inventory of these properties.

Bacterial Leaf Scorch

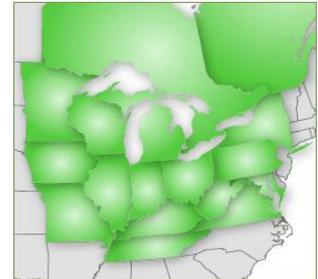
Bacterial Leaf Scorch (BLS) is an incurable disease that affects mainly Red Oak, as well as other oak species, American Elm, Sycamore and Red Maple. BLS is caused by a bacterium *Xylella fastidiosa*, which disrupts water flow, causing leaves to brown. It is believed to be spread by xylem feeding insects such as leaf hoppers, tree hoppers and spittle bugs. These bugs feed on an infected plant, picking up the bacteria and then injecting the bacterium into a healthy plant leaves. It can also spread from other plants, such as Goldenrod, Blackberry and Alfalfa.

Symptoms are most visible in the fall. The pattern of leaf scorch is irregular, beginning at the outer edges of the leaf and moving inward, with a characteristic red or yellow band between the brown and green portions of the leaf. Reduction of environmental and water stress, insects and other diseases may enhance the development of Bacterial Leaf Scorch. Improved growth rates, removal of stressed branches and watering are the recommended responses. Again this problem affects mainly urban trees, although a study is underway to gauge its effect on forested ecosystems.

There were no signs of Bacterial Leaf Scorch noted on these properties.

Emerald Ash Borer

The Emerald Ash Borer, *Agrilus planipennis*, is native to Asia and is found in China and Korea. In North America this species has only attacked all species of Ash trees including Green, White and Black Ash. First discovered in southeastern Michigan and Windsor Ontario, it has been found in the states and provinces denoted in green on the adjacent map.



Emerald Ash Borer was found in trees in Somerset County in Bridgewater and Hillsborough Townships and in traps in Mercer and Burlington County in 2014. The extent of its spread has not been determined at this time. This species can have a devastating effect of Northern Hardwood Forests of this area. Adult beetles are slender, elongate and 7.5 to 13.5 mm in length.



Males are smaller than females. Adults are usually bronze, golden or reddish green overall with emerald green wing covers.



Beetle activity peaks in mid-June into August. Adult beetle feed on Ash leaves and eggs are laid individually in bark crevices or under bark flaps. Larvae, chew through the bark and feed in the phloem layer for several weeks in serpentine galleries under the bark. Larvae overwinter in shallow chambers emerge from D shaped holes in the bark.

Symptoms are difficult to detect as the trees display very few external symptoms. The D shaped exit holes are one sign while as insect densities build, foliage will begin to wilt, branches will die and the tree canopy becomes increasingly thin. In heavy infestations trees die within 3 to 4 years. Infected trees have been as large as 55 inches in diameter and as small as 1 inch in diameter.

Asian Long-horned Beetle

The Asian Longhorned Beetle, *Anoplophora galbripennis*, is native to portions of eastern Asia and was first discovered in the United States in New York City in 1996. The beetles arrived in the United States via wood packing materials used in cargo shipments from China. Trees favored by the Asian Longhorned Beetle are mainly Maple, but infestations have also been found on Horsechestnuts, Poplars, Willows, Elms, Mulberry and Black Locust. Currently there is no known chemical or biological defense against this species. Outbreaks in New Jersey have been limited to urban areas, including Carteret, Woodbridge, Rahway, Jersey City and Linden. In case of infestation, the affected trees are cut down and destroyed, as are a buffer of healthy unaffected trees. A quarantine area is also established, from which no wood products are permitted to leave. No infestations have been found in forested environments, although the effect would be no less devastating.



Mature Asian Longhorned Beetles are very large insects, with bodies ranging from 1-1½ inches in length and antennae which can be up to 4 inches long. They are shiny black with white spots; the antennae are black and white banded. These beetles can fly but only over short distances. The major mode of transport is via transport of infested materials.

Signs of an infested tree include exit holes which are 3/8 to ¾ inches in diameter. Mature beetles emerge from trees in late May through October, with a peak in July. Sap may be noted oozing from infested trees, and coarse sawdust or frass may be found on the ground or lower branches.

The majority of damage is inflicted by the beetle larvae, which burrow deep within a tree to feed on the tree's food and water conducting vessels. This eventually girdles the cambium layer and causes structural defects.

There were no signs of this insect noted on these properties.

Wildlife

Although few species were noted during the inventory, with the exception of White-tailed Deer, Pileated Woodpeckers, a Ribbon Snake and Black-capped Chickadees, with proper management, these properties hold the potential to provide suitable habitat for many wildlife species including neo-tropical birds and amphibian species.

This mosaic of land use provides ideal habitat for the White-tailed Deer, while the proximity to residential developments may limit hunting opportunities. For forest management and habitat diversity, White-tailed Deer are the biggest concern. White-tailed Deer have become one of the greatest threats to forest restoration and growth and to species and vertical diversity. Extremely high deer populations are altering the vitality and composition of the future forest in many areas of New Jersey.

An indicator of a high deer population includes lack of forest regeneration, forest stratification, loss of shrub species and, in extreme cases, visible browse lines. In many areas of New Jersey, forest composition is being altered. This loss of stratification and vertical diversity is a major threat to biodiversity, particularly for herbaceous plants and ground or shrub nesting neotropical migrant birds.

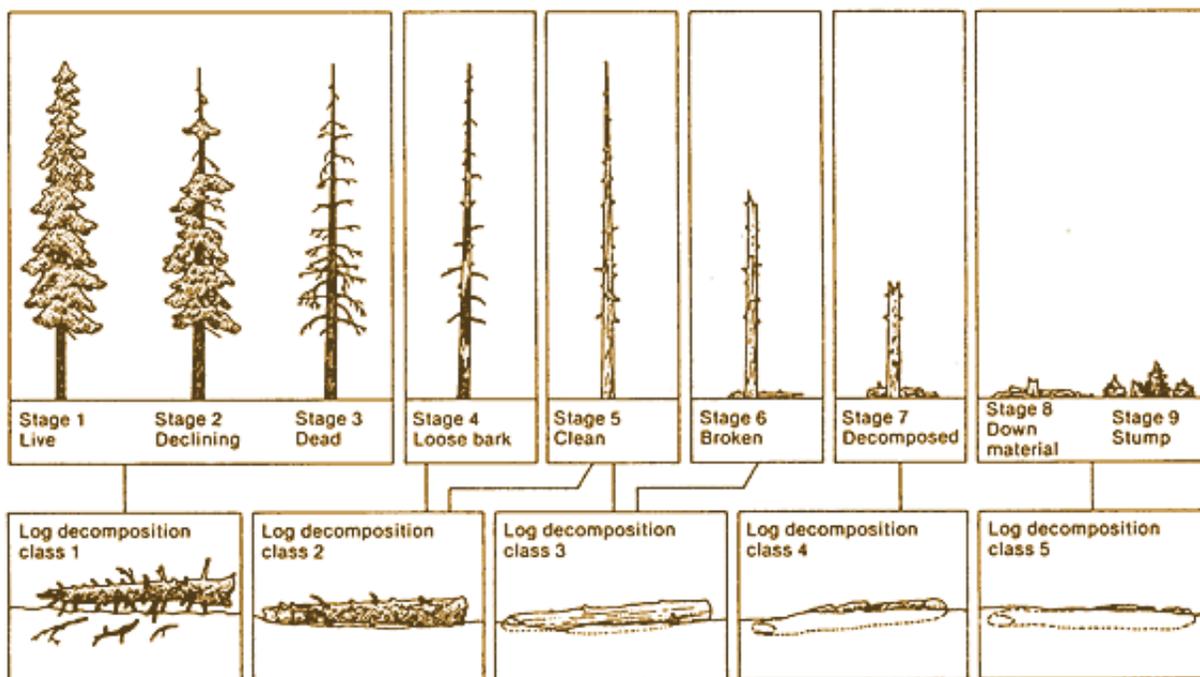
Deer need to be taken into account in every facet of this forest management plan to assure future forest regeneration and restoration of native shrub species. The most effective deer control programs focus on doe harvesting as does have a smaller home range and one buck can fertilize many does in a season. The Township understands the importance of keeping the deer population in check and may permit hunting on these properties.

