

Forest Conservation Technical Manual

**Guidance for the Conservation
of Cecil County's Forests
During Land Use Changes,
Under the 1991 Forest Conservation Act**

DECEMBER 31, 1992

Forest Conservation Manual

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Note: All information that is in bold type within this manual is required as part of the local program under the Forest Conservation Act of 1991.

Chapter 1

Introduction

This Forest Conservation Manual has been developed under the direction of the Maryland Forest Conservation Act to provide the standards and technical guidance needed to implement the Act. This manual will be used as the Technical Manual for the Cecil County Forest Conservation Program and will provide minimum standards for the implementation of the Cecil County Forest Conservation Regulations.

Standards or minimum requirements are presented in the manual in bold type for the sake of clarity.

Technical guidance is also included in the manual to assist in implementing the Act. This information is provided in the form of recommended procedures or specifications. This technical guidance information is presented throughout the manual with discretionary language and in normal type.

Purpose of the Act

The Forest Conservation Act was enacted to protect the forests of Maryland. Forests and individual trees greatly contribute to the quality of life in Cecil County and the health of its natural ecosystems. In addition, forest products represent the fifth largest industry in the State. The state's economic health, as well, depends heavily on its natural resources, of which forests are a major component.

Between 1985 and 1990, 2,295 acres of forest were lost in Cecil County. This loss threatens the health of the County's treasured natural resources. Forest areas have been lost due to numerous causes including but not limited to construction, agriculture, mining, and disease. Although the losses may have been incremental, the overall impact has significantly changed the condition of this environmental resource.

Forested areas play a vital role in the improvement and maintenance of water, soil and air quality, provide habitat for wildlife as well as recreational opportunities and resources for people. Table 1.1 summarizes many of these benefits which range from the reduction of atmospheric carbon dioxide, a significant greenhouse gas, to the filtering of particulate pollutants. Forests along waterways play a particularly crucial role in maintaining water quality and a healthy balance of flora and fauna.

Table 1.1

BENEFITS OF FORESTS

ISSUE	TREES CAN.....
<p>CO₂</p> <ul style="list-style-type: none"> ✗ CO₂ comprises up to 50% by volume of greenhouse gases ✗ CO₂ is produced primarily through burning of fossil fuels 	<ul style="list-style-type: none"> ✓ absorb up to 48 pounds of CO₂ per year or up to 10 tons per acre of trees during photosynthesis
<p>Microclimate</p> <ul style="list-style-type: none"> ✗ Concrete and asphalt increase the temperature of urban areas 3 to 10 ° F by absorbing thermal energy. 	<ul style="list-style-type: none"> ✓ reduce temperatures locally through shading and evaporation ✓ decrease energy consumption for cooling purposes by reducing local air temperatures
<p>Air Pollution</p> <ul style="list-style-type: none"> ✗ Gaseous pollutants and particulate matter from cars, dust, ash, smoke, and pollen contribute to poor air quality. 	<ul style="list-style-type: none"> ✓ filter particulates with leaves, stems and twigs ✓ absorb gaseous pollutants through pores on leaves
<p>Soil Erosion</p> <ul style="list-style-type: none"> ✗ Water and wind erode unvegetated soils removing the most productive layer, depositing sediment in waterways. ✗ Erosion is a particular problem along stream banks, drainage ditches and areas prone to surface runoff or high winds. 	<ul style="list-style-type: none"> ✓ hold soil in place with roots ✓ remove excess water from the soil keeping it cohesive yet not water logged
<p>Stormwater Runoff</p> <ul style="list-style-type: none"> ✗ Uncontrolled runoff from storms increases erosion and flooding 	<ul style="list-style-type: none"> ✓ improve soil permeability to water with roots, decreasing the amount and rate of storm runoff. ✓ filter nutrients, sediment and pollutants
<p>Stream Habitat</p> <ul style="list-style-type: none"> ✗ Loss of riparian forests decreases the health of streams ✗ Streams with open canopies experience extreme fluctuations in water temperatures making waterways inhabitable for aquatic organisms 	<ul style="list-style-type: none"> ✓ prevent heating of waterways in summer and rapid cooling in winter. ✓ provide a major source of food for lower order streams and river communities.
<p>Forest Products</p> <ul style="list-style-type: none"> ✗ Decreasing forest cover may result in the loss of resources for forest products. 	<ul style="list-style-type: none"> ✓ provide timber for building and fuelwood and non-timber products
<p>Recreation</p> <ul style="list-style-type: none"> ✗ Increasing numbers of urban residents seek local natural areas for a respite from daily lives. 	<ul style="list-style-type: none"> ✓ afford recreational opportunities, psychological and physical health benefits

The Act also provides an opportunity to maintain an often overlooked historic feature of Maryland, its native forests. The diverse patchwork of forest associations found across the state are part of the overall character of Maryland and efforts should be made to protect and preserve these areas. Expansion of native forests can be accomplished through the use of native Maryland plant species in reforestation or afforestation efforts.

The intent of the Act is to maximize the benefits of forests in a cooperative effort with development, thereby slowing the loss of forested land in the County and improving the environment of both developed and undeveloped areas.

Use of the Manual

This manual will be most helpful for developers and planners who are looking at specific sites and trying to balance the numerous constraints encountered in development. Ideally, the site specific forest conservation decisions should be made within the context of a larger vision for county wide forest conservation. In this way, site specific decisions can be made with reference to a comprehensive vision of the most valuable forests.

This manual is organized in accordance with the two major components of the Forest Conservation Regulations: The Forest Stand Delineation and the Forest Conservation Plan. The submittal of these two items is required by anyone making an application for subdivision, grading permit or sediment control plan on a land parcel containing 40,000 square feet or more, unless exempt under Section 3.2 of the Regulations. Both plans shall be prepared before any permits are issued or any work has begun on the site (Figure 1.1).

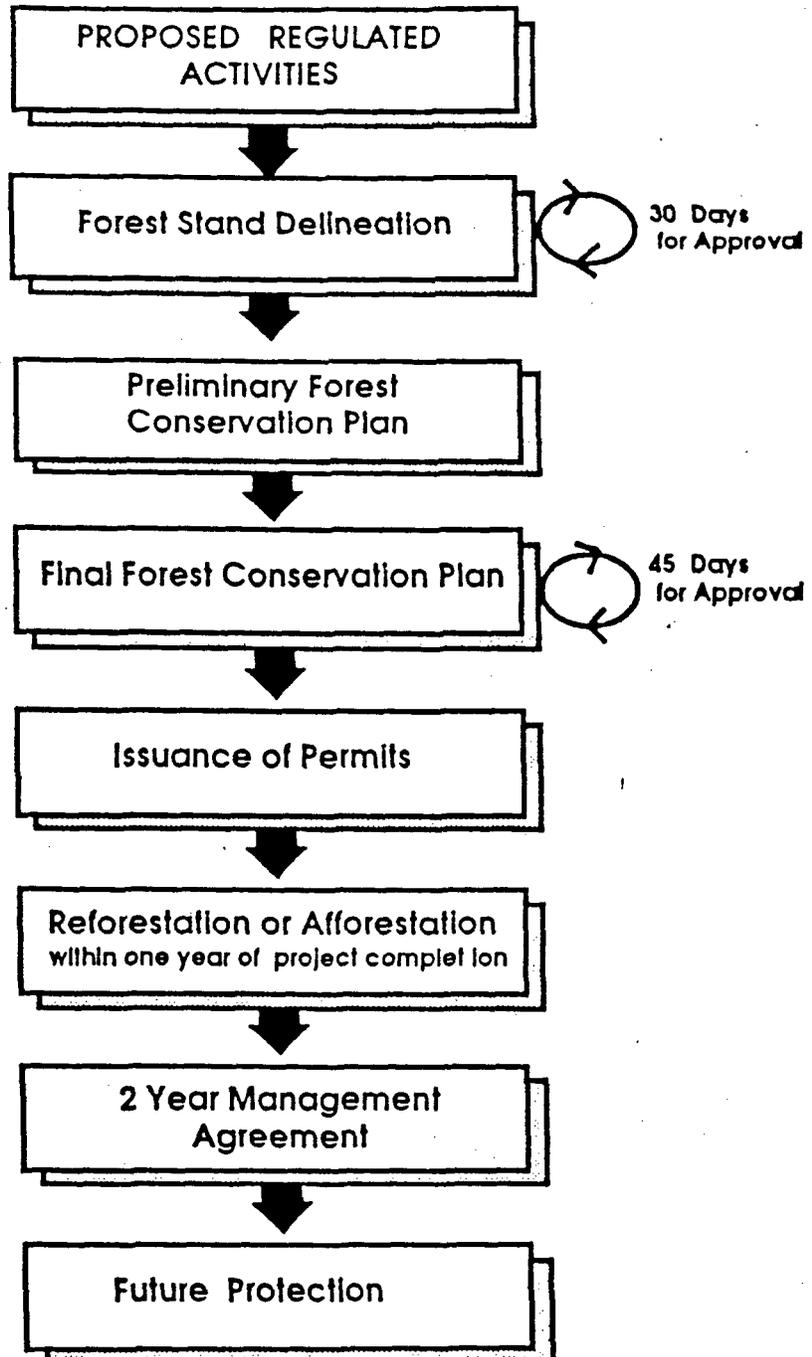
The Forest Stand Delineation is the first submittal requirement. It describes existing forest cover and other environmental features, as defined in the Regulations. Submittal requirements include detailed maps and narratives. Chapter 2 of the manual provides detailed information on submittal requirements and recommended procedures for compiling this information. Within thirty days of receipt of the delineation, the applicant will be notified whether the submittal is complete and correct, or if revisions are necessary.

The second component of the Regulations, the Forest Conservation Plan, is described in Chapter 3 of the manual. The Forest Conservation Plan is a separate submittal requirement that outlines proposed forest retention areas, reforestation and afforestation plans, and forest protection procedures associated with a land use change. It also is comprised of detailed maps and narratives describing the proposed strategies for conserving

forests on site. It should be prepared in conjunction with traditional site planning after the Forest Stand Delineation has been accepted. The reviewing authority will have forty-five days to approve the finalized Forest Conservation Plan.

Figure 1.1.

Forest Conservation Act Procedure



Chapter 2

FOREST STAND DELINEATION

Introduction

The purpose of the Forest Stand Delineation is to characterize and map the existing forests on site. Through a combination of resource mapping and field assessments, a detailed map, or Forest Stand Delineation Map, shall be completed. This information will be used in the Forest Conservation Plan to define retention, reforestation, and afforestation areas. As mentioned in Chapter 1, throughout this chapter, requirements are presented in bold type and additional guidance in normal type.

Requirements

Who is Affected?

A person making an application for a regulated activity, as defined in 2.52 of the Regulations, on areas greater than 40,000 square feet must complete a Forest Stand Delineation (FSD). Exemptions to this requirement are listed in Section 3.2 of the Regulations.

Who Can Prepare a Forest Stand Delineation?

A Forest Stand Delineation can be prepared by a licensed Forester, licensed Landscape Architect, or other qualified professional as specified in Article XVIII of the Regulations.

Submittal Requirements for Simplified Delineations.

The applicant shall submit:

1. Final Forest Delineation Map
2. Site Vicinity Map
3. Narrative of forest conditions

Contents of Submittal Requirements.

The submittal package shall include the following information:

1. Forest Delineation Map shall be prepared at the same scale as the grading, subdivision, or site plan including

the following information (see Appendix A, for precise definitions and Table 2.1 for potential sources):

- property boundaries
- topographic information
- perennial and intermittent streams and their buffers
- soils (indicate if hydric or highly erodible)
- current forested areas (include acreage)
- contiguous forested areas (include approximate acreage)
- steep slopes
- critical habitats
- adjacent land usage and zoning
- 100-year floodplains
- non-tidal wetlands, (identified from remote sources)

- project name
- owner name and address
- name, address, and title of preparer
- signature and seal of preparer
- tax map, parcel number, and deed reference of site
- date of drawing
- north arrow

2. Site Vicinity Map: This map shall indicate the location of the site within a square mile indicating major roads, land uses, and forest cover at a 1:2000 scale.

3. Narrative: A written description of forest conditions shall be submitted. The following information shall be addressed.

- Stand condition
 - forest association (deciduous, coniferous, mixed)
 - comments on evidence of past management practices

- Other environmental features:
 - presence or absence of floodplains
 - hydric soils
 - non-tidal wetlands
 - stream buffers
 - critical habitats
 - steep slopes or steep erodible soils
 - cultural features
 - historic sites
 - adjacent land uses, current and former (if known)

Table 2.1

Data Sources 1

Topography:	5' contour topographic maps available in the Department, or field run topography. US Geological Survey 7.5 minute quadrangles may be used with prior approval.
Perennial/Intermittent streams	As noted on USGS topographic map and field verified.
Soils	US Department of Agriculture Soils Survey, with hydric soils and K values (greater than .35) and structural limitations noted, as field verified.
Property boundaries	Plats, tax maps, or approved boundary surveys.
Forested areas	Most recent aerial photographs, Maryland Forest Resource Inventory maps (1992), or other approved sources.
Steep Slopes	Slopes 25% or greater or 15% or greater with a K value greater than 0.35 as measured off approved topographic maps, using a minimum area of 10,000 square feet..
100 year floodplains	Federal Emergency Mapping Agency maps, or other more detailed approved sources.
Non-tidal Wetlands	US Fish and Wildlife Service Non-tidal Wetlands Inventory maps or Maryland Non-tidal Wetlands Maps, and field verified.
Critical habitats 2	To be identified on Maryland Forest Resource Inventory, 1992 or made available at the discretion of the Natural Heritage Program in consultation with the Department of Natural Resources, or as identified in Federal Endangered Species Act of 1973, 16 U.S.C. 1531-1543; Natural Resources Article, 4-2A-01 through 4.2A-09 and 10-2A-01-10.2A-09; COMAR 08.03.08 and COMAR 08.02.12, or identified on site. 3
Adjacent land uses	Local zoning maps or comprehensive plans.
Historic sites or structures	Local, state or federal historic registers.
Champion trees	Local, state or federal lists of champions

-
- 1 The most recent version shall be used by the applicant.
 - 2 List of rare species of concern in Maryland is included in Appendix F.
 - 3 If rare, threatened or endangered species are identified on site, the Forest Stand Delineation shall be sent to the Department for review.

Procedural Requirements.

Simplified Forest Stand Delineations are permitted in accordance with Section 5.1,D of the Regulations. Areas for which a Simplified Forest Stand Delineation are permitted are not required to provide field sampling points or a forest structure analysis. A Simplified Forest Stand Delineation may also be submitted concurrently with a Forest Conservation Plan.

Submittal Requirements for Standard Forest Stand Delineations.

The applicant shall submit:

1. Final Forest Stand Delineation Map
2. Site Vicinity Map
3. Stand Summary Sheets
4. Narrative of forest stand conditions

Contents of Submittal Requirements.

The submittal package shall include the following information:

1. Forest Stand Delineation Map shall be prepared at the same scale as the grading, subdivision, or site plan including the following information (see Appendix A, for precise definitions and Table 2.1 for potential sources)

- property boundaries
- topographic information
- perennial and intermittent streams and stream buffers
- 100-year floodplains
- non-tidal wetlands (field delineated and flagged)
- soils (indicate if hydric or highly erodible)
- current forested areas (include acreage)
- contiguous forested areas (include approximate acreage)
- forest stand locations
- steep slopes
- field sampling points
- critical habitats
- adjacent land uses and zoning
- cultural features

historic sites
project name
owner name and address
name, address, and title of preparer
signature and seal of preparer
tax map, parcel number, and deed reference of site
date of drawing
north arrow

2. Site Vicinity Map: This map shall indicate the location of the site within a square mile indicating major roads, land uses, and forest cover at a 1:2000 scale.

3. Stand Summary Sheets: Data collected at individual sampling points shall be summarized for each stand (See Appendix D for the recommended form and definitions). The following information shall be submitted:

dominant species and forest association
size class of dominant trees
total number of tree species
number of trees per acre
common understory species
forest structure rating (See Appendix D for recommended input data and procedures). Other structure rating methods or procedures may be employed with the prior approval of the Department.

4. Narrative: A written summary of forest stand conditions shall be submitted. The following information shall be addressed.

Stand condition
stand structure (dominant species, understory species)
forest structure
retention potential
comments on evidence of past management

Other environmental features:
presence or absence of floodplains
hydric soils
non-tidal wetlands
stream buffers
critical habitats
steep slopes or steep erodible soils
cultural features
historic sites
adjacent land uses, current and former (if known)

Procedural Requirements.

The following procedures shall be followed in completing the field sampling portion of the Forest Stand Delineation:

Data Collection

The following information shall be collected in the field and recorded on Field Data Sheets (see Appendix D for recommended form):

Forest Stand Information:

- tree species (dominant and codominant)
- basal area
- size class (as defined on data sheet)
- number of trees
- number of tree species
- number of dead trees
- presence of specimen trees
- rare, threatened or endangered species

Forest Structure Analysis (shall be calculated using the field collected information):

- percent canopy closure
- percent of forest floor covered by shrubs
- percent of forest floor covered by herbaceous plants
- percent forest floor covered by downed, woody material
- exotic or invasive species (presence or absence)
- forest structure calculation

Preliminary Map Preparation for Field Verification.

To aid in preparation of the final Forest Stand Maps it may be beneficial to prepare preliminary maps from available data sources before doing your stand sampling in the field. The preliminary establishment of forest stands based on abiotic characteristics of the site (soils, topography, etc) will present the developer with enough information to make early choices on how to proceed with the project. The following procedure may help to prepare the final Forest Stand Maps.

Forest Stand Map (FSM)

1. A base map may be compiled that shows the following site features: property boundaries, topographic information, and perennial and intermittent streams (See Figure 2.1).

2. Existing forested and unforested areas may be added to the base map using the most recent aerial photography available (See Figure 2.2).

3. The preliminary delineation of forest stands may be determined using various abiotic site information, such as soils, upland versus bottomland areas, northern versus southern aspects, and knowledge of regional forest patterns (See Figure 2.3). Tree lines of contiguous forests may be indicated and contiguous tracts measured for forests that extend off-site.

This map constitutes the preliminary FSM that can be used to create a sampling location map (See Figure 2.4).

Environmental Features Map (EFM)

A preliminary map of other environmental features may be developed. These features are important in deciding other reasons for protecting certain forested areas. Environmental features to be addressed include those items listed under Contents of Submittal Requirements as found above (see Figure 2.5 for example).

Sources of information used in the preparation of the preliminary FSM or EFM should comply with Table 2.1.

Sampling Intensity:

The sampling intensity for the forest stand information shall be sufficient to adequately characterize the forest stand. Forest Stand Information shall be collected using an approved forest sampling procedure. The forest structure analysis shall be calculated at an intensity of one sample point per four acres of forest with a minimum of one sample point per stand.

Sampling Site Location:

The sample points shall be randomly chosen and should be drawn on a field map prior to visiting the site. The sample points shall be identified with blue striped flagging in the field.

Sampling Methods:

Sampling shall be conducted using a method approved by the Department. The forest structure analysis shall be completed on

1/10 acre plots. Two commonly used methodologies for vegetation sampling are the fixed plot and the variable plot methods (see Avery, 1975). If the applicant or preparer of these documents prefers to use an alternate methodology, that person shall submit a written request to the Department for approval. The request shall include a copy of the description of the sampling methodology (e.g. a chapter of a text book) which verifies that the methodology will provide for the collection of the required data.