Based upon the vertical structure and the lack of a shrub layer in many of the Stands on these properties, deer populations should be reduced for the health of the forest ecosystem as a whole. Browse levels should continue to be closely monitored as time goes on.

Snags

Snags (a snag is a standing dead or dying tree) provide essential habitat for at least 35 species in the Northeast that use cavities for nesting, shelter, roosting perching and foraging sites. Trees can be killed by a variety of factors including lightning, storms, fire, disease or insect outbreaks.

Large snags (>12" dbh) tend to be more valuable than small snags, as they can be used by a wider variety of species. Small clumps of snags scattered throughout the forest are best, as they provide nesting and foraging sites in one location. Large groups of snags are not usually used by more than one pair of the same species, due to territorial behavior.



Active forest management can have a positive impact on snags and also on downed woody debris in the following ways. (A downed log is a log lying on or near the forest floor.) During regeneration cuts, culled trees and snags can be left to provide for wildlife habitat. Trees can be girdled rather than removed from site. The tops can be removed from large trees to create a snag. Snags created should include trees of multiple sizes and types to provide shelter and food for a variety of species.

A combination of tree species should also be left as snags. Oaks, Hickories and Ash tend to be harder woods than Maples, Poplars and Pines and would provide habitat for a longer period of time.

Vernal Pools

A vernal pool is a wetland that holds water for 2-3 months a year in spring and early summer. A vernal pool is a contained basin depression lacking a permanent above-ground outlet for water.

They fill with water with the rising water tables of fall and winter and with melt-water and runoff from winter and spring snow and rain. Vernal pools are critical breeding habitat for numerous species of frogs and salamanders. The drying of these pools is critically important to these species, because the pools cannot support fish that would feed upon frog and salamander eggs and young stages of these species. By late summer,



vernal pools are generally (but not always) dry. Breeding of these species typically occurs immediately after snow melt.

Several vernal pools were noted on these properties, particularly the Beckmann/Kostrey property. A likely vernal pool was noted on the Glenside Tract as well. The vernal pools should be surveyed, monitored and protected during any forest management activities.

Threatened and Endangered Species

As part of the Forest Stewardship Program, a search of the Natural Heritage Database was conducted. Eleven Endangered, Threatened or Species of Concern were found to potentially reside on or near these Byram Township properties. This search includes both documented sightings and potential habitats as described by the Landscape Project.

Cave aquatic and Cave terrestrial communities were listed for the Owners Maintenance site. No information could be located concerning these habitats, and they will not be discussed further in this plan. It should be noted that no caves were noted during the forest inventory.

Bald Eagle Foraging Area

The Bald Eagle, *Haliaeetus leucocephalus*, is a State Endangered species (listed in 1974) and a federally Threatened species (proposed for delisting). Bald Eagles are large birds (7-8' wing span) with a fully white head and tail. Adult plumage does not appear until the fifth year. Prior to this, they are generally mottled brown and white. By the fourth year, they develop a white head and tail but retain some brown flecking and appear dirty.



Bald Eagle habitat consists of areas of forest that are associated with bodies of water. Their diet is primarily fish. Bald Eagles have historically been associated with the forests near the Delaware Bay and rivers emptying into the Atlantic Ocean and Delaware Bay. They require a location that is safe from human disturbance. Nests are typically in super-canopy trees that are taller than surrounding trees. This allows them to land and depart from the nest with ease.

Foraging habitat consists of large perch trees near water. Winter habitat consists of the same with the added condition of open ice-free waters.

As recently as 1982, there was only 1 Bald Eagle nest in New Jersey. The State launched a hacking program which brought 60 eaglets to New Jersey between 1983 and 1989. Combined with the ban of DDT in 1972 a second nest appeared in 1988. Currently, there are 59 pairs with 55 active nests in New Jersey with the majority concentrated in the Delaware Bay Region. This is a remarkable comeback for a species that maintained only one nest in 1982.

The management recommendations in this plan will not affect the local eagle nest or its foraging habits. Given the distance to a viable feeding area from these properties it is unlikely that a Bald Eagle would be noted on any of these properties other than soaring overhead.



Barred Owl

The Barred Owl, *Strix varia*, is a State Threatened Species in New Jersey. Barred Owls nest in dense coniferous and mixed forests, wooded swamps and river valleys. Nests are 20-50 feet from the ground,

typically in cavities but abandoned hawk and squirrel nests may be used. Nest sites in northern New Jersey were over 1600 feet from the nearest residence and had little or no forest clearings or trails. Typical home ranges are from 213-914 acres. These owls feed on mice and other rodents.

The Barred Owl is 21 inches tall with brown upper parts with buffy white barring. The tail has alternating bands of brown and gray. The throat is white and the head has no ear tufts. The facial disk is grayish white with a brown outline. Feet and toes are feathered. Eyes are dark brown and the hooked bill is buff yellow. The song “who cooks for you, who cooks for you all” is most likely heard February to April. Barred Owls prefer flat lowland terrain and avoid rocky slopes and hillsides.

Forest Management practices in this plan will have no effect on the Barred Owl. There are numerous large diameter trees on this property. Snags may be created to improve habitat, and large dead and dying trees may provide suitable habitat for this species. It is possible that these properties may serve as nesting or foraging site.

Bobcat

The Bobcat, *Felis reflexus*, was once thought to be extirpated from the State of New Jersey due partially to hunting but mainly to habitat destruction and fragmentation. It was listed in 1973 as a game species with a closed season. Between 1978 and 1982, 24 Bobcats were captured in Maine and released in northern New Jersey. In 1991 the Bobcat was reclassified as Endangered under NJ’s Endangered and Non-game Species Conservation Act.



Bobcats have been confirmed in Sussex, Warren, Morris and Passaic Counties by a scent post survey in 1995. Reliable sightings have been reported in Mercer, Somerset, Bergen, Burlington, Ocean, Atlantic, Cape May, Cumberland and Salem Counties.

Bobcats generally have tawny to grayish-brown fur with spots and streaks of whitish colored underside that is also spotted and streaked. The fur around the lips, chin, and underside of the neck are also lightly colored. They have ruffs of fur on both sides of

their face and small tufts on the ears. The tip of the short tail is black.

The Bobcat has relatively long legs in relation to its body, with hind legs longer than the front legs. This accentuates the 5-7 inch bobbed tail. A mature Bobcat is approximately 35” in length and 20” at the shoulder. Weights range from 15-25 pounds for adult females and 20-40 pounds for adult males.

Bobcats use habitat containing a mix of early and late successional stages and do not prosper in areas of intense agriculture or suburbanization. They prefer habitats that provide dense understory cover (such as Mountain Laurel and Rhododendron) for resting and protection from weather. Bobcats in northern New Jersey often use rock outcrops, caves and ledges for hunting, resting and rearing young. Bobcats feed on a variety of prey, including small mammals such as rabbits, squirrels, chipmunks other rodents and birds. Males will hunt deer during winter months if other prey is scarce.

Bobcats may inhabit or pass through the Byram owned properties, but the lack of dense understory growth except in Stand 1 limits the potential cover for this species. Forest management activity will improve habitat by improving understory cover.

Bog turtle

The Bog Turtle, *Clemmys muhlenbergii*, is a State Endangered and Federally Threatened species.

The bog turtle is 3-4 ½” in length. The identifying mark is a large yellow or orange patch on each



side of the head. The Bog Turtle is found in freshwater wetlands of high quality with little to no woody vegetation and also fens, wet meadows and marshes.

Given that the wetlands on these properties are forested it is unlikely that they serve as an ideal habitat for the Bog Turtle, which favors agricultural land and an open canopy. It is unlikely

that the Bog Turtle would be found on the Byram owned properties, although potential sites on the Beckmann/Kostrey and Arnell properties could be investigated further, if a wetlands survey were completed. The best time to see the Bog Turtle is from mid-April thorough June, basking in the sun.

If these parcels are found to be suitable habitat for the Bog Turtle, appropriate management recommendations can be added to this plan. This may require removal of woody vegetation and maintenance of herbaceous vegetation which can be accomplished via mechanical means mowing or cutting or livestock grazing.

Cerulean Warbler



The Cerulean Warbler, *Dendroica cerulean*, is a Species of Special Concern in New Jersey. This bird nests in mature deciduous forest, usually with oaks on high horizontal limbs far from the trunk 30-60 feet from the ground. The Cerulean Warbler is an insect feeder that forages high in trees with great agility. This species is very sensitive to forest fragmentation.

The Cerulean Warbler is 4 ¾ inches in length. The male is light blue above with white underparts and indistinct black streaks on the back and upper tail coverts. It has narrow black necklace on the upper breast, with some black streaking on the flanks, as well as white wing bars. The female has bluish-green to olive upperparts and white to yellow white underparts, with faint streaking on the flanks, two white wing bars and a yellowish eyebrow stripe. This bird's song has three parts. Two to three slow buzzy notes then several rapid buzzy notes followed by a longer buzzy note on a higher pitch, "zray zray zray ze-ze-zezreeeee".

This species may forage and nest on three of these properties and the surrounding area, which provide extensive contiguous forest. Forest management activities in this plan will have little effect on this species, which will maintain high canopy habitat.

Cooper's Hawk

The Cooper's Hawk, *Accipiter cooperii*, is a State Threatened Species. Cooper's Hawks typically nest in deciduous, coniferous and mixed riparian or wetland forests. Nests are 35-45 feet off the ground in the crotch of coniferous trees or near the trunk of deciduous trees. Occasionally, they will use old crow nests. Nest sites are in sub-climax forests with moderate to heavy shrub cover, one-third a mile from the nearest home. They are monogamous, solitary nesters. Home ranges vary

from 260 to over 1000 acres and contain forest edges and small openings near streams. Cooper's Hawks feed mainly on birds.

The Cooper's Hawk is crow sized, with short rounded wings and a long narrow tail. In flight this bird is cross-shaped and distinguished from the Sharp-shinned Hawk, which appears T-shaped with



a small head. Cooper's Hawk has a dark cap, blue-gray back and rusty, barred under parts. The tail is usually rounded and white-edged. The call given during the breeding season is a loud nasal "cak cak cak".

Forest management activities in this plan will maintain or improve the habitat for this species by increasing the vertical structure of the forest and habitat for its prey species. These birds often forage near homes and bird feeders. These properties provide potential habitat for the Cooper's Hawk.

Great Blue Heron

The Great Blue Heron, *Ardea herodias*, is the largest of North American herons and is a stable



species in New Jersey, whose breeding colonies are protected. The Great Blue Heron Stands four feet tall and has a wingspan of six feet; despite this the bird only weights 6.5 pounds. The body is dark blue-gray, which contrasts with a white streaked black breast and abdomen. It has a long gray neck with a white crown, cheek and throat. Two long black occipital crests rise from the crown stripe in adults. The Great Blue Heron has very long legs, a long neck and a sharp bill.

The Great Blue Heron's diet consists mainly of fish, which it swallows head first, as well as frogs, snakes, salamanders, rodents and sometimes insects. The Heron will wade through water and freeze briefly before striking at its prey with its bill. The Heron breeds in localized colonies called rookeries and may fly 15-20 miles to feeding locations. Mating occurs in March or April, with the male heron building the nest usually high in living trees but occasionally in

dead trees. Herons lay three to seven eggs and have a 28 day gestation period, and both parents care for the eggs and young. Usually one or two survive. Chicks fledge in about 60 days.

In the late 19th and 20th centuries, Great Blue Herons were shot in large numbers for their plumage for the millinery industry. Although they have adapted well to the presence of humans and shoreline development, their nesting colonies remain vulnerable.

No rookeries were noted on these properties. This species is a very unlikely but possible visitor to these properties due to the small stream and vernal pools on the Beckmann/Kostrey tract and the small stream on the Arnell tract. This species will be found on the Johnson Lake tracts. Forest management activities will have no effect on this species, as there are no rookeries noted on these properties and potential foraging areas will not be impacted.

New England Bluet Damsel

The New England Bluet Damsel, *Enallagma laterale*, is a State Species of Concern. Its flight season ranges from May 12th to June 28th. This species is found in Sussex, Morris, Passaic and Bergen Counties. This species is very rare and local throughout its range. They are just over one inch in size.

This species is a small semi-aquatic insect. It has large eyes on the sides of its head, short antennae and four heavily veined wings. The male's thorax is mostly blue with black stripes on the shoulder and top. It has a long and slender abdomen composed of ten segments. Abdomen segments are blue with black markings on segments one through seven. Segments six and seven are almost entirely black on top. Segments eight and nine are entirely blue.



These Damselflies are found in swampy open water. Nymphs are aquatic, while adults inhabit emergent vegetation in wetlands and also fields and forests near wetlands. Adults feed on a wide variety of smaller insects typically caught in flight. They are believed to have a one-year life cycle.

This species may be found near the vernal pools on the Beckmann/Kostrey property, the wetlands located on the Arnell tract as well as the Johnson Lakes parcels. It may be possible to survey this property for this species in late spring or early summer. Forest management activities will not affect this species.

Wood Turtle

The wood turtle, *Clemmys insculpta*, is a State Threatened species. The wood turtle is five to nine inches in length, with a brown carapace with irregular pyramids rising from concentric ridges. The



wood turtle breeds in vernal ponds or along clean streams and moves some distance from these breeding areas, especially after spring and summer rains.

The Arnell, Beckmann/Kostrey properties and to a lesser extent the Owner's Maintenance tract seem to provide suitable habitat for this species. Owner's Maintenance lacks the wetland portion of the habitat required for this species but wetlands on the Arnell tract are directly across the road from the Owner's Maintenance property. Glenside Woods and the Johnson Lakes Tracts also provide likely habitat for this species. The Beckmann/Kostrey property provides the best potential habitat for this species.

The fragmentation of the forest by development may have impaired the long term viability of this species. During any visit to the properties, special attention should be paid to looking out for this species. Any forest management activities involving motorized equipment will be completed during the winter months, while this species is dormant. Large woody debris should be left on the ground as shelter for this species. Creation of snags will provide beneficial habitat for this species when woody debris is added to the forest floor. Downed woody debris is limited at this time, but with the reduced health of this forest, large limbs are beginning to fall to the forest floor.

Early Coral-root

Early Coral-root, *Corallorhiza trifida*, is a 4-12 inch tall plant. The flower is yellowish-green, sometimes tinged with purple, and $\frac{3}{4}$ inch long. It flowers from May to June and is found in swamps and damp



woods. This plant is found from Maryland west to California and north to Alaska and Newfoundland, Canada. Early Coral-roots' leaves are bladeless bracts sheathing the stem. This plant may be sought by collectors and its location should not be disclosed. It is listed to have been located on one of the three parcels. This plant is listed as imperiled in New Jersey.