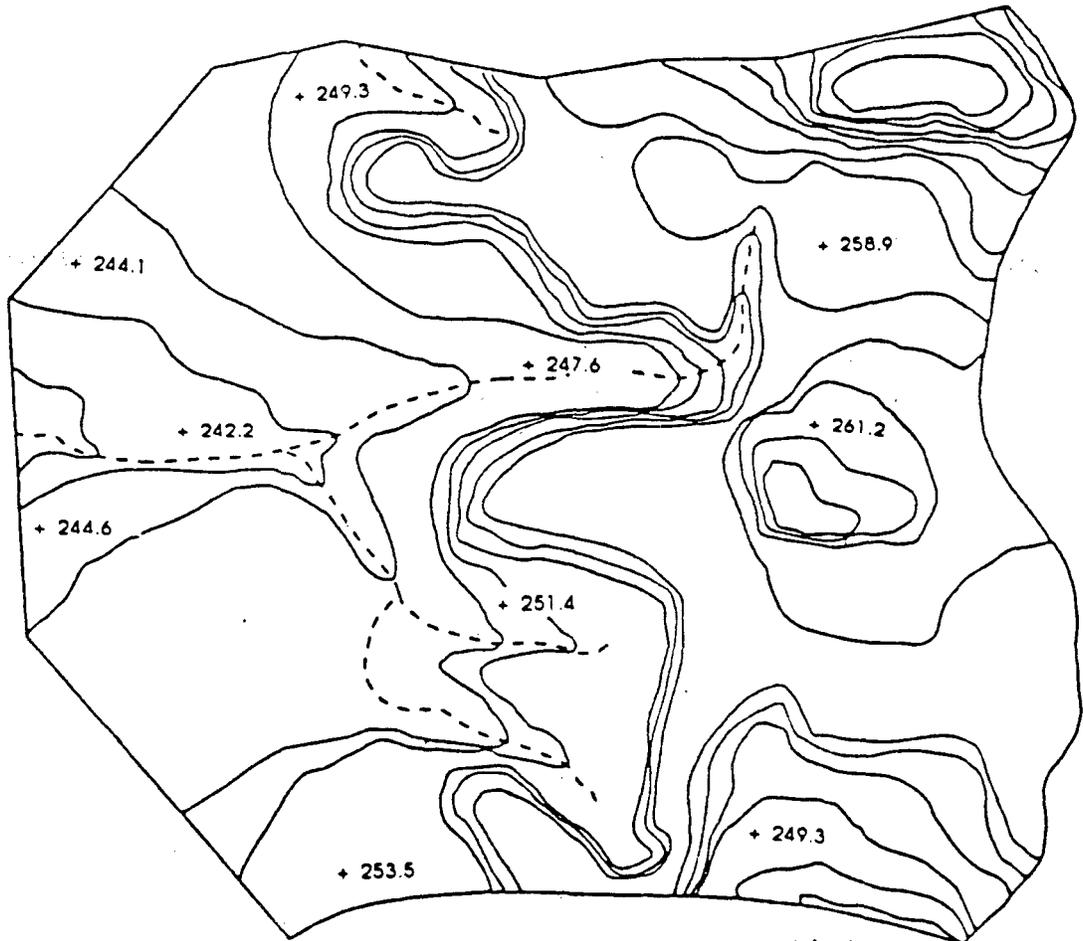
A fixed plot sampling method involves the establishment of a tenth of an acre plot (37.2 foot radius) and direct measurement of forest stand information within that fixed plot. A variable plot sampling method uses a wedge prism or angle gauge to count trees of a certain size. The prism commonly used in Maryland is of basal factor 10.

Figure 2. 1 :

Base Map

Site Information

Area: 34.7 acres
Zoning: 1 acre lot residential



Note: Contour lines are every two (2) feet.



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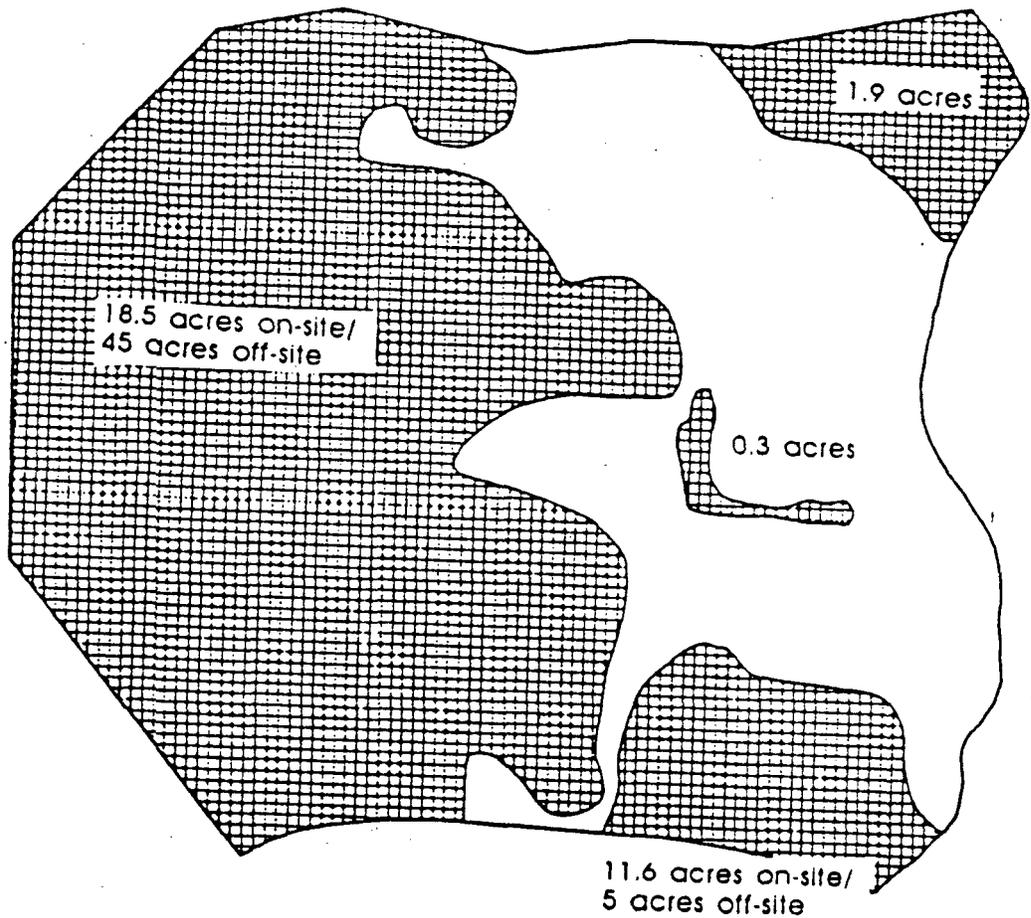
- Contour Lines
- - - Streams

(not to scale)

Figure 2.2 :

Forest Cover Map

Forest cover, as defined by tree lines, determined by recent aerial photography and field visits is depicted in the figure below. Approximations of large forest tracts extending off-site may also be noted at this time.



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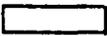
-  Forested
-  Non-Forested

Figure 2.3 (a): Soils

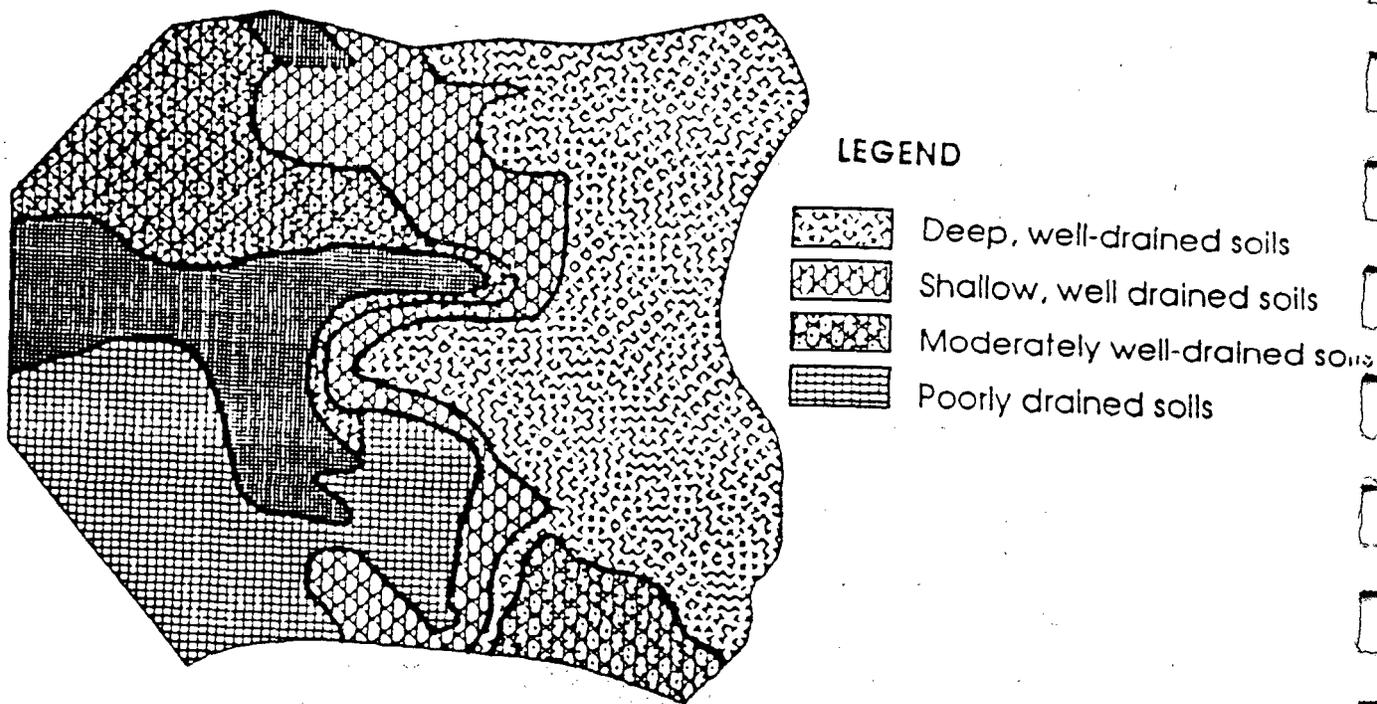


Figure 2.3 (b): Upland versus Bottomland Areas

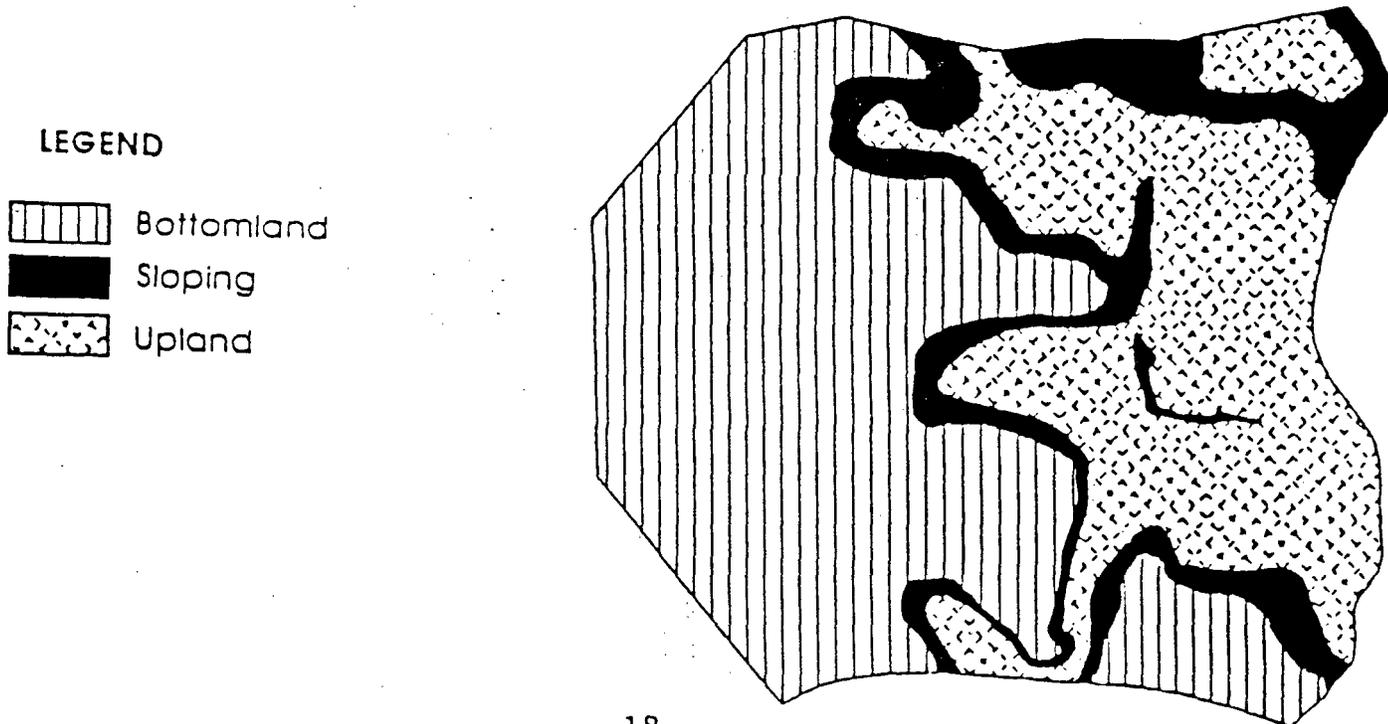
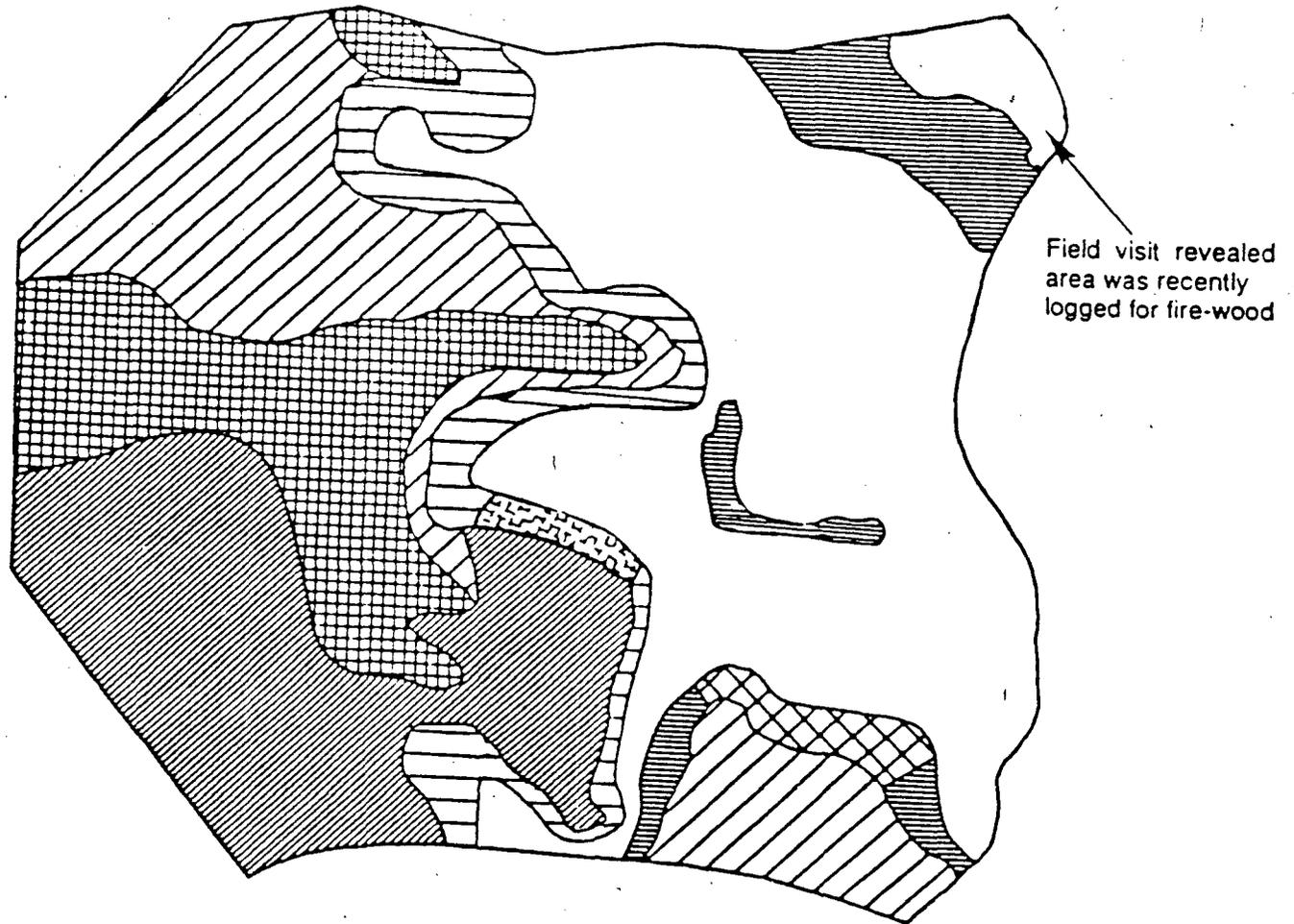


Figure 2.4 :

Preliminary Forest Stand Map



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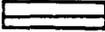
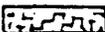
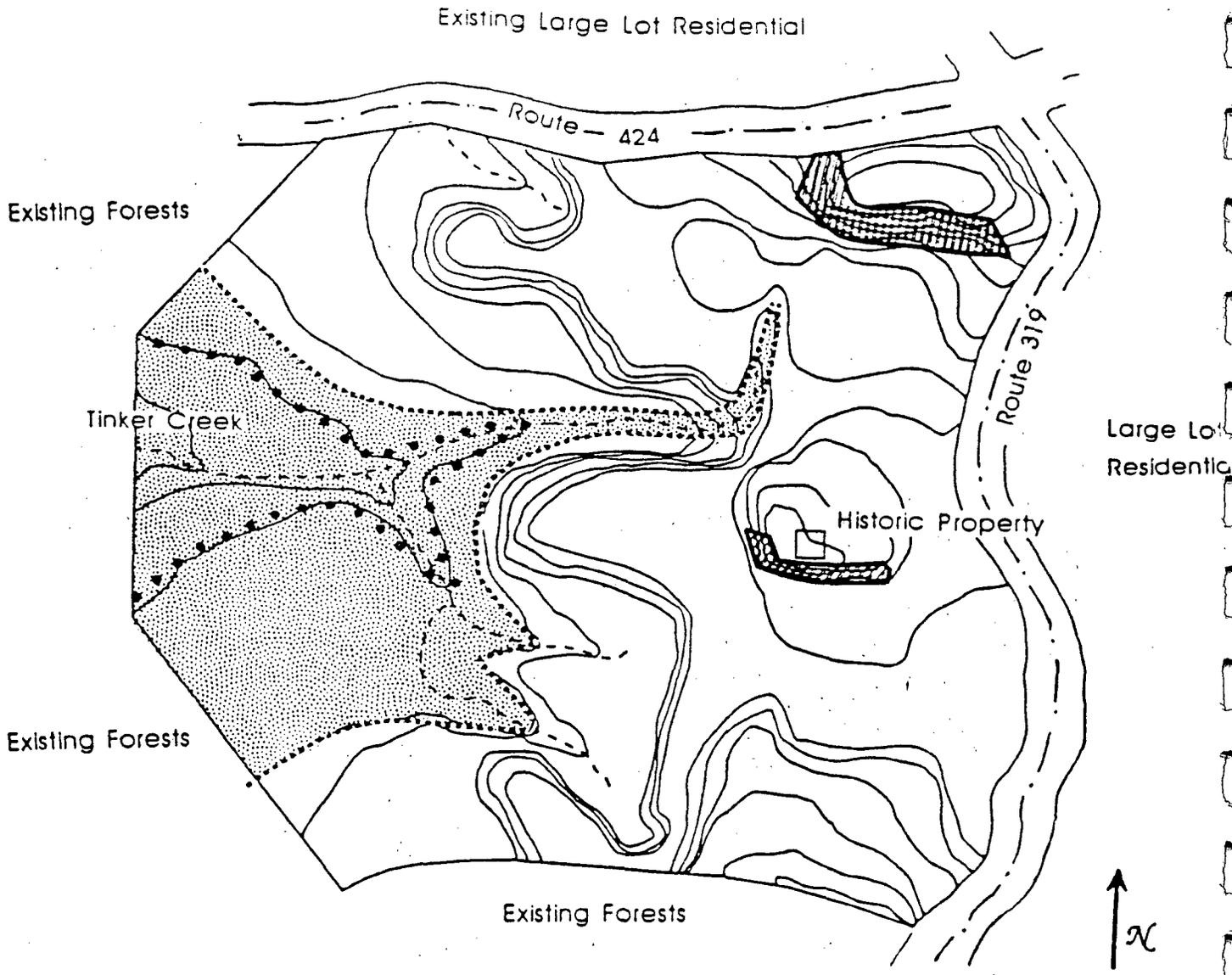
-  Forest on deep, well-drained soils
-  Forest on shallow, well-drained soils
-  Forest on moderately well-drained soils
-  Forest on poorly drained soils
-  Forest on south-facing, shallow, well-drained soils
-  Forest on south-facing, deep, well-drained soils