White Water Crowfoot (Longbeak Buttercup)

White Water Crowfoot, *Ranunculus longirostris*, is a State Threatened Species in New Jersey. It is found in slow moving streams, ponds and marshes. It is found from New Hampshire to Virginia, southwest



through Texas to California and north to Washington State. Most of this plant is submersed. Leaves are cauline (found near the top of the stem) globular in outline, flattened and 0.4 to 0.8 inches long and 0.8 to 1.2 inches in length. Flowers are five-petaled, white, and suffused with yellow at the base. Flowers are ¼ to ½ inch in width. This species is listed as appearing on one of the three tracts.

Federally Listed Species to Consider

Bog Turtle

Discussed above.

Dwarf Wedgemussel

The dwarf wedgemussel is a rare mussel with a trapezoid to ovate or humpbacked shell rarely exceeding 1.5 inches in length. The outer shell is dark brown to yellowish brown and often exhibits greenish rays in young mussels. The inner shell is bluish or silvery white.

Historically, the dwarf wedgemussel inhabited areas of the Delaware, Passaic and Hackensack Rivers. These populations however are thought to have been extirpated because of water quality degradation and other factors. The dwarf wedgemussels range from muddy sand to sand and



gravel /pebble bottoms in rivers and creeks with slow to moderate current. They favor shallow water with little silt deposition. It is often known to occur with eastern elliptio, triangle floater, creeper, eastern floater and eastern lampmussel.

There is a small stream on this property but no fish were noted in the stream during the inventory. Fish identified as suitable hosts for the dwarf wedgemussel include the tessellated darter, mottled sculpin and Johnny darter. It is unclear if this species would occur on these properties since most streams appear to be intermittent.

Indiana Bat

The Indiana Bat, *Myotis sodalis*, is a State and Federally Endangered Species. This bat's body ranges from 1-5/8 to 1-7/8 inches in length. This species has a strongly keeled calcar, a foot spur of cartilage that supports the membrane between the foot and tail. It has small hind feet. The chest and belly fur is lighter than the dull pinkish-brown fur on the back. The skull is marked by a small sagittal crest.

This species hibernates in limestone caves and open abandoned mine shafts from October through April. Ideal winter conditions are between 37° and 43° F and 87% relative humidity. During the summer females occupy maternity roosts of up to 100 females in riparian and floodplain forests under the loose bark of dead or dying trees or under loose bark of living trees. These roosts are often selected in areas that are heated by the sun. Male roost alone. These bats often forage over open water.

Eighty-five percent of the population hibernated at seven sites when listed in 1973. Human disturbance is a serious problem and number declined from 120,000 to 20,000 at these seven sites. Another problem more recently has been the onset of white nose syndrome which is affecting large number of bats throughout the east.



This property is a possibly forage and maternity area for

this species. Trees with peeling bark should only be removed from November to April to prevent disrupting roost sites. No activities in this plan will reduce habitat for this species and any removal of trees should be done in winter or outside of the breeding and nursery season. Creating snags would also improve habitat opportunities for this species.

Northern long-eared Bat

The Northern Long-eared Bat (*Myotis septentrionalis*) is a recently added federally listed species. During the summer these bats roost singly or in colonies underneath bark, in cavities or in crevices of live and dead trees. Males and non-reproductive females may roost in cooler places. They winter in

caves or mines with large entrances and constant temperatures and high humidity with no air currents. In the caves they are often in small crevices or cracks with only their nose and ears visible.



These bats emerge at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers and beetles. This bat also feeds by gleaning motionless insects from vegetation and water surfaces.

Breeding begins in late summer or early fall. Sperm is stored until the spring and the egg is fertilized when they emerge from the hibernacula. Pregnant females roost in small colonies and give birth to a single pup. Maternal colonies generally have 30-60 bats. They give birth in late May or early June to late July. Young bats start flying by 18 to 21 days after birth. Adult northern long-eared bats can live up to 19 years.

This species has declined by 98% due to white nose syndrome. This bat is 3 to 3.7 inches in length and has a wingspan of 9-10 inches. Its fur color can be medium to dark brown on its back to tawny to pale brown on the underside. This species is distinguished from other bats in this family for their long ears.



This species may forage and roost on or near the Byram properties. No trees with peeling bark will be cut during the months of May through August. Dead and dying trees will be left on the property where they do not present a hazard.

Invasive Species

Invasive plant and animal species are one of the biggest threats to biodiversity. Invasive plants and animals out-compete and eventually replace native species. During the inventory, the list of non-native plant species distributed to Consulting Foresters was also surveyed. Japanese Barberry, Asiatic Bittersweet, Garlic Mustard, Wineberry, Japanese Knotweed, Japanese Stilt Grass and Multiflora Rose are the non-native and invasive species were noted on these properties during the forest inventory.

Japanese Barberry

Japanese Barberry, *Berberis thunbergii*, was located in Stands 1, 3, 4, 7, 9 10, 12, 18, 20, 23 and 25. Japanese Barberry is a spiny deciduous shrub growing up to 8 feet in height and width. Leaves are alternate, simple and entire. Stems are numerous, reddish-brown and angled or grooved with stiff, short, single spines. The native species (found in the western US) usually has 3 prolonged spines and toothed leaves. Fruit appears in late summer, and is bright red, dry and oblong and may remain on the shrubs through winter. This plant was introduced between 1864 and 1879 from Japan. It is found in full sun to full shade in most soil types. Growth is minimal in low light and seedling survival drops from 90% in moderate to high light to 40% in low light. Plants will persist in low light conditions. They leaf out prior to canopy trees and leaves remain after leaf fall. Deer herbivory is minimal. There are at least 47 cultivars.

Threats

Barberry can grow in sun or shade and in many soil types. Branches touching the ground can root, and new shoots can develop from underground roots. Barberry can grow so thick in the understory of open forests that it shades out indigenous understory plants and decreases biological diversity. This could adversely affect birds and other animals dependent on the native plants. Barberry also affects soil properties, particularly pH, which can affect plant establishment. Severe infestations of Barberry can form nearly impenetrable thorny thickets that impact the recreational value of natural lands.

Control

Mechanical removal by hoe or weed wrench is effective if most of the root system can be removed. Regular mowing can prevent reinfestation in successional fields. Herbicide treatment can be used to treat shoots that resprout. Small patches can be pulled or dug out early in the season, before seed set.

Multiflora Rose

Multiflora Rose, *Rosa multiflora*, was located in Stand 13. Multiflora Rose is a perennial deciduous shrub up to 16 feet tall and as wide, with long arching branches. It reproduces by seeds, sprouts and layering, when long branches touch the ground and root. Leaves are alternate, pinnately compound, with 5-11 elliptical leaflets. Stems are flexible, green-red with rigid curved thorns with a wide base. Multiflora Rose was introduced in 1886 from Asia and promoted in the 1930's and 40's as a living fence, soil stabilizer and wildlife food and cover. It can be found in forest canopy gaps, roadsides, streambanks, pastures and mature forests. It may serve as nest sites for birds and rabbits. Repeated herbivory is lethal. There are at least 3 cultivars.

Threats

Multiflora rose can produce dense, impenetrable monocultures that exclude indigenous plants and restrict the movement of some animals. It is a strong competitor for below-ground resources, inhibiting the growth of indigenous plant species and also commercial crops in adjacent agricultural fields. It is tolerant of some shade, and of a range of moisture conditions, enabling it to invade a variety of natural plant communities. It significantly alters natural plant community structures and reduces overall biological diversity.

Control

Repeated mowing or cutting can be used to control the spread of small populations, but will not eradicate them (Eckardt 1987) since multiflora rose can resprout from stumps. Small plants can be dug out, provided the entire root is removed. Plant growth regulators have been used effectively to prevent plantings from spreading, and herbicides can be used to kill plants. Herbicides should be used with caution, as they could harm indigenous plants. Several potential biological control agents are under investigation.

Wineberry

Wineberry, *Rubus phoenicolasius*, was noted only in Stand 3. Wineberry grows from biennial arching canes, which reach up to two meters long. The leaves are divided into three leaflets whose undersides are covered in small, dense white hairs. The stems and buds are covered by dense 3-5 mm long purple hairs, which give the stems a shaggy appearance. The five-petaled flowers are white and bloom in late spring to early summer. The fruits mature in mid to late summer. Fruits are red, juicy berries dispersed by birds and other animals.

Habitat

Wineberry is frequent in open or disturbed habitats such as thickets, fields, and forest edges, railroad and utility rights-of-way, and old homesites. It also successfully invades wooded ravines, floodplain forests, calcareous forests, shale bluffs, and traprock and diabase forests.

Distribution

Wineberry was introduced into the eastern United States from Asia. Originally grown in cultivation, Wineberry is now widespread throughout the eastern United States, where it occurs from Vermont south to Georgia and west to Arkansas. It occurs throughout New Jersey's physiographic provinces, but reaches its greatest abundance in the Piedmont, Highlands, and Ridge and Valley provinces.

Threats

Wineberry forms an extensive, nearly impenetrable understory layer in favorable locations such as moist soils in forests over dolomite, marble, shale, diabase, and traprock. These substrates are known to support several rare plant communities and unique plant assemblages. Thickets of wineberry alter the structure of natural plant communities, outcompete rare or declining plant species, and contribute to the loss of biological diversity. In the Piedmont and the Kittatinny limestone valley of the Ridge and Valley Province, wineberry frequently occurs with the invasive nonindigenous species Japanese Barberry (*Berberis thunbergii*), Japanese Honeysuckle (*Lonicera japonica*), and Japanese Stilt Grass (*Microstegium vimineum*). Such wholly unnatural plant associations can dominate an acre or more of woodland, with an obvious reduction in the diversity of indigenous understory and herbaceous species.

Control

There is currently no control information specific to Wineberry, but other *Rubus* species are controlled mechanically and with herbicides. Small plants can be handpulled, and larger plants can be dug out. It is important to remove the root crown, as plants will resprout from the crown. Root crowns and stumps can also be treated with herbicides if left in the ground, but herbicides can harm adjacent indigenous plants.

Japanese Knotweed

Japanese Knotweed, *Polygonum cuspidatum*, was found in Stand 7. Japanese Knotweed is a herbaceous perennial that forms large clumps up to 13 feet tall. The smooth stems are stout and hollow like bamboo, and they show little branching. The leaves are broadly ovate, 2-6 inches long and taper to a point. The plants are dioecious (male and female flowers on separate plants), and bloom in late summer and early fall. The greenish-white flowers are very small and are arranged in branched sprays from the leaf axils. When in full bloom, the plant has masses of flowers all along the stem. The seeds are held in winged, triangular, shiny black-brown achenes that are generally wind dispersed, but that can also be dispersed by water and by transportation of fill dirt. The plant also produces long rhizomes (up to 20 meters in length) that allow the plant to spread quickly locally; and when rhizome fragments are transported to new sites, they can initiate a new population.

Habitat

Japanese Knotweed tolerates a wide range of soil types, pH levels, and nutrient levels. It prefers open areas, but can tolerate shade. It has become a characteristic species of floodplain forests throughout northern New Jersey and the Inner Coastal Plain. It typically forms dense monocultures along the banks of rivers and streams. It also grows on the margins of ponds and lakes, open woods and thickets, meadows and successional fields. It invades disturbed areas, such as ditches, roadsides, dredge spoils, and recently cleared or filled areas. Once established, it quickly spreads into moist or damp soils in adjacent undisturbed natural plant communities.

Distribution

Japanese Knotweed is indigenous to eastern Asia and was introduced to the United States as an ornamental before 1890. It is now widespread across the United States and is considered invasive in

at least nine eastern states. It is also invasive in the United Kingdom, where it is prohibited to introduce the plant into the wild. It occurs throughout New Jersey's physiographic provinces.

Threats

The early spring emergence of Japanese Knotweed, and its dense growth, prevents indigenous species from establishing, in turn reducing species diversity and wildlife habitat. Because Japanese knotweed favors damp areas and areas that have been disturbed, riparian corridors are particularly at risk. It can cause flooding by decreasing water flow through stream channels. Once established, it is extremely persistent.

Control

Natural areas should be monitored to prevent establishment of Japanese Knotweed. Small stands can be controlled by repeatedly cutting the stems during the growing season, and by revegetating once knotweed growth is reduced. All plant parts should be removed from the site. Digging out rhizomes creates soil disturbance and may spread rhizome fragments. Shading with black plastic or shade cloth may also reduce growth. Large stands can be treated effectively with herbicides, but many of the most effective herbicides are nonselective and may persist in the soil. Biological control agents are being investigated in Europe, but research is still in the early stages.

Asiatic Bittersweet

Asian Bittersweet, *Celastrus orbiculatus*, was found in Stand 7, 23 and 25. It is a deciduous, woody, perennial vine that can also grow into a trailing shrub. It climbs by twining around a support. The leaves are alternate, with a rounded glossy appearance and finely toothed edges. The stems are brown with noticeable lenticels. Asiatic Bittersweet flowers in spring, producing clusters of small greenish flowers in the leaf axils. Fruits mature in late summer to early fall. The green to yellow mature fruits split open to reveal bright red arils that surround the seeds.

Asian Bittersweet is sometimes confused with the similar indigenous American bittersweet (*Celastrus scandens*), especially in the nursery trade. American Bittersweet can be reliably distinguished from Asian Bittersweet by having terminal, rather than axillary, clusters of female flowers and fruits, and, less reliably, by its more elliptical shaped leaves and more orange-colored

fruits. The fruits are primarily dispersed by birds and small mammals. People are often dispersers as well, harvesting the branches for ornamental use and later discarding them. The vine also reproduces asexually by stolons (above-ground stems), rhizomes, and root suckering.

Habitat

Asiatic Bittersweet occupies a wide range of habitats, including forest edges and gaps, floodplains, fields, hedgerows, beaches and salt marsh edges. It is shade tolerant and can establish under a closed forest canopy.

Distribution

Asiatic Bittersweet is indigenous to eastern Asia, including Japan, Korea, and parts of China. It was introduced to the United States in the late 1800s, and was planted as an ornamental and used for wildlife food and cover and erosion control. In the United States it occurs from Maine to Georgia and west to Iowa and Arkansas. It is also present in Quebec and Ontario, Canada. Several states consider it invasive, including Connecticut, Delaware, Maryland, Massachusetts, New York, Pennsylvania, Tennessee, Virginia, and Vermont. It was mapped as widespread throughout northern New Jersey with records in all counties from Monmouth north to Sussex. It occurs in all physiographic provinces.

Threats

Trees and shrubs can be severely damaged by Asiatic Bittersweet, as its twining branches eventually constrict their trunks and branches and the vegetative growth can over-top and outshade them. This makes the trees more susceptible to damage by wind, snow and ice storms. It can form pure Stands over some areas. It threatens dune areas as well, possibly altering erosion patterns and outcompeting native dune vegetation. The alteration of natural vegetation structure caused by Asian bittersweet can make recovery of an area very difficult. Preliminary investigations indicate that Asiatic Bittersweet has a much higher percentage of pollen and seed viability than does American Bittersweet and may therefore be able to outcompete American Bittersweet. There is also evidence that Asiatic Bittersweet may be hybridizing with American Bittersweet, threatening the genetic identity of American Bittersweet.