Figure 2.5 : Preliminary Environmental Features Map



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-  Wetlands
-  100-Year Floodplain
-  Steep Slopes

Figure 2. 6

Forest Stand Delineation Procedures Checklist

Step 1: Preliminary Map Preparation for Field Verification

- Preliminary Forest Stand Map
- Preliminary Environmental Features Map

Step 2: Field Assessment of Forest Stands and Environmental Features

- Forest Stand Information
 - o forest association
 - o dominant and co-dominant species
 - o understory species
 - o number of trees
 - o number of trees species
 - o number of dead trees
 - o basal area
 - o specimen trees
 - o retention potential
 - o transplant potential
- Forest Structure Information (1/10 acre plot)
 - o percent canopy closure
 - o percent herbaceous cover
 - o percent downed, dead woody material
 - o percent exotic or invasive species
 - o number of shrubs per 1/100 acre

- Environmental Features
 - o 100-year flood plains
 - o hydric soils
 - o topography
 - o prime agricultural soils
 - o non-tidal wetlands
 - o streams, and buffers
 - o critical habitats
 - o steep and steep, erodible slopes
 - o cultural features
 - o historic sites
 - o adjacent land uses

Step 3: Finalize Maps

- Forest Stands
- Environmental Features
- Forest Stand Summary Sheets
- Narrative

Step 4: Combine Maps for Final Forest Stand Delineation Map

Chapter 3

FOREST CONSERVATION PLAN

Section 3.1

INTRODUCTION

A Forest Conservation Plan provides a blueprint for the retention and protection of forested areas, and reforestation and afforestation in response to the impacts of land use changes. This chapter provides a clear process for developing a Forest Conservation Plan so that the intent of the Act can be met. Throughout this chapter, requirements are presented in **bold type** and additional guidance in normal type.

Specific guidance is provided on the calculations that determine Forest Conservation requirements (Section 3.2), forest retention procedures (Section 3.3), forest protection procedures (Section 3.4), and specifications for reforestation and afforestation (Section 3.5). At the end of the chapter, a Forest Conservation Plan example is provided.

Who Is Affected?

A Forest Conservation Plan shall be submitted as part of any regulated activity that requires a Forest Stand Delineation.

Who Can Prepare a Forest Conservation Plan?

Any person who is qualified to prepare a Forest Stand Delineation may also prepare a Forest Conservation Plan. This includes, a licensed forester, licensed landscape architect or other qualified professional specified in Article XVIII of the Regulations.

Submittal Requirements

The Forest Conservation Plan shall contain the following elements:

1. The Approved Forest Stand Delineation, either a copy or reference to an existing plan (See Chapter 2).

2. A Forest Conservation Worksheet . This worksheet is used as the basis for determining all forest retention, reforestation and afforestation requirements for the site (See Section 3.2).

3. A Forest Conservation Map drawn at the same scale as the grading, subdivision, or site plan submitted for approval, clearly indicating the location and acreage of:

- Forest Retention Areas (with priority rating)
- Reforestation Areas
- Afforestation Areas
- Protective devices
- Limits of disturbance
- Stockpile Areas

4. Anticipated Construction Timetable including the sequence of reforestation, afforestation, maintenance and protective measures to be employed at the site.

5. Forest Protection Plan (Section 3.4) including:

- Specifications of temporary and permanent forest protection measures.
- Summary table of proposed protection devices for individual trees.

6. Reforestation Plan and Afforestation Plan (Section 3.5), if required, including in narrative form:

- Evaluation of reforestation and afforestation methods
- Plant stock table
- Planting plan
- Binding two year management plan for reforestation and afforestation sites.

7. Any additional supporting documentation or information required by the Department.

Procedural Requirements

See individual sections for a complete listing of required procedures.

Section 3.2

THE FOREST CONSERVATION WORKSHEET

The Forest Conservation Worksheet (Figure 3.2.1) serves as the basis for determining forest retention, afforestation, and reforestation requirements on site. In brief, the requirements of the Act are driven by three factors: land use type (category) shown in Table 3.2.1, existing forest acreage, and areas of forest to be cleared. To guide the applicant through the computations, the Forest Conservation Worksheet has been developed and is a submittal requirement of the Forest Conservation Plan.

Required information to complete the Forest Conservation Worksheet.

1. Land use category: The worksheet shall indicate the thresholds required based on the land use type (category) for the site given in Table 3.2.1.
2. Total site area: The acreage of the site boundaries as determined by tax plats, or boundary survey to the nearest one-tenth acre, unless shown to be a phased development.
3. Area of site within the 100-year floodplain: The area of the 100- year floodplain as defined by the Cecil County Zoning Ordinance, and/or as determined by Federal Emergency Management Agency (FEMA).
4. Area remaining in agricultural production: Areas fitting the definition given in Section 2.2 of the regulations.
5. Existing forest cover at site: This will be determined from the approved Forest Stand Delineation (Chapter 2).
6. Forest area proposed for clearing: This will be determined directly from the limits of disturbance defined on the grading or site plan. The worksheet figures shall be modified to reflect additional forest clearing attributed to utility rights of way, roadway grades and rights of way, stormwater and sediment control facilities, and other clearing not shown on the grading plan. Figures for clearing, both above and below threshold levels, shall be required.

Table 3.2.1

Land Use Thresholds

Land Use Type¹	Conservation Threshold	Afforestation Threshold
Agricultural and Resources Areas	50%	20%
Medlum Density Residential	25%	20%
Institutional Development Areas	20%	15%
High Density Residential Areas	20%	15%
Mixed Use and Planned Unit Development Areas	15%	15%
Commercial and Industrial Use Areas	15%	15%

¹ See Appendix A For Definition

Figure 3.2.1

Forest Conservation Worksheet

Input Data

- A. TOTAL SITE AREA: _____
B. AREA WITHIN 100 YEAR FLOODPLAIN: _____
C. AREA OF AGRICULTURAL LAND (no change in status): _____
D. NET TRACT AREA (A-B-C): _____

E. LAND USE CATEGORY: _____
F. AFFORESTATION THRESHOLD: _____
G. CONSERVATION THRESHOLD: _____

H. CURRENT FOREST COVER: _____
I. FOREST AREA ABOVE AFFORESTATION THRESHOLD: _____
J. FOREST AREA ABOVE CONSERVATION THRESHOLD: _____

K. ABOVE CONSERVATION THRESHOLD TO BE CLEARED: _____
L. BELOW CONSERVATION THRESHOLD TO BE CLEARED: _____
M. TOTAL FORESTED AREA TO BE CLEARED: _____
N. FORESTED AREA ABOVE CONSERVATION THRESHOLD TO BE SAVED: _____

Calculations

Break-Even Point:

- O. ACRES ABOVE CONSERVATION THRESHOLD TO BE RETAINED FOR NO REQUIRED REFORESTATION: $J \cdot 20\% =$ _____ ACRES

Afforestation Requirement:

- P. FORESTED ACRES REQUIRED: $D \cdot F =$ _____
Q. ACRES TO BE AFFORESTED: $P - H =$ _____

Reforestation Requirement:

- R. ACRES CLEARED ABOVE THRESHOLD: $K \cdot 1/4 =$ _____
S. ACRES CLEARED BELOW THRESHOLD: $L \cdot 2 =$ _____
T. REFORESTATION CREDIT: $N \times 1.25 =$ _____
U. TOTAL REFORESTATION REQUIREMENT: $R + S - T =$ _____ ACRES

Total Planting Requirement:

- V. AFFORESTATION AND REFORESTATION: $Q + U =$ _____ ACRES

Figure 3.2.2

Determination of Reforestation Requirements: Example 1

Clearing Up to Threshold

Net Tract Area: 100 acres
Current Forest Cover: 70 acres
Forest Cover Above Threshold: 45 acres
Area of Forest To Be Cleared: 45 acres
Land Use Category: Medium Density Residential Area
Conservation Threshold: 25%

Reforestation Calculations:

Above Threshold:	45 acres * 1/4 =	11.25 acres
Below Threshold:	0 acres * 2 =	+0.00 acres

Total = 11.25 acres reforestation required

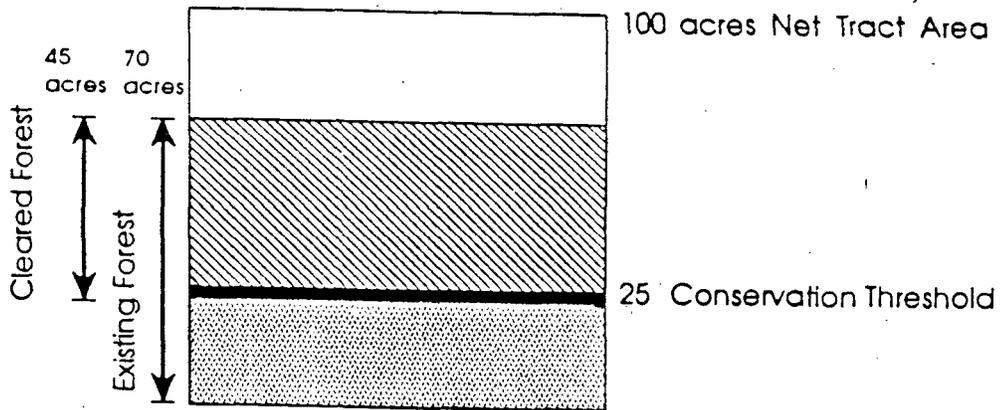


Figure 3.2.3

Determination of Reforestation Requirements: Example 2

Clearing Below Threshold

Net Tract Area:	100 acres
Current Forest Cover:	70 acres
Forest Cover Above Threshold:	45 acres
Area of Forest To Be Cleared:	50 acres
Land Use Category:	Medium Density Residential Area
Conservation Threshold:	25%

Reforestation Calculations:

$$\text{Above Threshold: } 45 \text{ acres} \times \frac{1}{4} = 11.25 \text{ acres}$$

$$\text{Below Threshold: } 5 \text{ acres} \times 2 = +10.00 \text{ acres}$$

$$\text{Total} = 21.25 \text{ acres reforestation requirement}$$

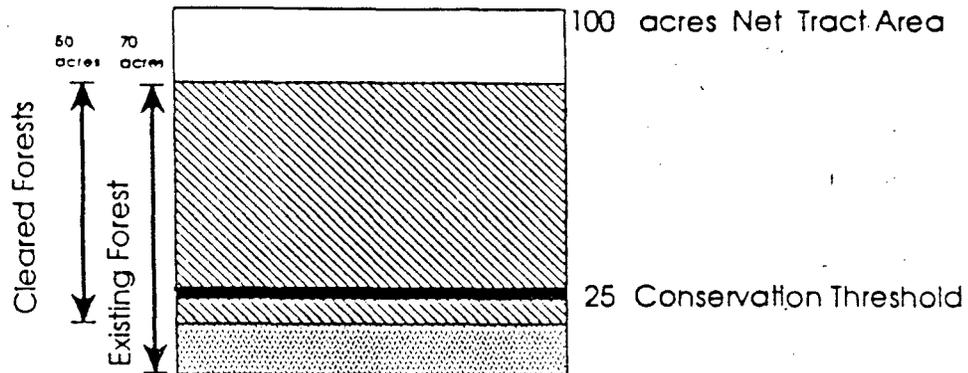


Figure 3.2.4

Determination of Reforestation Requirements: Example 3

Use of Reforestation Credit

Reforestation Credit Rule: Each acre of forest retained in the net tract area, above the forest conservation threshold, reduces the reforestation requirement by 1.25 acres. A break-even point exists such that the retained acreage compensates for the cleared acreage and no reforestation is required.

20% (one acre retained per four acres cleared = 1/5) of the original forested area above the Conservation Threshold must be retained, so that no reforestation will be necessary.

Using Example 1, how many acres of the 45 forested acres above the Conservation Threshold must be retained to compensate for cleared forest and eliminate the reforestation requirement?

Net Tract Area:	100 acres
Current Forest Cover:	70 acres
Forest Cover Above Threshold:	45 acres
Area of Forest To Be Cleared:	see calculations
Land Use Category:	Medium Density Residential Area
Conservation Threshold:	25%

Calculations:

Break-even Point:	$45 \text{ acres} \times 20\% = 9 \text{ acres}$
Forest To Be Cleared:	$45 \text{ acres} - 9 \text{ acres} = 36 \text{ acres}$

If 9 acres are retained above the Conservation Threshold, no reforestation is needed.

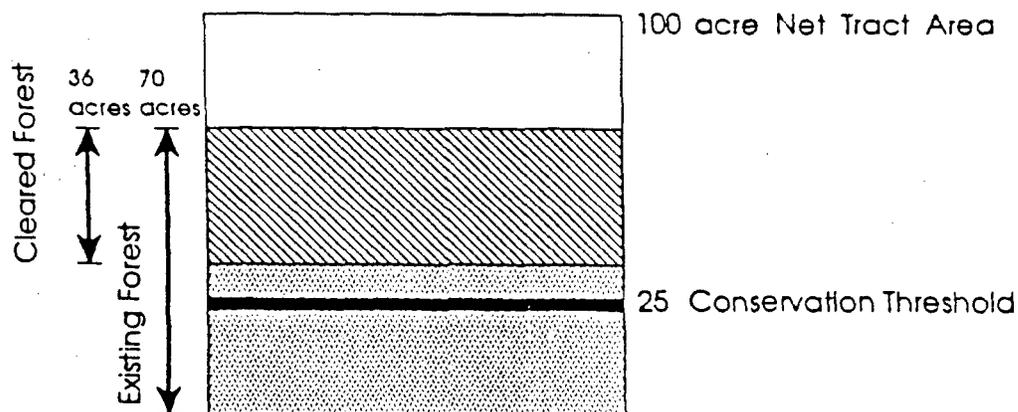


Figure 3.2. 5

Determination of Afforestation Requirements: Example 1

Total Forested Acreage Below Afforestation Threshold

Afforestation Threshold: If the Forest Stand Delineation finds that the site has less than the required percentage of the Net Tract Area in forest cover, it must be afforested to a required Afforestation Threshold (different from the Conservation Threshold).

Net Tract Area:	100 acres
Current Forest Cover:	15 acres
Forest Cover Above Afforestation Threshold:	0 acres
Area of Forest To Be Cleared:	0 acres
Land Use Category:	Medium Density Residential Area
Afforestation Threshold:	20%

Calculations:

$$\begin{aligned} 100 \text{ acres} \times 20\% &= 20 \text{ acres must contain forest} \\ 20 \text{ acres} - 15 \text{ acres (existing forest)} &= 5.0 \text{ acres must be afforested} \end{aligned}$$

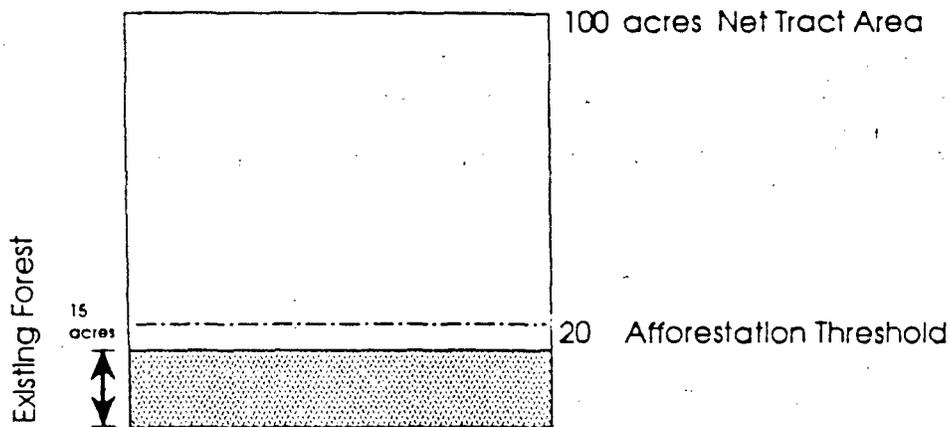


Figure 3.2.6

Determination of Afforestation Requirements: Example 2

Clear Forest Below Afforestation Threshold

Net Tract Area:	100 acres
Current Forest Cover:	15 acres
Forest Cover Above Afforestation Threshold:	0 acres
Forest Cover Above Conservation Threshold:	0 acres
Area of Forest To Be Cleared:	5 acres
Land Use Category:	Medium Density Residential Area
Afforestation Threshold:	20%
Conservation Threshold:	25%

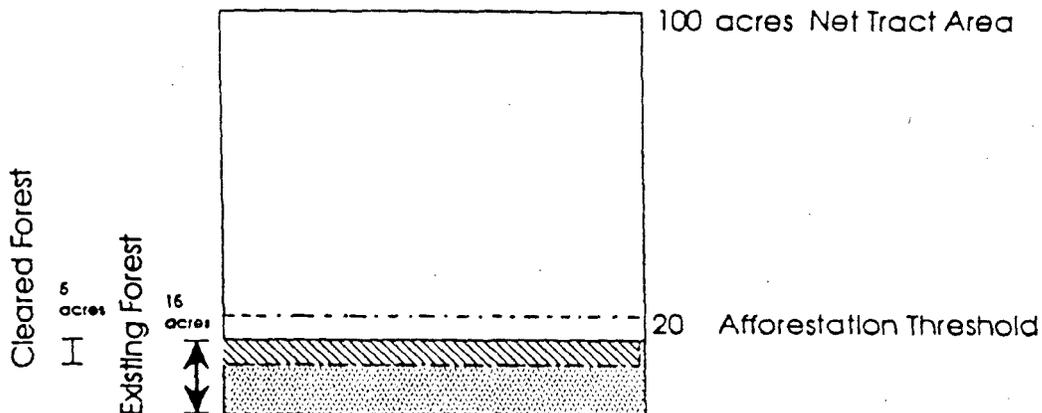
Calculations:

Afforestation Requirement -
 $100 \text{ acres} \times 20\% = 20 \text{ acres of forest required}$
 $20 \text{ acres} - 15 \text{ acres (existing forest)} = 5 \text{ acres must be afforested}$

Reforestation Requirement -
Area cleared below Conservation Threshold:
 $5 \text{ acres} \times 2 = 10 \text{ acres}$

Total Planting Requirement = $5 \text{ acres afforestation} + 10 \text{ acres reforestation}$

 15 acres



Section 3.3

FOREST RETENTION PROCEDURE

Introduction

This section provides a framework for identifying forest areas to be retained. Using the information gathered in the Forest Stand Delineation and forest retention criteria defined in the Act, a final plan for forest retention can be developed. This section provides a framework for prioritizing forested areas using specific retention criteria. Once priority areas are mapped and the acreage calculated, this Section provides additional guidance for the identification of the most important areas to be retained as Forest Retention Areas.