Control

Control of Asiatic Bittersweet can be difficult, as seed germination rates are high, and seeds are persistent in the soil bank. Small populations can be cut repeatedly until the root stores are exhausted. Juvenile plants can be hand-pulled, but any root portions not removed can resprout. All plant parts should be removed from the site to prevent reestablishment. A combination of cutting and herbicide treatment of stumps can be effective, but herbicides could adversely affect surrounding native vegetation.

Japanese Stilt Grass

Japanese Stilt Grass, *Microstegium vimineum*, was found in Stand 7 and 18. Japanese Stilt Grass grows as an annual grass with a sprawling habit and can reach heights of up to three. It has thin, pale green, lance-shaped leaves, about three inches in length, which grow alternately along a branched stalk. The leaves have a silvery stripe of reflective hairs down the center of the upper leaf surface. The stalk is distinctly divided by nodes, with the segments between the nodes flattened and widening toward the upper end. The flowers bloom along a delicate spike that emerges from the stalk tips in late summer and early fall. The seeds mature in mid to late fall and can remain viable for more than five years in the soil. Plants spread locally by rooting at the nodes. Seed dispersal is by animals, water, or deposition with fill dirt. The report that there is a rhizomatous perennial form occurring in eastern North America, has been challenged by those who believe the report is based on misidentification of the indigenous grass, *Leersia virginica* L. The two species are vegetatively similar and grow in similar habitats, often growing in mixed populations. Vegetative plants can be distinguished by the silvery stripe running along the middle of the leaves of Japanese Stilt Grass, a character lacking in *Leersia virginica*. The two species are easily distinguished when in flower or fruit.

Threats

Japanese Stilt Grass alters the structure of natural plant communities and reduces biodiversity by displacing indigenous herbaceous vegetation through its dense growth, which rapidly forms monocultures that are sometimes acres in extent. Because of its rapid and dense growth, it alters light and moisture regimes and likely affects seed germination. It has been speculated that Japanese Stilt

Grass in association with Japanese Barberry (*Berberis thunbergii*) raises pH and reduces the organic horizons in soils.

Control

Prevent introduction of Japanese Stilt Grass from invaded sites to adjacent natural areas by avoiding disturbance to vegetation and soil in the natural areas. Small infestations can be hand-pulled, but pulling will have to be repeated until the seed bank is exhausted. Plants can be mowed when flowers are blooming, but before seed set. Herbicides can be effective and should be applied before plants set seed. Herbicides should be used with caution, as they could harm indigenous co-occurring plants.

Garlic Mustard

Garlic Mustard, *Alliaria petiolata*, was found in Stands 1, 4, 6, and 23. Garlic Mustard is a herbaceous biennial that ranges in height from 0.05 to 1.5 meters. Seedlings emerge in spring and form rosettes of kidney-shaped leaves by midsummer.

During the second year of growth, plants form one or more stems with alternate, sharply-toothed, triangular to heart-shaped leaves. The plants smell like garlic when crushed, especially the young leaves. A cluster of white, four-petaled flowers form at the end of the stems and branches in spring. Garlic Mustard is pollinated by a number of small bees and flies but can self-pollinate in the absence of insects. The small oblong black seeds are held in siliques (long narrow capsules) at the ends of the stems. The seeds begin to mature in May and can remain viable through the summer. Garlic Mustard has the ability to form seed banks, but, these seed reserves are viable for only about four years. People readily disperse the seeds when they get stuck on their boots or clothing and by automobiles and mowers. Seeds may also be dispersed by floodwaters or indirectly by rodents, birds, and deer.

Threats

Alliaria petiolata can dominate forested understories, resulting in a decline in indigenous herb diversity. In turn, the decline of indigenous species alters habitat suitability for birds and other animals. Spring flowering plants and the animals dependent on them are particularly affected. Garlic Mustard may have allelopathic effects as well, preventing plants from growing near it.

Control

Alliaria petiolata spreads rapidly once established. If small populations are not eradicated promptly, within a few generations a few plants can rapidly spread and form dense populations throughout the forest. It is essential, therefore, to begin removal as soon as plants are first observed. Hand-pulling plants can control small infestations. This is most easily done when plants are small and the soil is moist. Plants should be pulled before seeds have matured to prevent inadvertent dispersal. Hand-pulling should continue for at least five consecutive years in order to exhaust the seed bank.

However, it is likely that seeds will be brought in from other contaminated sites and control methods may be required indefinitely. Flower stalks can be cut in small populations to prevent seeds from maturing, and fire or herbicides can be used to control larger populations. Late fall is the preferred season for fire or herbicide control, because most indigenous plant species are dormant. Fire is only effective if there is a critical increase in rootcrown temperature. Rootcrowns covered by 1-2 centimeters of leaf litter will be protected. Removal of the leaf litter will increase seedling survival after the fire, necessitating a second burn the following year. Regardless of the control method used, sites must be monitored for at least five years to ensure that the seed bank has been exhausted.

Norway Maple

Norway Maple is a deciduous tree that averages 90 feet tall. The leaves have five sharply pointed lobes, similar to Sugar Maple leaves. Norway Maple can be distinguished from all native species of maples occurring in New Jersey by the milky sap present when the leaf petiole is broken off from a branch. The leaves are 4-7 inches long and are arranged opposite along the stem. The tree produces small greenish yellow flowers in April, and the seeds are held in wind-dispersed samaras that are 1½ - 2 inches long. Leaves turn yellow in late autumn.

Habitat

Norway Maple readily establishes on disturbed sites, such as road and railroad embankments, vacant lots, and fallow fields. Norway Maple was not noted during the forest inventory; but given the amount of development surrounding these properties, it is likely encroaching on the forest edges along property boundaries. It also invades and establishes in natural plant communities. It is particularly successful on alluvial soils in floodplain forests and along riverbanks. It also occurs in woodlands and forests where it invades through cleared edges or blow-downs within the interior.

Tolerant of air pollution, drought and salt spray, it is commonly used as a street tree in cities and coastal communities.

Distribution

Indigenous to Europe and western Asia, Norway maple currently occurs from eastern Canada south to North Carolina and west to Nebraska. Scattered occurrences are reported from Idaho, Montana, Washington, and British Columbia. Delaware, Maryland, Massachusetts, New York, Pennsylvania, Vermont, and Virginia list Norway Maple as invasive. More than 150 occurrences have been mapped for the northern part of the State (i.e., Monmouth County north to Sussex County). It occurs in all physiographic provinces.

Threats

Norway Maple is an aggressive colonizer able to survive under a range of habitat conditions. The dense shade produced by the canopy decreases understory plant diversity but does not affect establishment of its own seedlings.

Control

Norway Maple can be controlled mechanically or with herbicides. In some situations, the use of herbicides could harm native plants. Seedlings and saplings can be hand-pulled or dug out. They will resprout if all the roots are not removed.

Autumn Olive

Autumn olive *Elaeagnus umbellata* grows as deciduous shrubs or small trees and was found in stand 25. Autumn olive has small simple alternate leaves that are oval to lance-shaped. The underside of the leaf is covered with silver-white scales. In early spring the plant produces small, light yellow flowers along the twigs, just after leaves have appeared. Small juicy fruits ripen to pink or red, dotted with silver-white scales, in late summer. Birds eat and disperse the fruits. Russian olive is closely related to autumn olive, and can be distinguished by its narrower lance-shaped leaves, silvery on both sides, thorny branches, and yellow, dry, mealy fruits. Russian olive also flowers later in the spring, well after the leaves have appeared. It commonly confused with autumn olive.