Requirements.

Definition of Retention Areas.

The Forest Retention Area shall be a minimum area of 10,000 square feet. Critical Root Zones of retained areas that are protected (See section 3.4) shall be counted toward the total Forest Retention Area (Figure 3.3.1). The critical root zones of isolated retained specimen trees (not already within above defined retention areas), shall also be counted toward the total Forest Retention Area. This retention credit shall only apply if the entire critical root zone is retained.

Use of Retention Areas.

Construction activities may not take place in the retention area. This includes siting and construction of:

- utility lines
- access roads
- staging, storage, and temporary parking areas
- stormwater management devices
- impervious surfaces
- grading
- berms for the purpose of temporary or permanent sediment and erosion control

If any of these or other construction activities take place in designated retention areas, these disturbed areas will no longer be credited toward retention and shall be compensated for by other retention areas or reforestation and afforestation.

Figure 3. 3.1

The Critical Root Zone

Roots are vital to the functioning of any tree. They provide structural support as well as the major mechanism for nutrient and water uptake for use by the tree. Destroying a section of a tree's roots, will ultimately result in a proportional loss to the tree's canopy.

The Critical Root Zone of a tree is the zone in which the majority of a tree's roots lay. Ninety-five percent of the roots of most trees will be found in the upper 12-18" of the soil. The majority of the roots that supply the nutrients and water to the tree are found just below the soil surface. The total amount of a tree's roots are generally proportional to the volume of the tree's canopy. Therefore, if the roots only penetrate a thin layer of soil, then the roots must spread far from the tree, beyond the extension of the canopy.

When delineating forest retention lines in the field, one must consider not only the visible portion of the tree (the trunk and canopy) but the below ground portion as well. On all Forest Conservation maps, isolated specimen trees should be noted with their critical root zones and all forest stands to be saved should be noted by the edges of their critical root zones and not just by the extent of their canopies.

The true size of the critical root zone is determined by the species and size of the tree as well as the conditions of the soil (including texture and moisture level). It is difficult to generalize for all trees but also difficult to field examine the root systems of all of the trees in question.

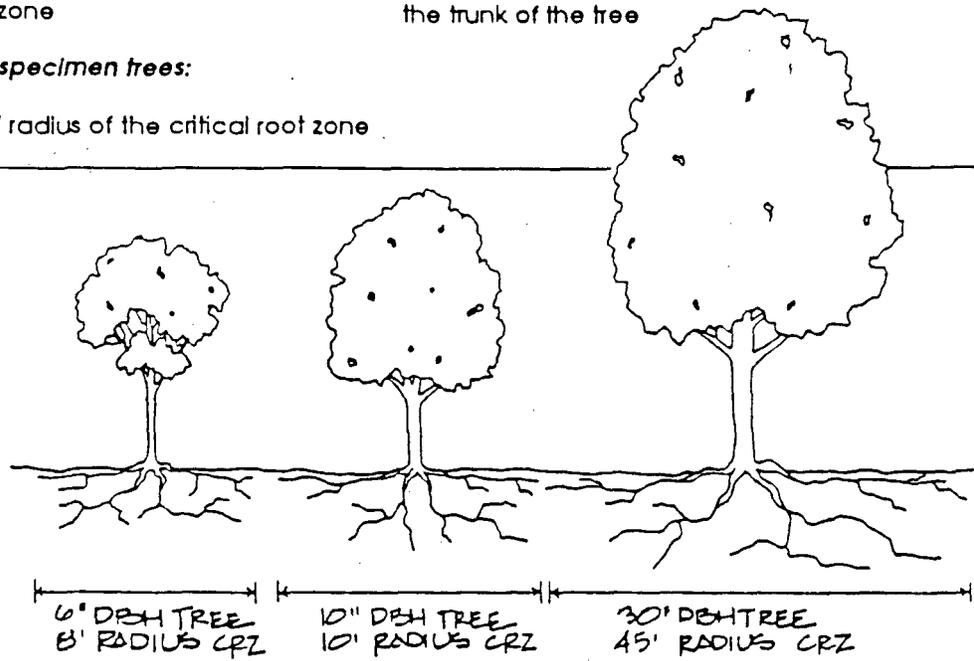
There are several ways to estimate the size of the critical root zone without examining the roots in the field. The following calculation is suggested but other methods may be accepted if shown to protect the complete root zone.

For the edges of large areas, use the greater of the two choices below:

1" DBH of the tree = 1' radius of the critical root zone or 8 ft radius circle around the trunk of the tree

For isolated specimen trees:

1" DBH = 1.5' radius of the critical root zone



The Critical Root Zone is the area in which most of a tree's roots lay. Retaining this area, along with the tree itself will help to insure a healthy retention area.

Source: MD Department of Natural Resources

Protection of Retention Areas During Construction

Forest retention areas and specimen trees that are to be protected from construction activities shall be identified at the construction site. Placement of highly visible signage shall be used to protect these areas and should be placed prior to any land clearing or grading. These devices shall be maintained throughout the entire construction phase of the project. attachment of signs or other objects to trees is prohibited and no equipment, machinery, vehicles, materials or excessive pedestrian traffic shall be allowed within protected areas.

As an alternative to devices a minimum 40' wide forested buffer may be used to protect the retention areas. Use of the buffer shall be approved by the Department and may be requested by the Department. No equipment, machinery, vehicles, material or excessive pedestrian traffic shall be allowed within the buffer area. Incidental damage due to construction activity shall not be found in non-compliance unless impact to the retention area also occurs.

Future Protection.

The future protection of retention areas, as well as reforestation and afforestation areas, is required by the Act. These areas shall be protected through the use of legal mechanisms described in Article XII of the Regulations. Compatible uses of retention areas may include such activities as unpaved hiking trails or silvicultural activities associated with an approved forest management plan.

Submittal Requirements:

The applicant shall provide a map at the same scale of the subdivision, site or grading plan submitted for review, with graphic illustration of:

1. Retention areas with priority rating and acreage
2. Field verified edges reflecting critical root zones
3. Specimen trees, isolated from retained areas, and their critical root zones

Designation of Retention Areas.

In the process of determining forest retention areas on site, the criteria listed below shall be used to designate areas of highest importance for retention.

Priority Area 1: High

Critical habitats of rare, threatened, or endangered species

Trees, shrubs, or herbaceous plants associated with:

- * intermittent and perennial streams and their buffers
- * slopes over 25 percent
- * hydric soils
- * soils with a K value greater than 0.35 on slopes of 15% or more

Trees, shrubs, or herbaceous plants that are part of a stand that has one or more of the following characteristics:

- * stands or portions of stands with high forest structural diversity (as defined in Appendix D)
- * contiguous forested areas of approximately 100 acres that connect the largest or most vegetated tracts of land within and adjacent to the site
- * forested areas which provide a corridor 300 ft. wide or more of primarily native vegetation between two larger forested tracts

Individual trees with one or more of the following characteristics:

- * trees that are part of a historic site or associated with a historic structure
- * trees designated as a national, state, or local champion tree
- * trees measuring 75 percent or more of the diameter measured at 4.5 feet above the ground (DBH) of the designated state champion tree
- * trees with a DBH of 30" or greater

Priority Area 2: Moderate

stands or portions of stands with good structural diversity (see Appendix D)

contiguous forested areas approximately 20 acres or more in size which connect the largest or most vegetated tracts of land within and adjacent to the site.

forested stream buffers up to forest corridor width (50ft-300ft wide)

Priority Area 3: Low

stands or portions of stands with poor forest structural diversity or areas with none of the characteristics mentioned in priority areas 1, 2, or 4.

Priority Area 4: Disturbed

approximately 40 percent of land covered with exotic or invasive species (See Appendix H).

If there are any changes to the designated retention areas after they have been approved, the amended plans shall be reapproved before construction can proceed on the amended areas.

Designating Forest Retention Areas

This involves the delineation of the proposed locations of the Forest Retention Areas. Priority 1 areas shall be set aside as forest retention areas unless disturbance is unavoidable and approval is granted by the Département. If the priority 1 area acreage is below that calculated for the required forest retention acreage, then portions of the land in priority 2 areas should be included as well. This process continues at least until the minimum amount of forest retention area is identified and set aside for protection and should continue until all forest areas left undisturbed are classified.

1. Elements to consider when deciding between two stands of apparently equal value are as follows:

a. Neighboring land uses: For example, if there are large roads adjacent to the property, a certain size and character forested buffer may reduce the noises reaching the property and will help to filter air pollutants.

b. Site-specific climate needs: Forests act as windbreaks and moderate temperature extremes.

c. Susceptibility to disease or pest infestation: There may be diseases or pests noted on the forest stand delineation which are not life threatening. These health concerns, however, may be the deciding factor between two apparently equally valuable stands.

d. Recharge of hydrologic regime: Some wooded areas may border but may not be within a technically defined buffer region of a wetland, stream, or spring. Disturbance of these areas may cause damage to the

existing hydrologic regime. In many cases, expansion of these buffers should take precedence over retention of isolated wooded areas of similar size and character.

e. Contiguous forested lands: Even small pieces of forests on site may be connected to areas off site which when combined, are important to retain.

2. If conservation of existing forests is not feasible, then the applicant shall propose a reforestation or afforestation plan as directed in Section 3.6 of this manual.

Staking Retention Area Edges in the Field

In the previous sections forest stand characteristics are used to determine which forested areas and specimen trees to retain. The on-site delineation of the retention area will require decisions about specific trees that border the edges of the retention areas. Differences between the conceptual limit of disturbance line on the site plan and the existing field conditions along the line of trees to be retained will require adjustment of the staked line in the field. Adjustments for the protection of individual trees along the forest retention line will require a decision on the survival potential of each tree. There are several different factors that shall be considered during this process.

1. Critical root zones (See Figure 3.3.1)
2. Tree health
decay, pests, disease (see Pirone, 1978, for methods of assessing tree health)
3. Susceptible species
wind throw, sun exposure, soil compaction (eg: Virginia pine is susceptible to wind throw, tulip poplar is sensitive to any soil disturbance, see Table 3.2)
4. Age
older trees are less resistant to disturbance

If the line of disturbance runs through the critical root zone of any tree, then move the line to accommodate trees with a high probability of survival. Some trees may have too much of the root zone within the disturbance area (above 30%) and may be removed. Others may just have a portion of the root zone within the disturbance area; and should be protected during construction. Once the line is staked or otherwise marked in the field those trees and their critical root zones shall receive protective devices during construction activity. Specific recommendations for the protection of trees along the retention line may be found in Section 3.4.

Figure 3. 3.2

Forest Retention Area Decision Matrix

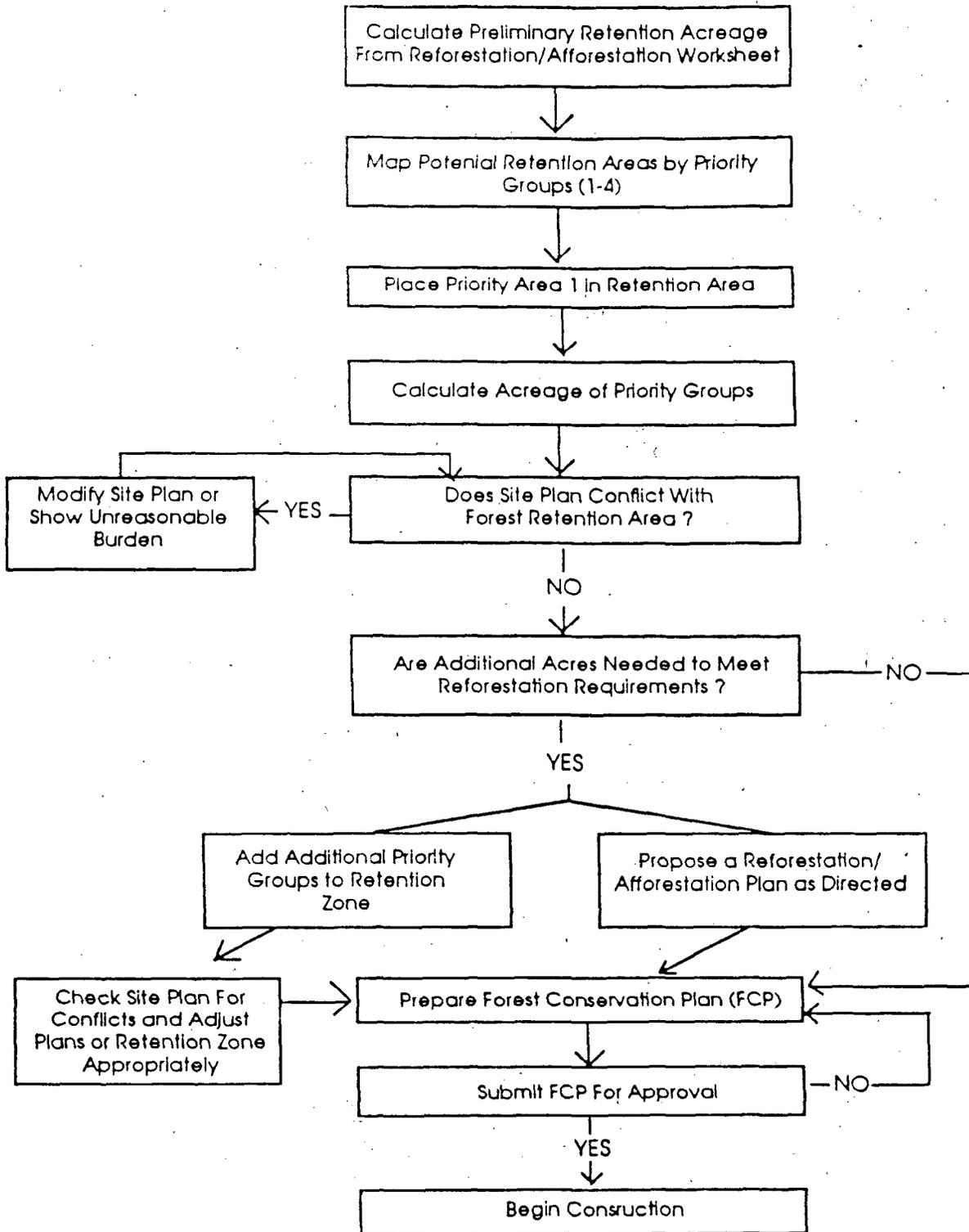


Table 3. 3.1

Compaction Tolerance

Highest -	<i>Ulmus spp.</i> (elm), <i>Populus spp.</i> (poplar), <i>Salix spp.</i> (willow), <i>Plantanus occidentalis</i> (sycamore), <i>Quercus palustris</i> (pin oak), and <i>Gleditsia spp.</i> (locust)
Next -	<i>Betula spp.</i> (birch), <i>Carya spp.</i> (hickory), and <i>Tsuga spp.</i> (hemlock)
Low -	<i>Acer saccharum</i> (sugar maple), <i>Fagus spp.</i> (beech), <i>Cornus spp.</i> (dogwood), <i>Quercus spp.</i> (oak), <i>Liriodendron tulipifera</i> (tulip tree), <i>Pinus spp.</i> (pines), and <i>Picea spp.</i> (spruce)

Section 3.4

FOREST PROTECTION PROCEDURES

Introduction

At this point in the preparation of the Forest Conservation Plan, the applicant should have identified and designated forest retention areas, isolated specimen trees, and the determined the siting of all utilities, access roads and limits of disturbances such as grading or stormwater management areas. The mere process of delineating these areas, however, does not guarantee the continued viability of the forested areas beyond the construction phase of the project. The impacts of construction activities to tree health include:

1. Damage to the Critical Root Zone by
 - soil compaction from equipment or storage of construction material or stockpile area;
 - tearing or removing roots;
 - desiccation or freezing;
 - increase in toxins;
 - changes in soil pH; or
 - flooding.
2. Damage to the trunk by
 - sun scald;
 - disease or insect infestation; or
 - impact from equipment.
3. Damage to the crown by
 - broken or damaged limbs; or
 - disease or insect infestations.

This section of the manual is intended to guide the applicant through the construction phase of a project, ensuring that construction activities will not adversely affect the forest that have been identified as retention areas or specimen trees. Examples of specifications for protection devices are located in Appendix J.

Requirements:

1. Provide a Forest Protection Plan addressing
 - Pre-construction activities, when appropriate
 - * Stress reduction
 - * Temporary and permanent protection devices
 - Future protection measures

2. Provide an overlay map to be added to the Forest Conservation Map showing:

Placement of stockpile areas, temporary and permanent tree protection devices (See Appendix J)

Construction timetable, and Specifications for required devices

Contents of Forest Protection Plan:

The above submittal requirement shall address the following issues:

1. Pre-construction activities*

Stress reduction of specimen trees isolated from forest retention areas addressing each of the items below noting if a technique is used and for what reason.

- * root pruning
- * crown reduction or pruning
- * watering
- * fertilizing
- * mulching

Temporary Protection measures, such as fencing, and signage for retained and reforested or afforested areas (See Appendix J)

Permanent protection devices of disturbed areas within the Critical Root Zone of retained areas (See Appendix J).

*If these situations do not occur the applicant may write "no Critical Root Zone impacted, therefore no permanent devices are needed."

2. Future protection measures:

The applicant shall include with the conservation plan a strategy for protecting all retention, reforestation and afforestation areas for the future. Appendix F describes alternative methods that are suitable to ensure this protection.

Procedural Requirements:

1. Planning and Design of Protection Devices

For all retained areas, including both forested and isolated specimen trees:

- * All retention areas and isolated specimen trees shall be protected by highly visible, well anchored Temporary protection devices.
- * All protection devices shall be in place prior to any grading or land clearing.
- * All protection devices shall remain in place until all construction has ceased in the immediate vicinity.
- * Devices shall be maintained throughout construction.
- * Attachment of signs, or any other objects, to trees is prohibited.
- * No equipment, machinery, vehicles, materials or excessive pedestrian traffic shall be allowed within protected areas.

2. Pre-construction meeting

After the boundaries of the retention area have been staked and flagged and before any disturbance has taken place on site, a pre-construction meeting at the construction site shall take place. The developer, contractor or project manager, and appropriate local inspectors shall attend. The purpose of this meeting will be to:

- * Identify the locations of the forest retention areas, specimen trees, limits of construction, employee parking areas, and equipment staging areas on site plans;
- * Inspect all flagged boundaries, protection devices, and Sediment and Erosion control devices on site;
- * Make all necessary adjustments; and
- * Assign responsibilities as appropriate and discuss penalties.

The meeting may also be used to inform all construction personnel of the purpose of the various flagging, protection devices, etcetera; and explain the importance of preserving these retention areas.

3. On-site decisions

Any changes made to the Forest Conservation plan due to on-site conditions shall be made in consultation with a qualified individual.

4. Post-construction phase

Corrective Measures shall be required if damages were incurred due to negligence:

- * stress reduction.
- * removal of dead or dying trees: This may be done only if trees pose an immediate safety hazard.

The following minimum standards shall be observed during the removal of temporary structures:

- * No burial of discarded materials will occur on-site within the conservation area.
- * No open burning within 100 feet of a wooded area
- * All temporary forest protection structures will be removed after construction.

Penalty for Violation:

Following the completion of construction, prior to use, the project inspector shall inspect the entire site. If trees die then the area encompassing the critical root zone(s) will be considered to be in violation of the conservation plan and appropriate action as outlined in Article XVI of the Regulations shall occur. Fees may be assessed accordingly in the minimum sum of \$1.00 per square foot of the affected area. Other penalties may apply.

Forest Protection:

The following is a suggested procedure for the protection of forest retention areas and corresponds to the specifications found in Appendix J of this manual. Figure 3.4.1 outlines the overall process for forest protection.

Pre-Construction Activities

This section applies after the site planning phase is complete and its purpose is to prescribe measures that should be taken on-site prior to any clearing. A development project may be completed in several phases. The measures outlined below should be completed before the start of any phase of a project.

Stress Reduction for Specimen Trees Isolated From Forested Retention Areas

Isolated specimen trees that are to be preserved should be examined to determine if stress reduction techniques are needed. Specific information on evaluation criteria and remediation techniques can be found in information available from the Department.

1. Root Pruning
2. Crown reduction or pruning
3. Watering
4. Fertilizing

Temporary Forest Protection Devices

When selecting the appropriate protective device it is important integrate the choice with other design considerations.

1. Combine protection and sediment and erosion control devices when possible.
2. Avoid injuring roots when installing anchoring posts.
3. At a minimum, fencing should be at least 4' high.
4. Fencing should be flagged with highly visible flagging.
5. Fencing should be securely anchored; at a minimum 1/3 of the anchor post should be below ground level.
6. Signs should be posted at all retention areas and specimen trees clearly identifying the area.

The following are representative of the types of devices that may be used. Specifications can be found in Appendix J.

1. For forest protection only
 - a. Blaze orange plastic mesh fencing.
 - b. Two to three strand barbed-wire fence with highly visible flags.
 - c. Snow fencing with highly visible flags on anchor posts.
 - d. Highly visible signage.
2. For combined forest protection and silt fencing
 - a. Filter cloth on wire mesh.
 - b. Straw bale dike.
 - c. Perimeter dike or swale. Construction of this device will be within the limits of disturbance only. Highly visible flags will be placed along the dike and will be maintained throughout the construction phase of the project.

Permanent Forest Protection Devices

The following activities should be undertaken, when construction activities will impact the critical root zone of the retained trees as shown on the Forest Conservation Plan. The construction of these may take place either before or after the grading process has started although their locations should be noted on the forest conservation plan. The devices are to remain in place for the life of the tree. The value of the impacted tree should be determined and compared with the cost of implementing the following. Specification for these devices and procedures can be found in Appendix J.

1. Install root aeration system as appropriate.
2. Install tree wells as appropriate
3. Install retaining walls as appropriate.
4. Install raised sidewalks as appropriate.
5. Use reinforced pier and panel wall as appropriate.
6. Apply tunneling practice.

Construction Phase

Improper or sloppy construction techniques can cause the death of trees immediately or as late as 10 years after construction has been completed. Tree conditions should be monitored during construction and corrective measures should be taken when appropriate.

1. The following should be monitored:

Soil compaction	aerate and monitor.
Root injury	prune and monitor; consider crown reduction.
Limb injury	prune and monitor.
Flooded conditions	drain and monitor; correct problem.
Drought conditions	water and monitor; correct problem.
Other stress signs	determine reason; correct and monitor.

2. On-site decisions shall be made in consultation with a qualified individual.
3. Permanent tree protection devices may be installed at this time as described earlier in the pre-construction activities.

Post-Construction Activities

Corrective Measures

After construction has been completed, several actions should be taken to increase the survivability of the trees that are retained on the project site. Written authorization for the removal of any trees within the retention area may be required. Each item listed below should be addressed on the plan.

1. Stress Reduction: see stress reduction under pre-construction activities
2. Repair of tree damages - consider:
Root repair
Removal of dead limbs: if they pose an immediate safety hazard
Soil aeration
3. Removal of dead or dying trees: Applicant shall not remove trees unless they pose a safety hazard (if the height of the tree is greater than or equal to the distance to the nearest building).

Removal of Temporary Structures

After construction has been completed, it is necessary to remove all temporary structures such as temporary roadways, short-term protection devices, and sediment control devices. They should not be buried within the conservation area. Open burning should not take place within 100 feet of a wooded area. Other items to consider include:

1. Remove temporary roads by removing stone or broadcasting mulch; pre-construction elevation should be maintained.
2. Aerate compacted soil.
3. Replant disturbed sites with trees, shrubs and/or herbaceous plants.
4. Retain signs for retention areas or specimen trees.

Future Protection Measures

The forest conservation areas, including the retention, reforestation and afforestation areas, shall be protected long after construction ceases. Appendix F describes methods that are suitable to insure this protection.

Figure 3.4.1

Forest Protection Procedures

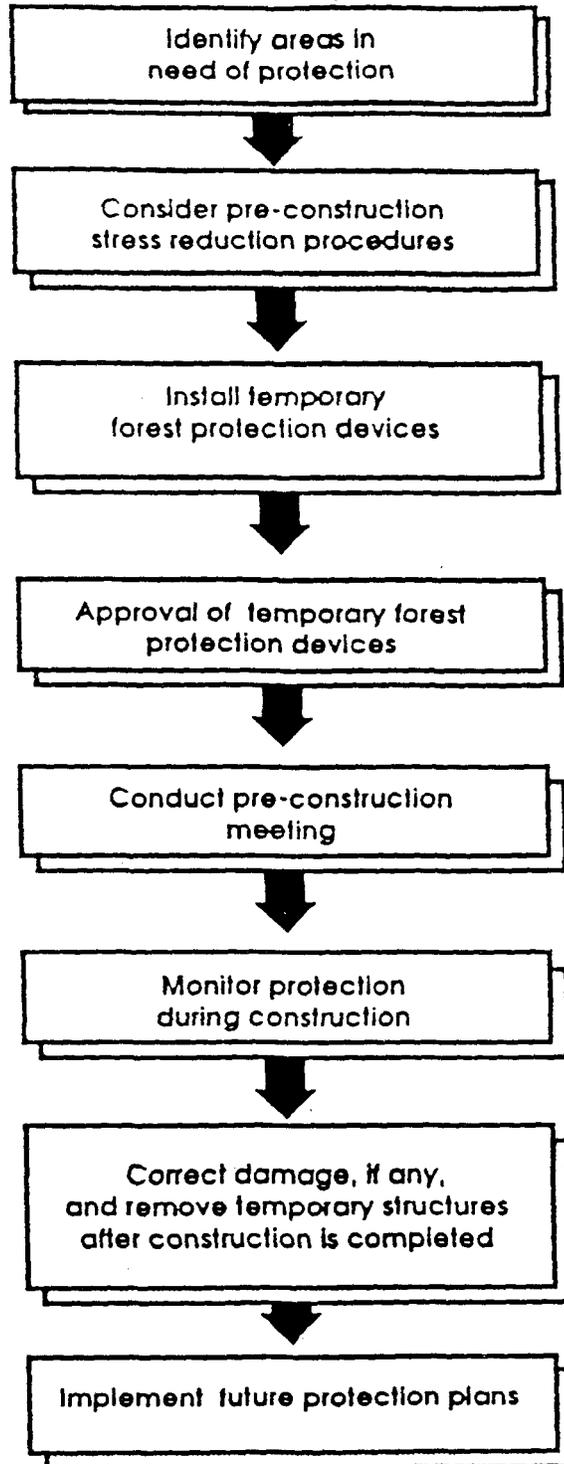
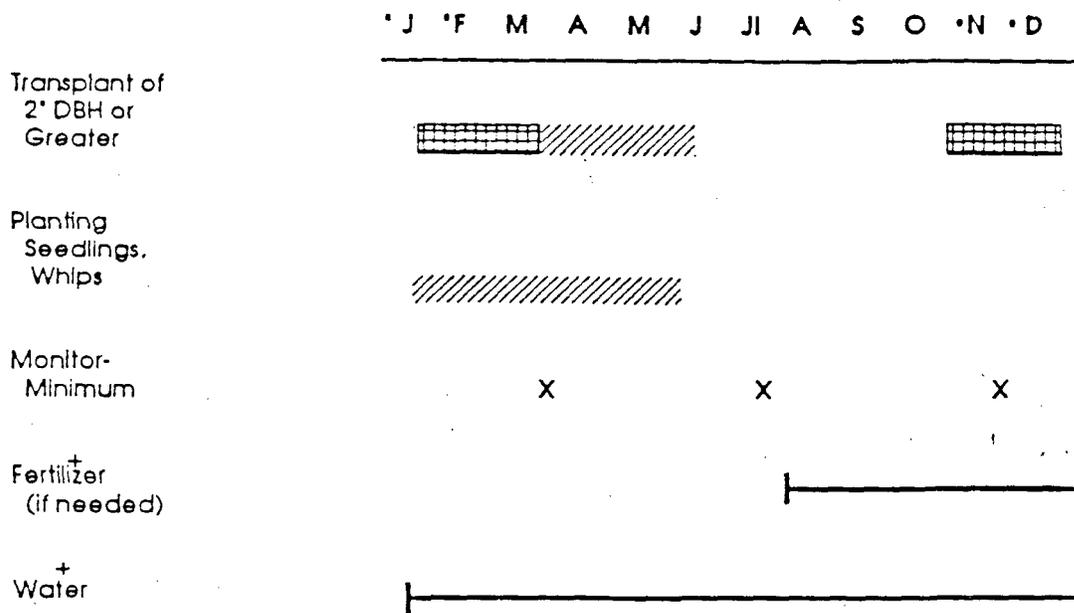


Figure 3.4.2

Tree Planting and Maintenance Calendar



Key:

- - activities during these months are dependant upon ground conditions
- //// - greatly recommended
- ▣ - recommended with additional care
- - not recommended
- + - dependant upon site conditions

Figure 3.4.3

Forest Protection Procedures Checklist

Step 1: Pre-Construction

Address stress reduction of isolated specimen trees

- Root Pruning
- Crown reduction or pruning
- Watering
- Fertilizing
- Mulching

Temporary forest protection devices

- Forest protection fences or
- Combined sediment control and tree protection fences
- Forest retention area signs

Permanent forest protection devices

- Tree wells
- Root aeration system
- Retaining walls

Include on site plan:

- Forest retention areas
- Isolated specimen trees
- Employee parking areas
- Equipment staging areas on site plans

Pre-construction Meeting

- Discuss penalties
- Inspect protection devices on site

Step 2: Construction Phase

Monitor

- Soil compaction
- Root Injury
- Trunk wounds
- Limb Injury
- Flooded conditions
- Drought conditions

Step 3: Post-construction

Stress Reduction

- Root Pruning
- Crown reduction or pruning
- Watering
- Fertilizing
- Mulching

Repair of tree damages

- Root repair
- Removal of dead limbs
- Soil aeration

- Removal of dead or dying trees posing an immediate safety hazards
- Removal of temporary tree protection structures
- On-site inspection by local or state project inspector

Future Protection Measures _____

Section 3.5

REFORESTATION AND AFFORESTATION PROCEDURES

Introduction

After an assessment of forest retention areas has been made, an option exists for the reforestation and afforestation of tracts of land. Two goals to keep in mind while developing a reforestation or afforestation plan are:

1. the need to integrate native forest associations into developed landscapes, and
2. the promotion of diverse, stable forests that are able to provide multiple benefits to the community.

This section presents a process to assist the applicant in developing reforestation and afforestation plans.

Requirements

When is Reforestation Necessary?

1. If an applicant plans to clear existing forest cover below the break-even point, and
2. If it can be shown that "every reasonable effort" has been made to minimize the cutting or clearing of forests.

When is Afforestation Necessary?

1. If there were no trees on the site or
2. If the existing forest cover on site is below the afforestation threshold

Where Shall Reforestation and Afforestation Occur?

Priority areas for reforestation and afforestation:

1. Areas adjacent to intermittent and perennial streams
2. 100 year flood plains
3. Areas that enhance or establish forested corridors
4. Areas that establish or enhance forest buffers adjacent to critical habitats
5. Areas of steep slopes of 25% or greater or slopes of 15% or more with soils having K values greater than .35 including the slopes of ravines or other natural depressions
6. Areas adjacent to areas of differing land use or adjacent to highways or utility rights of way
7. Areas adjacent to large tracts of forests

Others areas for consideration include:

1. prime agricultural soils as identified by the USDA
2. buffers to non-tidal wetlands.

Choosing the best methodology for reforestation or afforestation

The next step is to decide which reforestation or afforestation method to use in planting these areas. The options, in order of priority, are listed below.

Sequential Reforestation Methods

1. Selective clearing and supplemental planting.
2. Transplanted or nursery stock that is greater than 1.5 inches diameter breast height.
3. Transplanted or nursery stock using whip and seedling stock.
4. Landscaping.
5. Off site reforestation or afforestation using transplanted or nursery stock that is greater than 1.5 inches dbh.
6. Off-site reforestation or afforestation using whip and seedling stock.
7. Natural regeneration on-site.
8. Natural regeneration off-site.

Appendix K provides evaluation criteria for each of the methods identified above. The developer should use this information in determining the potential for success of the method desired.

Stocking and Survival Requirement:

Site Stocking

Stocking, as a minimum standard, shall meet the following density requirements.

- | | | |
|-----|----------------------------------|--|
| 100 | 2" caliper trees/acre | (20' x 20' spacing*) |
| 200 | 1" caliper trees/acre | (15' x 15' spacing*) |
| 350 | hardwood seedlings or whips/acre | with tree shelters
(11' x 11' spacing*) |
| 700 | seedlings/acre | (8' x 8' spacing*) |

*This is not to imply that trees must be planted in a grid pattern.

It is customary to plant trees of a single size for one site. In some cases, it may be appropriate to plant a mixture of size stock. The following should be considered:

1. Plant larger stock around the perimeter in order to protect interior smaller stock.
2. Mix stock size when no mechanized equipment is proposed for use on site.
3. Mix size stock when seedlings are thoroughly mulched.
4. Use smaller stock for understory trees and larger stock for overstory in a random plantings.

Larger stock may be more effective than seedlings and whips in areas of high human activity.

The survival rate for afforestation and reforestation areas shall be a minimum of 100 trees per acre or at least 75% of the total number of trees planted per acre under the approved plan, whichever is greater.

Species Selection:

Species native to Maryland shall be used, unless proven unavailable. Local genetic stock, within a 100 mile radius, is preferred because of hardiness and disease resistance. There shall be a minimum of 5 different species unless sites are to be actively managed under an approved Forest Management Plan or Landscaping Plan.

Selected species should reflect the association of species within the general watershed region. Attempts to establish areas with species historical resident but now present only in isolated pockets of the county is strongly encouraged. An attempt should be made to supply both canopy and shrub species to the reforestation or afforestation project.

Plant Material Selection

1. All plant materials greater than 1" caliper shall meet or exceed the requirements of standard nurserymen specifications. All plants shall be typical of the species and variety, shall have a normal habit of growth, and shall be first quality, sound, vigorous, well-branched, and with healthy, well furnished root systems. They shall be free of disease, insect pests and mechanical injuries.
2. Planting stock less than 1" caliper should meet the following standards.

Seedlings/whips:	
hardwoods-	1/4" to 1/2" caliper with roots no less than 8" long
conifers-	1/8" to 1/4" caliper with roots not less than 8" long and top height of 6" or more

Shrubs: 1/8" or larger caliper with 8" root system

3. Bare root stock, plants should be packaged and handled in the field in such a manner so as to retain moisture in the roots.

Penalty for Violation:

A site inspection shall take place at the end of the 2-year management agreement. If the survival rate of reforestation and afforestation areas fall below established survival requirements by the end of the two-year management agreement, the remaining amount of the cash bond or other surety may be subject to forfeiture, or other penalties as may be imposed.

Submittal Requirements:

The following items shall be submitted as part of the Forest Conservation Plan:

1. Overlay on Forest Conservation Plan Map of reforestation and afforestation areas.
2. Narrative of sequential analysis of reforestation and afforestation methods.
3. Planting Plan
4. Binding two year management agreement

Contents of Planting Plan:

The Planting Plan shall include:

1. Summary of site assessment and preparation needed.
2. Target species for reforestation.
3. Plant materials table including plant material source and
 - a. Species
 - b. Number of plants
 - c. Size of plants

Contents of Management Agreement:

The Management Agreement shall address:

1. Watering plans*
2. Fertilizing plans*
3. Control of competing vegetation*
4. Protection from disease, pests, and mechanical injury*
5. Reinforcement planting provisions if survival falls below accepted levels

6. Name of company or individual responsible for tree care
*Agreement may indicate little or no action if appropriate.

Appendices

- A Glossary of Terms
- B Forest Conservation Policy Document
- C Maryland Soils Data
- D Sample FSD Worksheets and Tables
- E Rare Species of Concern to Maryland
- F Protective Agreements for Forest Conservation Areas
- G Forest Association Species List
- H Exotic and Invasive Species
- I Forest Borders for Wildlife
- J Forest Protection Specifications
- K Sequential Reforestation Methods Evaluation Criteria
- L Soil Treatment Guidance
- M Planting Plan and Inspection Form
- N Maryland State Champion Trees 1990
- O References

Appendix A

Glossary of Terms

GLOSSARY OF TERMS

Act-

The Forest Conservation Act, Natural Resources Article, 5-1601 et seq., Annotated Code of Maryland.

Afforestation-

- A. Establishment of a forest on an area from which forest cover has been absent for a long period of time;
- B. Planting of open areas which are not presently in forest cover; or
- C. Establishment of a forest according to procedures set forth in the Cecil County Forest Conservation Technical Manual.

Agricultural activity-

farming activities including plowing, tillage, cropping, installation of best management practices, seeding, cultivating, and harvesting for production of food and fiber products (except commercial logging and timber harvesting operations), the grazing and raising of livestock, aquaculture, sod production, orchards, nursery, and other products cultivated as part of a recognized commercial enterprise.

Agricultural and resource areas-

undeveloped areas designated or regulated for densities of less than or equal to one dwelling unit per 3 acres.

Basal Area-

a measure of forest stand density through an estimate of cross-sectional areas.

Break-even point-

the point at which the Forest Conservation requirements can be met solely through forest retention and no reforestation.

Caliper-

tree diameters measured at 2 inches above the root collar.

Champion tree-

the largest tree of its species within the United States, the state, or county, or municipality as determined by the Maryland Department of Natural Resources.

Codominant trees-

trees with crowns forming the general level of the crown cover and receiving full sunlight from above but little from the sides; trees with medium sized crowns.

Commercial and industrial uses-

are those uses allowed under the commercial and industrial zoning categories of the Cecil County Zoning Ordinance, or defined as such uses by the Cecil County Zoning Administrator.

Commercial logging and timber harvesting-

the cutting and removing of tree stems from a site for commercial purposes, leaving the root mass intact.

Conservation threshold-

the point at which the reforestation requirement changes from a ratio of 1/4 acre planted for every one acre removed above the threshold to 2 acres planted for every one acre removed below the threshold, as determined by the land use category.

Critical habitat area-

a critical habitat for an endangered species and its surrounding protection area. A critical habitat area shall:

A. Be likely to contribute to the long-term survival of the species;

B. Be likely to be occupied by the species for the foreseeable future.

C. Constitute habitat of the species which is considered critical under Natural Resources Article, Sections 4-2A-04 and 10-2A-06, Annotated Code of Maryland.

Critical habitat for endangered species-

a habitat occupied by an endangered species as determined or listed under Natural Resources Article, Sections 4-2A-04 and 10-2A-04, Annotated Code of Maryland.

Critical Root Zone-

a circular region measured outward from a tree trunk representing the essential area of the roots that must be maintained or protected for the tree's every inch of tree diameter (dbh) measured at 4.5 feet from the ground, with a minimum of 8 feet. For Specimen trees, the formula changes to 1.5 feet for every inch of tree diameter, dbh.