Habitat

Autumn olive has nitrogen-fixing root nodules that allow it to thrive in poor soils. Typical habitats for autumn olive include disturbed areas, roadsides, pastures, fields, forest edges, and open woodlands. The species invades a number of uncommon or rare plant communities including limestone and trap rock woodlands, shale bluffs, glades, limestone fens and meadows, and dune thickets. It also has been found growing in saturated soils of wooded calcareous swamps.

Distribution

Autumn olive is indigenous to Asia. It was widely planted in the United States as an ornamental shrub, wildlife cover, and for revegetation of disturbed areas. Autumn olive is considered invasive in nearly all of the eastern states. Autumn olive occurs throughout New Jersey, occurring in all physiographical provinces.

Threats

Autumn olive could adversely affect the nitrogen cycle of native communities on poor soils. It grows rapidly, resprouts when cut, and is a strong competitor. The dense shade it produces suppresses plants that require sunlight. At some locations, it forms dense monocultures that alter the structure of natural plant communities and reduces plant diversity.

Control

Burning and cutting stimulate resprouting. Seedlings can be dug out when the soil is moist to ensure removal of the root system. Herbicides are effective when applied in fall, but herbicides can also harm indigenous plants. Public and governmental education is essential to controlling the further spread of this species. As recently as 1992, autumn olive was still being recommended for “habitat improvement projects designed to attract wildlife, provide barriers, beautify existing landscapes, and reclaim disturbed sites” with little or no warnings on its invasive nature. The species is still widely planted in New Jersey, especially along highway corridors.

Access

Access to these properties for forest management activities is limited at this time. The most accessible tract is Arnell, which would require an agreement with a private landowner to gain access to the roads that run through that property. Any other access would have to cross the stream and

wetland along the road. In order to actively manage these properties, access will have to be improved.

Access to Owner's Maintenance is possible from the road but would require extensive work. The Beckmann/Kostrey tract is limited by steep slopes. Access for hiking trails and passive recreation is very good, with road frontage for pullouts to be constructed and maintained.

Johnson Lake East has good access from Roseville Road with the new access being constructed at the time of the inventory. Johnson Lake West utilizes a shared driveway with a private residence on Tamarack Road. Glenside Woods the most likely access point would be from Ranger Trail. If equipment was going to be utilized to complete forestry activities it would require a stream crossing from this location. Other potential access can be achieved through power line right of ways after discussion with the power utilities.

Other trails could be created and maintained in order to complete forest management activities proposed on these properties. Any new logging roads will be completed in accordance with the Flood Hazard Control Act and Freshwater Protection Act and will be constructed in accordance with the New Jersey Forestry and Wetlands Best Management Practices Manual.

Recreation

Recreation is a major priority for these properties. The Township received a grant and worked with the NY/NJ Trail Conference and the Consultant Forester to design a trail system on Owners Maintenance and Arnell Tracts. These properties offer sufficient acreage for short loop trails, as well as hilltops for views on Beckmann/Kostrey, with views of a lake and limited views from Owners Maintenance tract.

These properties will also provide good opportunities for wildlife viewing and



wildflower walks. The short trails may also provide educational opportunities, given the diversity of terrain and forest ecosystems and habitats found in a relatively short distances. Clearly marked boundaries will prevent hikers from wandering off the municipal land and onto private property.

Glenside Woods Tract had a marked trail through the property. The Johnson Lakes tracts did not have marked trails during the forest inventory. Each tract would provide lake views to hikers utilizing the property.

Access by ATV's should be closely monitored, especially along the PSE&G right of way on the Owners Maintenance tract. ATV activity should be discouraged. Clearly delineated boundaries may provide some deterrent to illegal activity. It may be possible to GPS-locate the current trails to aide in future enforcement activities. Township ordinance prohibits ATV use on municipally owned parcels.

Reforestation

Reforestation will be completed through natural regeneration via canopy openings. Other areas may



be planted, including the ridgetop on the Beckmann/Kostrey tract and the Hemlock stand on the Beckmann/Kostrey tract which has been decimated by the Woolley Adelgid. Once invasive species have been removed along the roadway on the Arnell tract, this area should be replanted with native trees and shrubs to revegetate this area.

All regeneration will be closely monitored during this planning period. If this is unsuccessful due to aspect, excessive deer populations or lack of seed sources in the immediate area, fencing and planting will be required on these properties and a plan amendment will be completed. The single most important activity that could benefit forest regeneration would be to reduce the deer population via a carefully planned deer reduction program.

Soil Protection

Soil protection is a critical part of this plan and will be completed by implementing Best Management Practices. Special attention will be paid to soil retention throughout this planning period, especially in the extremely wet areas on the Arnell Tract and streamside areas of the Beckmann/Kostrey Tract. Areas of steep slopes on all three tracts will be avoided with mechanized equipment. Any trees felled in steep slope areas will be felled parallel to the slope and left to reduce the speed and amount of runoff.

Johnson Lake West has steep slopes leading down to the lake while Johnson Lake East and Glenside Woods have moderate to slight slopes. Special care will be taken to not impact the water quality of Johnson Lake.

If access issues are remedied, removal of trees via mechanized vehicles on forest roads and skidding should be completed during the winter when soils are frozen and less susceptible to disturbance. Increasing vertical structure and age class diversity of the forests will also provide long term soil protection by providing sustainable long term forest cover.

Timber Management

Access issues would have to be worked out prior to any timber being removed from these sites. Timber management is not the highest priority on these tracts but will be possible as trees mature increasing the amount of timber available for a logging operation to take place. A harvest plan should also be completed prior to a commercial harvest to lay out landings, logging roads and skid trails that will minimize impact to the surrounding forest, soil and water resources and to protect regeneration of the future forest.

Site productivity on these properties is good for growth of forest products. Forest stand improvement activities will improve growth of future crop trees left in the forest Stand while creating openings in the canopy to promote advanced regeneration. Incremental growth will provide added value to the future timber sale. If overall forest health declines or if potential timber trees do

not appear healthy enough to survive through the planning period, a limited timber sale may be administered on the property once access issue are worked out.

As the Emerald Ash Borer gets closer to Sussex County the Township should evaluate removing the Ash possibly in cooperation with the adjacent landowners at the same time.

Freshwater Wetlands Protection Act (FWPA)

All activities occurring within wetlands governed under the FWPA will be conducted in conformance with this Forest Stewardship Plan upon approval by the New Jersey Forest Service.

No stumps shall be removed from the freshwater wetlands or open waters or wetland transition areas. These areas currently in forest cover will not be permitted to undergo land use change unless a FWPA permit is attained prior to the activity.

No new roads will be constructed in the areas under jurisdiction of the FWPA. Existing roads will be maintained in their current condition and will provide access for future forest management activities. Should the land use change, these roads will be removed.

Forest Management Best Management Practices (BMP's)

- I. Streamside Management Zones – No activity will occur within 50 feet of open waters. These areas at this time are forest and scrub-shrub habitat around some of the wetlands. Soils in this streamside management zone are susceptible to erosion. Forest management work that may occur within this zone would be related to stream restoration or to protect soil resources or water quality.
- II. Filter Strips - Filter strips will be maintained between any roads, skid trails and loading areas. Filter strips will be planned, mapped and laid out prior to any timber harvest.
- III. Stream Crossings – Stream crossings would designed consistent with forest management BMP's. Temporary bridges may be installed after consultation with NJDEP.