Cultural Features-

human structures, such as roads or buildings, that are within view of the proposed land use change.

Department-

the Cecil County Office of Planning and Zoning.

Development project completion-

for the purposes of afforestation, reforestation, or payment into a fund the occurrence of one of the following:

A. The release of the development bond, if required; or

B. Acceptance of the project's streets, utilities, and public services by the Department of Public Works of Cecil County; or

C. Recordation of a subdivision project, or

D. Designation by the Department that a:

(1) Development project has been completed, or

Forest Stand-

a contiguous group of trees sufficiently uniform in species composition, arrangement of age classes, and condition to be distinguishable, homogenous unit.

Forest stand delineation-

the methodology for evaluating the existing vegetation on a site proposed for development, as provided in the Cecil County Forest Conservation Technical Manual.

Forested Slopes-

an area meeting the definition of forest and growing on an area with a slope of 25% or more and covering an area of at least 10,000 square feet.

Forest Structure-

is a measure vertical and horizontal structural diversity within a stand; is related to stand age and habitat.

Growing season-

the period of consecutive frost-free days as stated in the current soil survey for this county published by the National Cooperative Soil Survey Program, 16 U.S.C. §590 (a)--(f).

High density residential areas-

areas zoned for densities greater than 1 dwelling unit per acre, including both existing and planned development and their associated infrastructure, such as roads, utilities, and water and sewer service.

Historic Sites-

as defined by local, state or federal Historic Registers.

Hydric Soils-

are generally defined as soils that are saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper layer of soil.

Institutional development area-

schools, colleges and universities, military installations, transportation facilities, utility and sewer projects, government offices and facilities, golf courses, recreation areas and buildings, parks, post offices, cemeteries, and churches and other religious establishments.

Intermittent stream-

a stream in which surface water is absent during a part of the year as shown on the most recent 7.5 minute topographic quadrangle published by the United States Geologic Survey as confirmed by field verification.

(2) Particular stage of a staged development project, including a planned unit development, has been completed.

Extenuating Circumstances-

conditions requiring extension of a set time limit to process an application, render a decision, or conduct a public hearing.

Forest-

A. "Forest" means a biological community dominated by trees and other woody plants covering a land area of 10,000 square feet or greater.

B. "Forest" includes:

(1) Areas that have at least 100 live trees per acre with at least 50 percent of those trees having a 2-inch or greater diameter at 4.5 feet above the ground and larger; and

(2) Areas that have been cut but not cleared.

C. "Forest" does not include orchards.

Forest Conservation-

the retention of existing forest or the creation of new forest at the levels set by the Department.

Forest Conservation Fund-

a fund into which payments for reforestation and for penalties will be made when an applicant is not in compliance with the Forest Conservation Plan.

Forest Conservation Plan-

a plan attached to the site development plan containing a map drawn to scale which shows:

(1) areas required for forest conservation,

(2) an afforestation plan showing planting areas on or off site,

(3) a construction timetable, and

(4) management and protective agreements for the conservation areas.

Forest cover-

the area of a site meeting the definition of forest extending to the dripline of the edge of the forested area.

Forest management plan-

a plan establishing best conservation and management practices for a landowner in assessment of the resource values of forested property.

Forest Product-

any wood fiber product extracted from a forest which can be sold on the commercial market.

Landscaping plan-
a plan:

- A. Drawn to scale, showing dimensions and details for reforesting an area at least 35 feet wide and covering 2,500 square feet or greater in size;
- B. Using native or indigenous plants when appropriate; and
- C. Which is made part of an approved forest conservation plan.

Maintenance Agreement-

a legally binding, two year agreement to ensure the survivability of all sites afforested, reforested or landscaped.

Medium density residential areas-

areas regulated for densities greater than 1 dwelling unit per 3 acres and less than or equal to 1 dwelling unit per acre, including both existing and planned development and their associated infrastructure, such as roads, utilities, and water and sewer service.

Mixed use development-

a single, relatively high density development project, usually commercial in nature, which includes two or more types of uses, and is permitted by the Cecil County Zoning Ordinance.

Natural regeneration-

the natural establishment of trees and other vegetation with at least 400 woody, free-to-grow seedlings per acre, which are capable of reaching a height of at least 20 feet at maturity.

Net tract area-

- A. Except in agriculture and resource areas the total area of a site, including both forested and nonforested areas, to the nearest 1/10 acre, reduced by the area found to be within the boundaries of the 100-year floodplain; and
- B. In agriculture and resource areas, the part of the total tract for which land use will be changed or will no longer be used for primarily agricultural activities, reduced by the area found to be within the boundaries of the 100-year floodplain.

Nontidal Wetlands-

A. An area that is:

- (1) Inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal conditions does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation; and
- (2) Considered a nontidal wetland in accordance with the delineation methodology used and approved by the Department of Natural Resources and the United States Army Corps of Engineers; and

(3) Regulated under COMAR 08.05.04.

B. "Nontidal wetlands" does not include tidal wetlands regulated under Natural Resources Article, Title 9, Annotated Code of Maryland.

Offsite-

outside of the boundaries of the area encompassed by the tract, or lot.

Onsite-

within the boundaries of the area encompassed by the tract or lot, including an area classified as a 100-year floodplain.

100-year floodplain-

an area along or adjacent to a stream or body of water, except tidal waters, that is capable of storing or conveying floodwaters during a 100-year frequency storm event, or a 100-year flood. Except for Class III waters (natural trout streams), a body of water with a watershed less than 400 acres is excluded.

Perennial stream-

a stream containing surface water throughout an average rainfall year, as shown on the most recent 7.5 minute topographic quadrangle published by the United States Geologic Survey, as confirmed by field verification.

Permanent Tree Protection Devices-

structural measures, such as retaining walls or aeration devices, that are designed to protect the tree and its root systems throughout its lifetime.

Person-

includes the federal government, the state, any county, municipal corporation, or other political subdivision of the state, or any of their units, or an individual, receiver, trustee, guardian, executor, administrator, fiduciary, or representative of any kind, or any partnership, firm, association, public or private corporation, or any of their affiliates, or any other entity.

Planned unit development-

a form of development comprised of a combination of land uses or varying intensities of land use in accordance with an integrated plan and unified site design that is intended to provide flexibility in land use design with at least 20 percent of the land permanently dedicated to open space and is developed in accordance with the Planned Unit Development guidelines set forth in the Cecil County Subdivision Regulations and Cecil County Zoning Ordinance.

Prime agricultural soils-

fertile soils as defined by USDA, Soil Conservation Service.

Priority Retention Areas-

a hierarchy of forest stands and stand characteristics that are used to prioritize forested areas to be retained.

Reforestation-

A. "Reforestation" or "reforested" means the:

(1) Creation of a biological community dominated by trees and other woody plants containing at least 100 live trees per acre planted on areas recently cleared, cut or graded, and

(2) Established according to procedures set forth in the Cecil County Forest Conservation Technical Manual.

B. "Reforestation" or "reforested" includes landscaping of areas under an approved landscaping plan establishing a forest at least 35 feet wide and covering 2500 square feet or more of area.

Regulated activity-

any of the following activities, when that activity occurs on a tract of land which is 40,000 square feet or greater:

A. Subdivision;

B. Grading;

C. An activity that requires a sediment control permit;
or

D. Project plan of a local agency.

Retention-

the deliberate holding and protecting of existing trees, shrubs or plants on the site according to established standards as provided in the Cecil County Forest Conservation Technical Manual.

Retention Areas-

areas designated on-site for preservation; to be referred to as Forest Conservation areas.

Seedling-

an unbranched woody plant, less than 24 inches in height and having a diameter of less than 1/2 inch measured at 2 inches above the root collar.

Selective clearing-

the careful and planned removal of trees, shrubs, and plants using specific standards and protection measures under an approved forest conservation plan.

Slope Aspect-

the orientation of the site with regard to the sun.

Soil Amendments-

the modification of soil properties for improvement of soil structure; not to be confused with fertilizers whose purpose is to correct chemical imbalances in soils for silvicultural purposes.

Specimen Tree-

trees having a diameter measured at 4.5 feet above the ground of 30 inches or more, or trees having 75% or more of the diameter of the current state champion tree of that species.

Stand Structure-

the composition of the forest stand with reference to forest association (SAF cover type), dominant and co-dominant species, understory and herbaceous species.

State Program-

the State of Maryland's Forest Conservation Program administered by the Department of Natural Resources.

Steep slopes-

areas with slopes greater than 25 percent slope.

Steep Erodible slopes-

areas with slopes greater than 15 percent have soils with K values greater than 0.35.

Stream buffer-

all lands lying within 110 feet, measured from the top of each normal bank, of a perennial stream or 50 feet from an intermittent stream.

Subdivision-

any division of a unit of land into 2 or more lots or parcels for the purpose, whether immediate or future, of transfer of ownership, sale, lease, rent or development.

Temporary Tree Protection Devices-

structural measures, such as fencing or berms, installed prior to construction for the purpose of preventing access to forest retention areas or afforestation areas during construction.

Tree-

a large, branched, woody plant having one or several self-supporting stems or trunks that reach a height of at least 20 feet at maturity.

Tree line-

the boundaries of existing forests as determined by the last recent aerial photography and/or field verification.

Understory Trees-

trees with crowns entirely below the general level of the canopy receiving little or no sunlight from above or the sides.

Variance-

- A. "Variance" means partial relief from these regulations.
- B. "Variance" for the purposes of these regulations does not mean a zoning variance.

Watershed-

all land lying within an area described as a subbasin in water quality regulations adopted by the Department of the Environment under COMAR 26.08.02.08.

Whip-

an unbranched woody plant greater than 24 inches in height and having a diameter of less than 1 inch measured at 2 inches above the root collar.

Appendix B

Forest Conservation Policy Document

POLICY OVERVIEW

It is the policy of Cecil County, Maryland to conserve and protect our forest resource to the maximum possible extent by regulating site planning and construction activities in order to insure forest retention and allow for the clearing of minimum amounts of forest cover essential for development.

In order to insure this policy is carried out, regulations have been produced which serve as development guidelines and minimum standards. Cecil County regulations are modeled after the State's Forest Conservation Act and as such, meet the intent desired by its drafters, that is, to efficiently protect the forested resources of our County.

The regulations will thus be used to guide our development in a carefully managed way as it impacts our forest resource. Identification of sensitive areas on any site prior to plan approval, will to eliminate unnecessary confusion at the beginning of a project. Through the establishment of long term protective agreements, the County hopes to alleviate further pressures placed on this invaluable resource. It must be understood that the primary goals of these regulations is to retain the highest quality and highest functional forest habitat in Cecil County. It is also a goal to reclaim areas denegated by activities which are no longer practiced. The County will encourage the restoration of areas important for water quality, air quality, aesthetics, and habitat values.

In order to see these goals fulfilled, the Cecil County Planning Commission and Cecil County Office of Planning and Zoning will periodically evaluate current practices, techniques and regulations effecting our forest resources. These evaluations may produce specific policy guidelines, guidance papers, which will be included into this document, or changes to regulatory programs to insure the continued protection and welfare of our resources. Third party interests may also suggest to the Cecil County Planning Commission recommended policies, guidelines or amendments to regulatory programs.

Appendix C

Maryland Soils Data

APPENDIX C MARYLAND SOILS DATA

K factors have been designated as $>.35$ if any one of the horizons within the soil series exceeds $.35$.

This list should aid the applicant in identification of hydric soils. It should accompany field verification which should be in accordance with The Army Corps of Engineer's guidelines. The soils consist of very poorly drained and poorly drained soils having a water table within at least 1.5 feet of the surface for a period of time during the growing season. Morphological factors which are observable in the field include composition of black muck or black to dark brown peat, and gray colors often with brighter colors mottled. Colors can be identified by comparison with a Munsell color chart. Applicants should sample the soil between a depth of ten inches and 1.5 feet.

(Tiner, 1988, MD DNR, USDI Fish and Wildlife Service)

MARYLAND SOILS DATA

<u>Soil Series</u>	<u>K. Value</u> ¹	<u>Hydric Soils</u> ²	<u>Soil Series</u>	<u>K. Value</u> ¹	<u>Hydric Soils</u> ²
Abottstown	+		Barclay	-	
Adelphia	+		Bayboro	+	+
Albrights	+		Bayboro ponded		+
Aldino	+		Beach land	-	
Allegheny	-		Belmont	+	
Alloway	+		Belstville	+	
Alluvial land	-		Benevola	+	
Altavista	+		Berks	-	
Andover	+	+	Bermudian	+	
Andover, Stony	+		Berryland	-	+
Armaugh	+	-	Bertie	+	
Armaugh, Stony		+	Bibb	+	+
Ashby	-		Birdsboro	+	
Ashton	-		Bladen	+	+
Athol	+		Bladen, ponded		+
Atkins	+	+	Borrow pits	-	
Atsion		+	Bourne	-	
Atsion, tide flooded		+	Bowmansville	+	+
Augusta	+		Braddock	-	
Aura	+		Brandywine	-	
Axix		+	Brinkerton	+	+
Baile	+	+	Brinkerton, Stony		+
Baltimore	-		Brooke	+	
Barbour		+	Buchanan	+	

1 Erodability Factor

+ >.35

- ≤.35

2 - Hydric Soils

MARYLAND SOILS DATA

<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>	<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>
Bucks	+		Colluvial land	-	
Butlertown	+		Colts Neck	-	
Calvert	+		Comus	-	
Calvin	-		Conestoga	+	
Captina	+		Congaree	+	
Cardiff	-		Conowingo	+	
Caroline	+		Cookport	+	
Catoctin	-		Corydon	+	
Cavode	+		Croom	-	
Chalfont	+		Croton	+	+
Chandler	-		Croton, Stony		+
Chavies	-		Cut and Fill land	-	
Chester	-		Dekalb	+	
Chewacla	+		Delanco	+	
Chillum	+		Donlonton	+	
Christiana	+		Downer	-	
Chrome	-		Dragston	+	
Clay pits	+		Duffield	+	
Clayey land	+		Duneland	-	
Clymer	-		Dunmore	+	
Coastal beach	-		Dunning	+	+
Codorus	+		Edgemont	-	
Colbert	+		Edom	-	
Colemantown	+	+	Elioak	-	
Collington	-		Elk	+	

MARYLAND SOILS DATA

<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>	<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>
Elkins	+	-	Wabers	+	+
Elkton	+		Hazel	-	
Elliber	-		Highfield	-	
Elsinboro	-		Hollinger	-	
Eroded land	+		Holston	-	
Ernest	+		Howell	+	
Etowah	-		Huntington	+	
Evesboro	-		Hyde	+	+
Exum	+		Ipswich		+
Fairfax	+		Iredell		+
Fallsington	-	+	Iuka	+	
Fauquier	+		Jimtown	-	
Fort Mott	-		Johnsburg	+	
Frankstown	+		Johnston	-	+
Frederick	-		Joppa	-	
Galestown	-		Kalmia	-	
Gilpin	-		Keansburg	-	
Glenelg	+		Kedron	+	
Glenville	+		Kelly	+	
Gravel pits and quarriers	-		Kenansville	-	
Greenwich	+		Keyport	+	
Gullied land	+		Kingsland		+
Guthrie	+	+	Kinkora	+	+
Guthrie, ponded		+	Klej	-	
Hagerstown	-		Klinesville	-	

MARYLAND SOILS DATA

<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>	<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>
Laidig	-		Magnolia	-	
Lakeland	-		Manor	+	
Lamington	+		Markes		+
Landisburg	+		Marr	+	
Lansdale	+		Matapeake	+	
Lantz	+	+	Matawan	-	
Largent	+		Mattapex	+	
Leadvale	-		Meadow	-	
Leetonia	-		Meckesville	-	
Legore	-		Melvin	+	+
Lehew	-		Melvin, cool		+
Lehigh	+		Melvin, ponded		+
Lenoir	+	+	Mench	-	
Leon	-	+	Mixed alluvial land	-	
Leon, flooded		+	Monmouth	+	
Leonardtwn	+	+	Monongahela	+	
Lewisburg	-		Montalto	-	
Lickdale	+	+	Montevallo	+	
Lickdale, stony		+	Morgnec	-	
Lindside	+		Mt. Airy	-	
Linganore	-		Muck	-	
Litz	-		Muirkirk	+	
Loamy and clayey land	+		Murrill	-	
Loysville	+	+	Myersville	-	
Made land	-		Neshaminy	-	

MARYLAND SOILS DATA

<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>	<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>
Nolo	+	-	Relay	-	-
Nolo, stony	-	-	Ridgely	-	-
Norfolk	-	-	Roanoke	-	+
Norton	-	-	Roanoke	-	+
Ochlockonee	-	-	Roanoke, ponded	-	+
Opequon	+	-	Robertsville	-	+
Osier	-	+	Rocky land	-	-
Osier, flooded	-	+	Rohrersville	+	-
Osier, ponded	-	+	Rowland	+	-
Othello	+	+	Rumford	-	-
Pamlico	-	-	Rutledge	-	+
Peat	-	-	Rutledge, ponded	-	+
Penn	-	-	Sandy, land, steep	-	+
Philo	+	-	Sandy and clayey land	+	-
Plummer	-	+	Sassafras	+	-
Plummer, ponded	-	+	Sequatchie	-	-
Pocomoke	-	-	Shelocta	-	-
Pocomoke, drained	-	+	Shrewsburg	+	+
Pocomoke, ponded	-	+	Silty and clayey land	+	-
Pope	-	-	St. John's	-	+
Portsmouth	-	+	St. John's depressional	-	+
Purdy	+	+	Steinsburg	-	-
Raritan	+	-	Stony land	-	-
Rayne	-	-			
Readington	+	-			

MARYLAND SOILS DATA

<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>	<u>Soil Series</u>	<u>K Value</u>	<u>Hydric Soils</u>
Strip mines and dumps	+		Wharton	+	
Sunnyside	-		Whiteford	-	
Swamp	-		Wickham	-	
Talleydega	+		Wiltshire	+	
Talleyville	-		Woodstown	-	
Teas	-		Worsham	+	+
Thurmont	-				
Tidalmarsh	-				
Trego	+				
Tuxedo	+				
Tyler	+				
Ungers	-				
Urbana	+				
Warners	+	+			
Warners, non-flooded		+			
Watchung	+	+			
Watchung, stony		+			
Waynesboro	-				
Wayside	+				
Wehadkee	-	+			
Westbrook		+			
Weikert	-				
Westmoreland	+				
Westphalia	+				

Appendix D

Sample Forest Stand Delineation Worksheets and Tables

Figure D-1

Forest Conservation Worksheet

Input Data

- A. TOTAL SITE AREA: _____
- B. AREA WITHIN 100 YEAR FLOODPLAIN: _____
- C. AREA OF AGRICULTURAL LAND (no change in status): _____
- D. NET TRACT AREA (A-B-C): _____

- E. LAND USE CATEGORY: _____
- F. AFFORESTATION THRESHOLD: _____
- G. CONSERVATION THRESHOLD: _____

- H. CURRENT FOREST COVER: _____
- I. FOREST AREA ABOVE AFFORESTATION THRESHOLD: _____
- J. FOREST AREA ABOVE CONSERVATION THRESHOLD: _____

- K. ABOVE CONSERVATION THRESHOLD TO BE CLEARED: _____
- L. BELOW CONSERVATION THRESHOLD TO BE CLEARED: _____
- M. TOTAL FORESTED AREA TO BE CLEARED: _____
- N. FORESTED AREA ABOVE CONSERVATION THRESHOLD TO BE SAVED:

Calculations

Break-Even Point:

- O. ACRES ABOVE CONSERVATION THRESHOLD TO BE RETAINED FOR NO REQUIRED REFORESTATION: $J * 20\% =$ _____ ACRES

Afforestation Requirement:

- P. FORESTED ACRES REQUIRED: $D * F =$ _____
- Q. ACRES TO BE AFFORESTED: $P - H =$ _____

Reforestation Requirement:

- R. ACRES CLEARED ABOVE THRESHOLD: $K * 1/4 =$ _____
- S. ACRES CLEARED BELOW THRESHOLD: $L * 2 =$ _____
- T. REFORESTATION CREDIT: $N \blacksquare =$ _____
- U. TOTAL REFORESTATION REQUIREMENT: $R + S - T =$ _____ ACRES

Table D-1: Field Sampling Data Sheet

Property Name:
Stand #

Plot #

Prepared by:
Date:

	Size Class of Trees Within the Sample Plot				
Tree Species (note dominant and co-dominant species)	Number of Trees 2- 5 5.9" dbh	Number of Trees 6-10' dbh	Number of Trees 11-17' dbh	Number of Trees 18-29' dbh	Number of Trees >30' dbh
Number of Trees per size class					
List of understory species					
Basal Area					
Number of Dead Trees per plot					
Comments					

Table D - 2

Explanation of Terms

Forest Stand Information

Stand # - divide the vegetative cover into different stands depending on species groups, size groups, cover types, etc.

Acres - measure the acreage in each separate stand and open areas. Round off to the nearest 1/20 acre.

Species - list the four or five most common, dominant and co-dominant species tallied.

Size Class - use the following size classes: 2" to 6" dbh, 7" to 10" dbh, 11" to 17" dbh, 18" to 29" dbh, and greater than 30" dbh.

Basal Area - this is a density measurement and should be expressed on a per acre basis for each stand.

Number of Trees - count all trees 2" dbh or greater occurring on the plot.

Number of Tree Species - count the total number of trees species occurring on the plot.

Number of Dead Trees - count the total number of dead trees occurring on the plot.

Understory Species - record the 3 to 5 most commonly occurring understory species on the plot.

Forest Cover Type - use the Society of American Foresters classification, the Maryland forest Association Species List and the species tallied on site to determine this.

Forest Structure Data Sheet

Number of Understory Shrubs - count the total number of shrubs occurring on the plot.

Percent Canopy Closure - estimate the canopy closure using the method described.

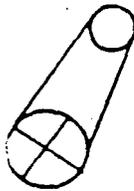
Percent Understory Herbaceous Ground Cover - estimate the herbaceous ground cover using the method described.

Percent Down Woody Debris (greater than 2" in diameter) - estimate the amount of dead and down woody debris on the ground using the method described.

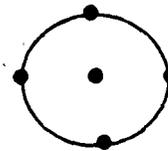
To measure canopy coverage, herbaceous coverage, dead and downed woody material present and exotic species, it will be necessary to sample in the following way:

- 1) Construct a sampling tube from a paper towel or toilet paper roll. Attach wires or string on one end of the tube in the configuration of a cross with four evenly spaced openings (see a below).
- 2) Select 1 random sampling point within each forest stand. To do this, construct an circular sampling plot of 1/10 acre. Take samples from 4 points around the circle and one within the circle (see b below).
- 3) Walk to each sample point and look through the sampling tube at each sample point.
 - a) For canopy coverage, record "yes" or "no" for green seen through the tube when pointed up (tube must be held vertically; count only trees 7" DBH and larger.).
 - b) For herbaceous coverage, record "yes" or "no" for green seen through the tube when pointed down (tube must be held vertically).
 - c) For dead and down woody material, record "yes" or "no" for any root wads, logs, downed limbs, or bark seen through the tube (tube must be held vertically).
 - d) For exotic or invasive species, record "yes" or "no" for any of these species (See Appendix H) seen through the tube (tube must be held vertically).
- 4) Calculate the percentage of sample points at each sample site which were answered by "yes". Use the above information and additional information provided in the forest stand summary sheet to calculate the forest structure value to be assigned to the site for each individual parameter.
- 5) Count number of shrubs found within a 1/100 acre plot. Shrubs can be most easily counted if the central stem can be identified.

a.



b.



(for more information see: James, F.C. and Shugart, H.H. 1970. A Quantitative Method of Habitat Description. Audubon Field Notes. 24: 727-36.)

Table D-3: Forest Structure Data Sheet

Property :

Prepared by:

Stand #:

Plot #:

Date:

Forest Structure Variable	sample point 1	sample point 2	sample point 3	sample point 4	sample point 5	% yes
Canopy coverage						
herbaceous ground cover						
downed woody debris						
invasive plant cover						
number of shrub species (1/100 acre)						

Forest Structure Sampling Method:

1/10 acre plot,
5 sample points

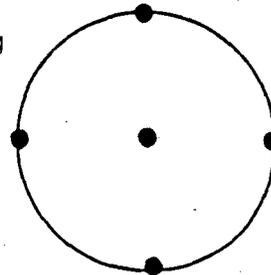


Figure D-3

Forest Structure Analysis

The following parameters will be measured and evaluated at each site according to Figure D-2. Each parameter at each sample site will be given a value of 3, 2, 1, or 0. Three represents the most valuable structure and 0, the least valuable. Upon completion of the sampling, the person preparing the FSD will calculate the forest structure value for each stand. This analysis along with the other forest stand data will be used to determine the retention potential of the stand.

To determine the total habitat value use the following scale:

Range of total habitat numbers from samples taken April - October:

15-21	Priority forest structure
7-14	Good forest structure
0-6	Poor forest structure

In the winter and late fall, from November - March, only numbers 1, 3, 4, 5, 7, can be measured. During that time, the range of total habitat numbers will be:

11-15	Priority forest structure
6-10	Good structure
0-5	Poor forest structure

<p>1. Percent Canopy Closure of trees with a DBH greater than 7"</p> <table border="0"> <tr> <td>70% - 100 %</td> <td>3</td> </tr> <tr> <td>40% - 69%</td> <td>2</td> </tr> <tr> <td>10% - 39%</td> <td>1</td> </tr> <tr> <td>0% - 9%</td> <td>0</td> </tr> </table>	70% - 100 %	3	40% - 69%	2	10% - 39%	1	0% - 9%	0	<p>5. Size Class of Dominant Trees¹</p> <table border="0"> <tr> <td>Greater than 20"</td> <td>3</td> </tr> <tr> <td>7" - 19.9"</td> <td>2</td> </tr> <tr> <td>3" - 6.9"</td> <td>1</td> </tr> <tr> <td>Less than 3"</td> <td>0</td> </tr> </table>	Greater than 20"	3	7" - 19.9"	2	3" - 6.9"	1	Less than 3"	0
70% - 100 %	3																
40% - 69%	2																
10% - 39%	1																
0% - 9%	0																
Greater than 20"	3																
7" - 19.9"	2																
3" - 6.9"	1																
Less than 3"	0																
<p>2. Number of Understory Shrubs 1/100 acre</p> <table border="0"> <tr> <td>6 or more</td> <td>3</td> </tr> <tr> <td>4 - 5</td> <td>2</td> </tr> <tr> <td>2 - 4</td> <td>1</td> </tr> <tr> <td>0 - 1</td> <td>0</td> </tr> </table>	6 or more	3	4 - 5	2	2 - 4	1	0 - 1	0	<p>6. Percent of Understory Herbaceous Coverage</p> <table border="0"> <tr> <td>75% - 100%</td> <td>3</td> </tr> <tr> <td>25% - 74%</td> <td>2</td> </tr> <tr> <td>5% - 24%</td> <td>1</td> </tr> <tr> <td>0% - 4%</td> <td>0</td> </tr> </table>	75% - 100%	3	25% - 74%	2	5% - 24%	1	0% - 4%	0
6 or more	3																
4 - 5	2																
2 - 4	1																
0 - 1	0																
75% - 100%	3																
25% - 74%	2																
5% - 24%	1																
0% - 4%	0																
<p>3. Number of Dead Trees/tenth acre plot¹</p> <table border="0"> <tr> <td>3 or more</td> <td>3</td> </tr> <tr> <td>2</td> <td>2</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> </table>	3 or more	3	2	2	1	1	0	0	<p>7. Number of Tree Species with a DBH greater than 7"/plot¹</p> <table border="0"> <tr> <td>6 or more</td> <td>3</td> </tr> <tr> <td>4 - 5</td> <td>2</td> </tr> <tr> <td>2 - 4</td> <td>1</td> </tr> <tr> <td>0 - 1</td> <td>0</td> </tr> </table>	6 or more	3	4 - 5	2	2 - 4	1	0 - 1	0
3 or more	3																
2	2																
1	1																
0	0																
6 or more	3																
4 - 5	2																
2 - 4	1																
0 - 1	0																
<p>4. Percent of Dead and Downed Woody Material Present</p> <table border="0"> <tr> <td>15% - 100%</td> <td>3</td> </tr> <tr> <td>5" - 14"</td> <td>2</td> </tr> <tr> <td>0 - 1</td> <td>1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> </table>	15% - 100%	3	5" - 14"	2	0 - 1	1	0	0									
15% - 100%	3																
5" - 14"	2																
0 - 1	1																
0	0																

¹ Data included in Forest Stand Summary Sheet (See Table D-4).

Table D-4 : Forest Stand Summary Sheet

Property Name:

Prepared by:

Date:

Stand Variable	Stand # Acreage	Stand # Acreage
Forest Association (SAF cover type)		
Size class of dominant trees		
Number of Trees/acre		
Number of tree species/plot		
Basal area		
Number of dead trees/acre		
List of common understory species		
Number of shrubs 1/100 acre plot		
% Canopy coverage		
% Herbaceous cover		
% Downed woody material		
% Exotic or invasive species		
Forest Structure Value		
Comments		

Appendix E

Rare Species of Concern to the Maryland
Natural Heritage Program

RARE SPECIES OF CONCERN TO THE MARYLAND NATURAL HERITAGE PROGRAM

ANIMALS

Planarians

Phagocata virilis A planarian
Planaria dactyligera A planarian
Sphalloplana sp 1 A planarian

Molluscs

Alasmidonta undulata Triangle floater
Alasmidonta varicosa Brook floater
Anguispira clarki Clark's beehive snail
Lampsilis cariosa Yellow lampmussel

Crustaceans

Ankylocythere tridentata An entocytherid ostracod
Attheyella spinipes A harpacticoid copepod
Caecidotea sp 1 An isopod
Caecidotea sp 2 An isopod
Caecidotea sp 3 An isopod
Dactylocythere scotos An entocytherid ostracod
Diacyclops palustris A cyclopoid copepod
Eulimnadia francesae A conchostracan phyllopod
Eulimnadia ventricosa A conchostracan phyllopod
Stygobromus pizzinii Pizzini's cave amphipod
Stygobromus sp 5 Crabtree cave amphipod
Stygobromus sp 6 An undescribed amphipod

Spiders

Atypus bicolor American purse-web spider
Oreonetides sp 1 Snivelys cave spider
Porrhomma cavernicolum Appalachian cave spider

Insects

Amblyscirtes hegon Pepper-and-salt skipper
Apamea apamiformis A noctuid moth
Apamea plutonia A noctuid moth
Arrhopalites sp 1 Crabtree cave springtail
Capis curvata A noctuid moth
Catocala marmorata Marbled underwing
Catocala pretiosa Precious underwing
Chlorotettix sp 1 A cicadellid leafhopper
Cicindela lepida Little white tiger beetle
Cicindela patruela A tiger beetle
Colias interior Pink-edged sulphur
Cyclophora nanaria A geometrid moth
Cyllopsis gemma Gemmed satyr
Dasychira atrivenosa A lymantriid moth
Ectoedemia castaneae American chestnut nepticulid moth
Ectoedemia phleophaga Phleophagan chestnut nepticulid moth
Elaphria georgei A noctuid moth
Erynnis persius Persius duskywing
Euchloe olympia Olympia marble
Euphyes pilatka Saw-grass skipper
Hadena ectypa A noctuid moth

Hemileuca maia ssp 4	Woodland buckmoth
Hesperia attalus	Dotted skipper
Hesperia sassacus	Indian skipper
Hoperius planatus	A hydrophylid beetle
Hydrochara occulta	A hydrophylid beetle
Hydrochus sp 1	Seth forest water scavenger beetle
Isoparce cupressi	Cypress sphinx moth
Laccophilus schwarzi	Schwarz' diving beetle
Limotettix sp 1	Eastern sedge barrens planthopper
Lucanus elephas	Giant stag beetle
Meropleon titan	A noctuid moth
Mitoura hesseli	Hessel's hairstreak
Nicrophorus americanus	American burying beetle
Papaipema duovata	A noctuid moth
Papaipema marginidens	A noctuid moth
Papaipema polymniae	Polymnia stalk borer
Papilio cresphontes	Giant swallowtail
Papilio palamedes	Palamedes swallowtail
Potamanthus walkeri	Walker's tusked sprawler
Satyrium acadica	Acadian hairstreak
Satyrium kingi	King's hairstreak
Schinia parmeliana	A noctuid moth
Scymnus gordonii	A coccinellid beetle
Sperchopsis tessellatus	A hydrophylid beetle
Speyeria diana	Diana
Sphinx franckii	Franck's sphinx
Stylurus notatus	Elusive clubtail dragonfly
Synanthedon castaneae	Chestnut clearwing moth
Tachopteryx thoreyi	Thorey's grayback damselfly
Xestia bollii	A noctuid moth

Fishes

Acantharchus pomotis	Mud sunfish
Acipenser oxyrhynchus	Atlantic sturgeon
Centrarchus macropterus	Flier
Clinostomus elongatus	Redside dace
Enneacanthus chaetodon	Blackbanded sunfish
Fundulus luciae	Spotfin killifish
Noturus flavus	Stonecat
Percina caprodes	Logperch

Amphibians

Plethodon wehrlei	Wehrle's salamander
Pseudacris brachyphona	Mountain chorus frog
Rana virgatipes	Carpenter frog

Reptiles

Apalona spinifera	Eastern spiny softshell
Graptemys geographica	Map turtle
Pituophis melanoleucus	Northern pine snake

Birds (breeding only)

Accipiter striatus	Sharp-shinned hawk
Aegolius acadicus	Northern saw-whet owl
Ammodramus henslowii	Henslow's sparrow

Asio flammeus
Asio otus
Botaurus lentiginosus
Catharus ustulatus
Circus cyaneus
Cistothorus platensis
Dendroica coronata
Egretta caerulea
Empidonax alnorum
Gallinula chloropus
Ixobrychus exilis
Junco hyemalis
Laterallus jamaicensis
Limnothlypis swainsonii
Lophodytes cucullatus
Podilymbus podiceps
Porzana carolina
Regulus satrapa
Sitta canadensis
Sphyrapicus varius
Sterna antillarum
Sterna sandvicensis
Troglodytes troglodytes
Vermivora ruficapilla

Mammals

Condylura cristata parva
Erethizon dorsatum
Mustela nivalis
Myotis leibii
Neotoma floridana magister
Sorex dispar
Sorex hoyi winnemana
Sorex longirostris
Spilogale putorius
Sylvilagus transitionalis
Ursus americanus

PLANTS

Abies balsamea
Agalinis decemloba
Agalinis linifolia
Agalinis skinneriana
Alnus maritima
Alopecurus aequalis
Alopecurus carolinianus
Ammannia coccinea
Ammannia latifolia
Ampelopsis arborea
Ampelopsis cordata
Amsonia tabernaemontana
Anemone riparia
Arabis glabra
Arabis hirsuta
Aristida curtissii

Short-eared owl
Long-eared owl
American bittern
Swainson's thrush
Northern harrier
Sedge wren
Yellow-rumped warbler
Little blue heron
Alder flycatcher
Common moorhen
Least bittern
Dark-eyed junco
Black rail
Swainson's warbler
Hooded merganser
Pied-billed grebe
Sora
Golden-crowned kinglet
Red-breasted nuthatch
Yellow-bellied sapsucker
Least tern
Sandwich tern
Winter wren
Nashville warbler

Southeastern star-nosed mole
Porcupine
Least weasel
Eastern small-footed bat
Eastern woodrat
Long-tailed shrew
Southern pygmy shrew
Southeastern shrew
Eastern spotted skunk
New england cottontail
Black bear

Balsam fir

Seaside alder
Short-awned foxtail
Carolina foxtail

Koehne's ammannia
Pepper-vine

Blue dogbane
Large white anemone
Tower mustard
Hairy rockcress
Curtiss' three-awn

Aristida tuberculosa	Sea-beach three-awn
Aster nemoralis	Bog aster
Aster praealtus	Willow aster
Aster sagittifolius	Arrow-leaved aster
Azolla caroliniana	Mosquito fern
Bacopa monnieri	
Betula populifolia	Gray birch
Blephilia hirsuta	Hairy woodmint
Bouteloua curtipendula	Side-oats grama
Calystegia spithamea	Low bindweed
Campanula rotundifolia	Harebell
Cardamine pratensis	Cuckooflower
Carex arenaria	Sand sedge
Carex brevior	
Carex cephaloidea	Thin-leaved sedge
Carex echinata	Little prickly sedge
Carex emoryi	Emory's sedge
Carex meadii	Mead's sedge
Carex projecta	Necklace sedge
Carex retrorsa	
Carex richardsonii	Richardson's sedge
Carex rostrata	Beaked sedge
Carex rugosperma	
Carex tonsa	Shaved sedge
Carex trichocarpa	Hairy-fruited sedge
Carex typhina	Cat-tail sedge
Celtis laevigata	Sugarberry
Centrosema virginianum	Spurred butterfly-pea
Chaerophyllum tainturieri	
Chamaesyce vermiculata	Hairy spurge
Chenopodium leptophyllum	Narrow-leaved goosefoot
Cimicifuga americana	American bugbane
Clintonia alleghaniensis	Harned's swamp clintonia
Corydalis aurea	Golden corydalis
Croton capitatus	Hogwort
Croton monanthogynus	Prairie-tea
Cuscuta indecora	
Cyperus houghtonii	
Cyperus refractus	Reflexed cyperus
Cyperus retrofractus	Rough cyperus
Cystopteris tennesseensis	Tennessee bladder-fern
Desmodium viridiflorum	
Dioscorea hirticaulis	Wild yam
Eleocharis flavescens	Pale spikerush
Eleocharis geniculata	Capitate spikerush
Eleocharis tortilis	Twisted spikerush
Epilobium leptophyllum	Linear-leaved willowherb
Eragrostis hirsuta	
Erianthus alopecuroides	Woolly beardgrass
Erigeron pulchellus	Lucy Braun's robin plantain
var brauntiae	
Eriocaulon compressum	Flattened pipewort
Eriocaulon decangulare	Ten-angled pipewort
Euphorbia zinniflora	Flowering spurge
Fimbristylis puberula	Hairy fimbristylis