- IV. Access Roads – Access roads were constructed previously on this property. These roads will be maintained in their current condition, as they have not impeded the flow of water or the chemical or biological characteristics of wetlands. All roads have been naturally revegetated to stabilize soils.
- V. Timber Harvesting – All timber harvests on this property will be completed in compliance with the Forest Management BMP Manual. Skid trails and logging decks will be planned and laid out prior to any harvesting activities.
- VI. Site preparation – Site preparation to facilitate natural regeneration will be implemented as necessary. Native regeneration on this site should be sufficient once invasive species and White-tailed Deer populations are reduced.
- VII. Forest Pesticides – All pesticides shall be applied by a certified pesticide applicator and only in reaction to a significant threat to forest health from an insect or disease vector.
- VIII. Reforestation – At this time, reforestation will occur through natural regeneration, given the species make-up and seed source currently found on these properties. Reforestation is discussed further above.
- IX. Fire Protection – Forest fire is not a significant threat on these properties at this time with the exception of where soils are thinner and drier, such as in Stands 3, 4 and 15.

Forest Sustainability

Sustainability is a complex idea involving economic, environmental and social factors.

Sustainability criteria and indicators were identified by the Montreal Process and include:

1. Conservation of biologic diversity.
2. Maintenance of productive capacity of forest ecosystems.
3. Maintenance of forest ecosystem health and vitality.
4. Conservation of soil and water resources.
5. Maintenance of forest contribution to the carbon cycle.
6. Maintenance and enhancement of long term, multiple socio-economic benefits to meet the needs of society.
7. Legal, institutional and economic framework for forest conservation and sustainable management.

Most of the above listed criteria have been addressed in this Forest Stewardship Plan.

Recommended Management and Implementation Schedule:

No forest management activities should occur on these properties without prior consultation with the Forester and municipal committee(s) responsible for management of these tracts to assure that the plan is being followed. If forest health declines, a timber sale may be conducted prior to the prescriptions laid out in this plan and a revised plan will be completed.

2015 Clearly delineate the property boundaries of the new properties.

Remove invasive species and clean up litter from the wetland area in Stand 7.

Monitor Gypsy Moth populations on all six tracts.

Continue to implement the deer management plan and extend it to the newly purchased properties.

Develop an ATV enforcement policy for Township-owned land.

2016 Remove remaining invasive species from all of the Arnell Tract.

Remove the invasive shrubs from Glenside Woods and the Johnson Tracts.

Survey the tracts for Gypsy Moth populations.

Evaluate the growth of White Pine trees underplanted in Stand 14 and girdle poorly formed trees.

Create small patch cuts in Stand 17 to maintain Oak cover in this stand. Shade-tolerant species should also be removed during this activity.

Assess the success of invasive species removal.

Walk all hiking trails and remark them and clean up any debris and evaluate hazard trees near the trails.

Monitor ATV activity on all tracts; GPS all existing trails.

If Emerald Ash Borer is nearing Sussex County evaluate removing White Ash in advance.

Work with adjacent landowners when possible.

2017 Remove sprouting invasive species from the Owners Maintenance tract.

Survey vernal pool habitats for herptile species.

Survey wetland areas for rare plants.

- Evaluate resprouting on invasive species in Stand 7 and replant this site with native species.
Create small deer exclosures on each property.
Clear competing trees from some of the American Chestnuts on Glenside Woods.
- 2018 Inspect and remove invasive species from the Beckmann/Kostrey Tract and Owners Maintenance tract for resprouting invasive species.
Monitor deer browse pressure on Owners Maintenance.
Survey plant species in Stand 6 and attempt to remove the Garlic Mustard.
Evaluate the possibility of fencing a small portion of this stand to gauge deer impact.
Fell trees parallel to the slope in Stand 12 to reduce soil erosion if Hemlocks die in large numbers.
Walk all hiking trails and remark them and clean up any debris and evaluate hazard trees near the trails.
- 2019 Remove firewood from Stand 8 if access has been established; if not girdle unacceptable growing stock or fell and leave on site.
Assess native forest regeneration in Stand 4.
Monitor ATV trails and remap them.
Monitor soil erosion in Stand 13.
Evaluate the effectiveness of the deer reduction program.
Remove invasive species from Glenside Woods and the Johnson Tract.
- 2020 Open the canopy in Stand 4 to improve forest regeneration. Trees may be removed in groups to facilitate growth in the understory.
Remove trees in small groups in Stand 9 to facilitate old growth type character in this stand by creating gaps for groups of young trees to develop. Possibly fence one gap to gauge deer browse pressure.
Maintain aesthetics in the area of the residential homes during these projects.
Walk all hiking trails and remark them and clean up any debris and evaluate hazard trees near the trails.
- 2021 Evaluate native regeneration in Stand 8.
Inspect all tracts for non-native and invasive species growth. Remove specimen that are located.
Evaluate Stand 13 and assess if a thinning is required at this time.

- 2022 Open the canopy in Stand 5 to improve forest regeneration. Trees may be removed in small groups to facilitate growth in the understory.
- Conduct a pre-commercial thinning in Stand 16. Remove poorly formed trees and increase the growth rates of future crop trees left in the stand.
- Assess forest regeneration in Stand 12. Replant if necessary.
- Walk all hiking trails and remark them and clean up any debris and evaluate hazard trees near the trails.
- 2023 If access is possible, some trees in these patches may be sold as timber from Arnell and Glenside to create some early succession habitat.
- Evaluate regeneration within the deer exclosures. Present the data to the township.
- 2024 Reinventory the property and prepare the second Forest Stewardship Plan.
- Walk all hiking trails and remark them and clean up any debris and evaluate hazard trees near the trails.

Acceptable Growing Stock – Tree of good form and quality which would be satisfactory crop trees in the final Stand on this site, or as a potential high value product within 20 years.

Basal Area – The cross sectional area of a tree trunk at 4.5 feet above the ground. The total basal area is the amount of ground surface that would be occupied if every tree was severed at 4.5 feet above the ground.

Board foot – Used to express the volume that can be sawed from logs greater than 12 inches in diameter. A board foot would be equal to a piece of wood 1 foot by 1 foot and 1 inch thick.

Cord – A measure of firewood four feet in height, four feet wide and eight feet in length, equalling 128 cubic feet.

DBH – Diameter at Breast Height. The diameter of a tree measured at 4.5 feet above the ground.

Even-aged Stand – A Stand of trees in which all of the trees are within the same aged class (within 20 years).

Floor species – Plants found growing on the forest floor, typically less than one foot in height.

Forest Stand Improvement – The intermediate cuttings used to improve the composition, condition or growth of a forest Stand.

Log Landings – An area where harvested logs are stored and loaded onto trucks for removal from the site.

Overstory – Trees which form the uppermost layer in the forest canopy.

Poletimber – Trees which are not large enough to be considered sawtimber but are suited for other products, firewood for example, typically, trees between 6 and 10 inches in diameter class.

Sawtimber – Trees which are large enough to saw boards from, trees greater than 12 inches in diameter.

Site index – A term used to describe the productivity of a site based on the height of dominant trees at a certain aged, usually 50 years. The higher the site index the more productive the site.

Shrub species – Woody plants which grow between 1 and 15 feet.

Stand – A community of tree which possess uniformity in regard to species composition, tree aged, condition and arrangement, enough to be distinguished from adjacent communities.

Unacceptable Growing Stock – Tree which are not desired in a Stand because of poor form. These trees can be used as firewood or providing habitat for wildlife.

Understory – Trees and other woody plants growing beneath the overstory and above the shrub layer.

Uneven-aged Stand – A forest Stand composed of trees in a variety of age classes.

Windthrow Hazard – The likelihood of trees being uprooted by wind as a result of inadequate root anchorage. This situation may occur in areas where trees are removed and causing others to receive increased wind speeds and possibly be uprooted.