Galax aphylla	Galax
Galium palustre	Marsh bedstraw
Gymnocladus dioicus	Kentucky coffee-tree
Helianthus hirsutus	Hirsute sunflower
Houstonia tenuifolia	Slender-leaved bluets
Juncus articulatus	Jointed rush
Juncus brevicaudatus	Narrow-panicled rush
Juncus polycephalus	
Liatris spicata	Spiked blazing-star
Limonium nashii	Nash's sea lavender
Ludwigia brevipes	Creeping ludwigia
Ludwigia decurrens	
Lycopodium inundatum	Bog clubmoss
Lycopodium sabinifolium	Ground-fir
Manfreda virginica	False aloe
Matteuccia struthiopteris	Ostrich fern
Muhlenbergia glabriflora	
Muhlenbergia glomerata	
Myriophyllum heterophyllum	Broadleaf water-milfoil
Nemophila aphylla	
Nymphaea tuberosa	Tuberous white water lily
Oldenlandia uniflora	Clustered bluets
Panicum aciculare	Bristling panicgrass
Panicum aculeatum	Tall rough panicgrass
Panicum angustifolium	Narrow-leaved panicgrass
Panicum commonsianum	Commons' panicgrass
Panicum laxiflorum	
Panicum leucothrix	Roughish panicgrass
Panicum tuckermanii	Tuckerman's panicgrass
Panicum yadkinense	
Passiflora incarnata	Purple passionflower
Pilea fontana	Coolwort
Poa alsodes	Grove meadow-grass
Poa languida	Weak speargrass
Poa palustris	Fowl bluegrass
Polygonum amphibium	Water smartweed
Polygonum careyi	Carey's knotweed
Polygonum glaucum	Seaside knotweed
Polygonum opelousanum	Opelousas smartweed
Polygonum setaceum	Bristly smartweed
Populus balsamifera	Balsam poplar
Potamogeton illinoensis	Illinois pondweed
Potamogeton natans	Floating pondweed
Potamogeton perfoliatus	Clasping-leaved pondweed
Potamogeton pusillus	Slender pondweed
Potamogeton spirillus	Spiral pondweed
Potentilla arguta	Tall cinquefoil
Prunus pumila	Eastern dwarf cherry
Psoralea psoralioides	
Pycnanthemum virginianum	Virginia mountain-mint
Quercus laurifolia	Laurel-leaved oak
Quercus macrocarpa	Mossy-cup oak
Quercus shumardii	Shumard's red oak
Ranunculus laxicaulis	
Rhododendron calendulaceum	Flame azalea

Rhododendron canescens	
Ribes glandulosum	Skunk currant
Ribes hirtellum	Low wild gooseberry
Rosa setigera	Prairie rose
Rumex hastatulus	Engelmann's dock
Sagittaria longirostra	Long-beaked arrowhead
Salix discolor	Pussy willow
Salix tristis	Dwarf prairie willow
Scirpus cylindricus	Salt-marsh bulrush
Scirpus fluviatilis	River bulrush
Scirpus verecundus	
Scleria reticularis	Reticulated nutrush
Scleria triglomerata	Tall nutrush
Scutellaria galericulata	Common skullcap
Sesuvium maritimum	Sea-purslane
Sibara virginica	Virginia cress
Smilax ecirrhata	Upright smilax
Solidago stricta	Wandlike goldenrod
Spiranthes laciniata	Lace-lip ladys' tresses
Spiranthes praecox	Grass-leaved ladys' tresses
Sporobolus asper	Long-leaved rushgrass
Stachys clingmanii	Clingman's hedge-nettle
Stachys cordata	Nuttall's hedge-nettle
Stachys hyssopifolia	Hyssop-leaved hedge-nettle
Stachys latidens	
Streptopus amplexifolius	White mandarin
Stylophorum diphyllum	
Symplocos tinctoria	Sweetleaf
Thalictrum dasycarpum	Purple meadowrue
Thalictrum macrostylum	
Thalictrum subtrotundum	
Thelypteris phegopteris	Northern beech fern
Tillandsia usneoides	Spanish moss
Tofieldia glutinosa	False asphodel
Triadenum tubulosum	
Trichostema setaceum	Narrow-leaved bluecurls
Triglochin maritimum	Seaside arrow-grass
Utricularia cornuta	Horned bladderwort
Uvularia grandiflora	Large-flowered bellwort
Verbesina virginica	
Vernonia gigantea	Giant ironweed
Viburnum lentago	Nannyberry
Viola appalachiensis	Appalachian blue violet
Viola incognita	Large-leaved white violet
Viola septentrionalis	Northern blue violet
Vitis cinerea	Graybark
Vitis rupestris	Sand grape
Wolffia papulifera	
Wolffia punctata	Water-meal
Xyris difformis	Variable yelloweyed-grass
Zephyranthes atamasca	Atamasco lily

7/23/91

Appendix F

Protective Agreements for
Forest Conservation Areas

Protective Agreements for Forest Conservation Areas

Deed restrictions are a means of protecting or restricting the use of certain land areas. The restrictions are binding and are recorded with the land records for that property. For the purposes of this Act, any areas set aside for preservation shall be protected by deed restrictions. These areas include but are not limited to:

1. Trees, shrubs and plants located in sensitive areas including 100-year floodplains, intermittent and perennial streams and their buffers, steep slopes and critical habitats.
2. Contiguous forest that connects the largest undeveloped or most vegetated tracts of land within and adjacent to the site.
3. Trees, shrubs or plants identified on the list of rare, threatened and endangered species.
4. Trees that are part of a historic site or associated with a historic structure, or trees designated by the Department or local authority as a national, state or local champion trees.
5. Trees having a diameter measured at 4.5 feet above ground of:
 - a. 30 inches or more; or
 - b. 75% or more of the diameter, measured at 4.5 feet above ground, of the current state champion tree of that species.
6. Existing or established forested buffers adjacent to intermittent and perennial streams.
7. Existing or established forested buffers adjacent to critical habitat.
8. All land retained on site as forest whether it was forested, afforested, or reforested.

The restrictions shall limit the uses of forest to those activities that are consistent with forest conservation, such as recreational activities, forest management, and wildlife management. Covenants and conservation easements are the primary method used to accomplish this. Covenants are deed restrictions that tell what may and may not occur on the property. Covenants may include statements that allow for the removal of dead or dying trees, limit

clearing of the forest understory, provide for removal of noxious plants or weeds, allow for the development of passive recreational uses such as hiking or nature study, allow forest and wildlife management activities to take place, or prevent the dumping of trash or other material within the protected areas. The covenants are enforceable by the developer or the home owners association, not by the county.

Conservation easements are another protective device for land. The easement is usually held by a non-profit organization such as the Maryland Environmental Trust or Chesapeake Bay Foundation. These easements may be negotiated to allow the owner certain uses of the property while prohibiting future development. A more detailed explanation of easements is attached.

Forest management practices are allowed within all land retained on site as forest whether it is forested, afforested or reforested, and that is not included in items 1 through 7 above. The property owner may place forest in the Forest Conservation and Management Program or under a forest management plan. Additional information about the Forest Conservation and Management Program is attached. In either case, a forest management plan written by a professional forester, licensed by the State of Maryland, shall be required prior to commencement of any forest practice. The forest management plan shall conform to the format shown here. Reforestation shall be required when a final regeneration harvest is complete or if determined to be necessary due to the lack of adequate natural regeneration.

For information concerning the development of a forest management plan, please contact your local forestry office.

Conservation Easements

Any land which demonstrates a definite conservation purpose can be protected by an easement. This includes forestland, farmland, wetlands, meadows, endangered species habitat, beaches, scenic areas, natural areas, wild and scenic rivers, historic sites, and any other type of land which is basically undeveloped. An easement is an effective way for property owners to control the future appearance and character of their land. There are no negative impacts on neighboring property values. Easements can be handled without assistance or regulation from the local government.

The major benefits of easements are:

1. Permanent protection of open space, farmland, forestland and historic sites
2. Flexible easement provisions tailored to the needs of the owner
3. Long term monitoring with future owners
4. Federal and state income tax benefits
5. Lower estate and inheritance taxes due to the reduced development potential of the property
6. Fifteen year property tax credit on the unimproved portions of the property

Easements are generally perpetual. The landowner who gives an easement gives up the right to develop the land, both now and in the future. The terms of the easement therefore apply to all present and future owners of the land. Easements are executed in the form of a deed and are recorded with the land records of the county.

The easement allows for additions and modifications to existing structures, construction of accessory and farm structures, logging in accordance with accepted forestry practices, and normal agricultural practices. The easement prohibits commercial, industrial and residential development, the dumping of waste materials, the erection of billboards, and excavation, dredging and mining activities, with some exemptions.

Because the easement restricts the economic and development uses of the property, the fair market value of the land is often reduced. Also, if the terms of the easement are breached, restoration of the property to its prior condition is required.

Forest Conservation and Management Program

A Forest Conservation and Management Agreement is a binding contract between a landowner and the Maryland Department of Natural Resources which provides for the freezing of the assessment of forested areas if the property is managed according to sound forest conservation principles. A forest resource management plan, written by a professional forester licensed by the State of Maryland, is required and must be approved by the Department. A tax savings results from the freezing of the property taxes at an agricultural rate at the time the contract is let.

Any owner of 5 or more contiguous acres of forest land may enter the Forest Conservation and Management Program. Open land that was recently planted to forest tree seedlings can be included. So can land that is used to grow Christmas trees if they will be cut at harvest. The agreement does not apply to the assessment on house sites, other structures, crop land, mining sites and other non-forested open space.

Forest Management is often considered the art and science of matching the owners objectives with biological requirements of the forest. Good forest management results in a healthy forest which will produce quality timber, increase income of the owner, reduce soil erosion and flooding, and provide open space for recreation and aesthetic enjoyment. Tree species, soils, topography, tree age, property location and other factors will have to be evaluated as well as the owners desires and the requirements of the law. The plan must contain a detailed schedule of practices to be accomplished and their completion date.

The contract must cover a minimum of 15 years. A memorandum of the contract and any subsequent changes are recorded at the county courthouse. The contract can be renewed indefinitely if forest conservation practices are approved and are accomplished. The contract can be assigned and transferred to a new owner of the property if the buyer agrees to assume the obligation of the agreement. The property will be re-assessed if the agreement ends, the agreement is terminated or the property changes hands. A nominal administrative fee is charged to the owner upon entering the program, when changes to the agreement must be made and for each five year inspection.

FOREST MANAGEMENT PLAN

for

(Landowner's Name)

(Address)

(Property Location)

(Maryland Grid Coordinates)

In

_____ County

on

_____ Acres

Prepared By:

Date

A. Landowner's Objectives

B. Soil Types: List the primary soil types on the property with a general narrative of their capabilities and productivity.

C. Topography: A brief description of the aspect and slopes, and the limitations it might impose on the proposed management.

D. Forest Stand Delineation: This section is to be used by the forester to describe the results of forest data collection. This section shall also include all relevant data about the site collected through any previous field inventories and/or environmental reviews.

E. Management Recommendations:

1. Forestland

2. Open Land

3. Wetlands

F. Management Practice Schedule

G. Map shall include the following features:

1. North arrow
2. Acreage
3. Scale
4. Date of preparation
5. Critical habitat areas
6. Stream buffers
7. Locality or distinguishing landmarks
8. Specimen trees
9. Public and private roads
10. Property boundary
11. Slopes greater than 25%
12. Perennial and Intermittent streams
13. Non-tidal wetlands

Preparation of Forest Management Plans

Forest Management Plans shall be prepared by professional foresters, licensed by the State of Maryland.

Sample Forest Management Objectives

1. Provide passive recreation opportunities (such as nature trails, nature observation, photography, etc.).
2. Provide for wildlife habitat.
3. Protect habitat for endangered or special plant/wildlife communities.
4. Improve hunting opportunities.
5. Provide for income through timber resource development and harvesting.
6. Provide firewood and timber products for the landowners use.

TIMBER HARVEST PLAN

for

LANDOWNER:

ADDRESS:

STAND:

PHONE NUMBER:

LOCATION:

ACRES:

PREPARED BY:

ADDRESS:

MD FORESTER REGISTRATION #

PHONE NUMBER:

DATE:

TIMBER HARVEST PLAN

LANDOWNER:

ACREAGE:

OWNER'S MANAGEMENT GOAL(S):

DOMINANT SPECIES IN STAND:

DOMINANT SOIL SERIES:

SLOPE RANGE:

TYPE OF HARVEST (Clearcut, Shelterwood, Deferred Rotation, Seedtree, Thinning, Selection, Diameter Limit, etc.)

CURRENT BASAL AREA:

POST HARVEST BASAL AREA:

DBH OF DOMINANT TIMBER SIZE CLASS:

PROPOSED SITE PREPARATION METHOD:

PROPOSED REGENERATION METHOD AND DESIRED STOCKING:

OTHER LAWS AND ORDINANCES THAT APPLY FOR THE HARVEST SITE (Seed Tree, FCMA, etc.) N/A

A 'LETTER OF INTENT', WHICH SATISFIES THE CECIL COUNTY FOREST CONSERVATION PROGRAM, SHOULD BE SUBMITTED WITH THE 'TIMBER HARVEST PLAN'.

A 'SEDIMENT AND EROSION CONTROL PLAN' FOR FOREST HARVEST OPERATIONS SHALL BE PREPARED FOR SUBMITTAL TO THE COUNTY SOIL CONSERVATION DISTRICT FOR ITS REVIEW AND APPROVAL. WORK WILL BE DONE IN COMPLIANCE WITH THE APPROVED PLAN.

A DRAFT OF THE 'SEDIMENT AND EROSION CONTROL PLAN' SHOULD BE ATTACHED TO THE 'TIMBER HARVEST PLAN', FOR SUBMITTAL TO THE CECIL FOREST CONSERVANCY DISTRICT BOARD.

DESCRIBE MEASURES THAT WILL BE TAKEN TO PROVIDE FOR WILDLIFE CORRIDORS AND INTEGRITY-CONTINUITY OF HABITAT -

HABITAT PROTECTION AREAS (HPA'S)

Note if harvesting is to occur in or adjacent to any of the following (YES or NO):

- A. PERENNIAL STREAM BUFFER -
- B. NON-TIDAL WETLAND (NTW) -
- C. HABITAT FOR THREATENED & ENDANGERED SPECIES OR SPECIES IN NEED OF CONSERVATION -
- D. FOREST INTERIOR DWELLING BIRD HABITAT -
- E. COLONIAL NESTING WATER BIRD HABITAT -
- F. PLANT or WILDLIFE HABITAT OF LOCAL SIGNIFICANCE -
- G. NATURAL HERITAGE AREA -

For each positive response noted above, include an attachment with the following information:

1. Delineation of the HPA within the stand.
2. How the harvest will be modified to to protect the HPA.
3. Attach the appropriate survey information and/or DNR Forestry Programs recommendations for C, D, and G (rare species habitat, forest interior dwelling bird habitat, and Natural Heritage Areas).
4. If harvesting is to be done in a non-tidal wetland, include the wetland classification from the National Wetland Inventory Maps, dominant understory vegetation, Best Management Practices and mitigation for wetland alteration.
5. If harvesting is to be done in a Perennial Stream Buffer, include a 'Buffer Management Plan'.

Appendix G

Maryland Forest Association Species List

Maryland Forest Associations Species List (Brush et al., 1977)

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure
Tamarack	hemlock	T	C	M-W	A
	red spruce	T	C	M-W	F-P
	tamarack	T	C	D-M-W	F-P
Hemlock-Birch	red maple	T	P-ES	M-W	P-S
	northern red oak	T	ES	M	F
	witch hazel	S	ES	M-W	P-S
	black cherry	T	P-ES	M	F-P
	sugar maple	T	C	M	F
	white oak	T	C	M	F
	beech	T	C	D-M	A
	ironwood	T	C	M	A
	mapleleaf viburnum	T	P	M	A
	shagbark hickory	S	P	M	A
	white ash	T	C	M-D	F-P
	striped maple	T	P-ES	D-M	F-P
	hemlock	T	P-ES	M-W	A
	black birch	T	C	MW	P-S
			T	ESC	M-W
		T	ESC	M-W	F-P
Chestnut Oak-Bear Oak	white oak	T	C	D-M	A
	northern red oak	T	ES	M	F
	early low blueberry	T	P	D	F-P
	red maple	S	P-ES	M-W	P-S
	black oak	T	C	D-M	F-P
	sassafras	T	P	D-M	F-P
	grape	T	P-ES	D-M-W	S
	fall deerberry	V	P	D	F-P
	flowering dogwood	S	C	M	A
	pinnut hickory	T	C	D-M	A
	black gum	T	ES	M-W	F
	black cherry	T	P-ES	M	F-P
	black locust	T	P	D-M	F
	hawthorn	T	ES-C	D-M	F-P
	white pine	S	P-ES	D-M-W	F
	mockernut hickory	T	C	M	F-P
	greenbriers	T	P-ES	D-M	F
	V	P-ES	D-M-W	A	

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure	
Chestnut Oak-Bear Oak (cont.)	service berries	S	ES-C	W-M	A	
	mapleleaf viburnum	S	P	M-D	F-P	
	sweet pignut hickory	T	ES-C	D-M	P-S	
	Virginia pine	T	P	D-M	F	
	witch hazel	S	ES	M-W	P-S	
	chestnut oak	T	C	-D-M	F-P	
	bear oak	T	C	D-M	F-P	
	Sugar Maple-Basswood	northern red oak	T	ES	M	F
		black cherry	T	P-ES	M	F-P
red maple		T	P-ES	M-W	P-S	
white oak		T	C	D-M	A	
white ash		T	P-ES	M-W	A	
flowering dogwood		T	C	M	A	
Virginia creeper		V	ES-C	M-D	A	
witch hazel		S	ES	M-W	P-S	
black locust		T	P	D-M	F	
greenbriers		V	P-ES	D-M-W	A	
grape		V	P-ES	D-M-W	S	
hop hornbeam		T	P	M	A	
poison ivy		V	P-ES	D-M	P-S	
pignut hickory		T	C	D-M	A	
black birch		T	ES-C	M-W	F-P	
serviceberries		S	P-ES	W-M	A	
sassafras		T	P	D-M	F-P	
mockernut hickory		T	C	D-M	F	
sweet pignut hickory		T	ES-C	D-M	P-S	
hawthorn		S	ES-C	D-M-W	F-P	
brambles		V	P-ES	D-M	F-P	
sugar maple		T	C	M	F	
basswood		T	ES	M	F-P	
Chestnut Oak	red maple	T	P-ES	M-W	P-S	
	white oak	T	C	D-M	A	
	sassafras	T	P	D-M	F-P	

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure
Chestnut Oak (cont.)	northern red oak	T	ES	M	F
	black cherry	T	P-ES	M	F-P
	black gum	T	ES	M-W	F
	black oak	T	C	D-M	F-P
	early low blueberry	S	P	D	F-P
	pinut hickory	T	C	D-M	A
	flowering dogwood	T	C	M	A
	American chestnut	T	C	D	P-S
	mockernut hickory	T	C	D-M	F
	Virginia Creeper	V	ES-C	M-D	A
	grape	V	P-ES	D-M-W	S
	chestnut oak	T	C	D-M	F-P
	tall deerberry	S	P	D	F-P
	brambles	V	P-ES	D-M	F-P
	mapleleaf viburnum	S	P	M-D	F-P
	greenbriers	V	P-ES	D-M-W	F-P
	scarlet oak	T	ES	D	F-P
	white ash	T	P-ES	M-W	A
	witch hazel	S	ES	M-W	P-S
	Tulip Poplar	red maple	T	P-ES	M-W
flowering dogwood		T	C	M	A
Virginia creeper		V	ES-C	M-D	A
black gum		T	ES	M-W	F
white oak		T	C	D-M	A
sassafras		T	P	D-M	F-P
black cherry		T	P-ES	M	F-P
grape		V	P-ES	D-M-W	S
mockernut hickory		T	C	D-M	F
southern arrowwood		S	P	M-W	F-P
pinut hickory		T	C	D-M	A
black oak		T	C	D-M	F-P
poison ivy		V	P-ES	D-M	P-S
greenbriers		V	P-ES	D-M-W	A
beech		T	C	M	A
spicebush		S	P	M-W	A
northern red oak		T	ES	M	F

Forest Associations	Associated Species	Form	Serial Stage	Moisture Regime	Sun Exposure
Tulip Poplar (cont.)	mapleleaf viburnum	S	P	M-D	F-P
	early low blueberry	S	P	D	F-P
	choke cherry	S	P	M-D	A
	brambles	V	P-ES	D-M	F-P
	tulip poplar	T	ES	M	F-P
Sycamore-Green Ash- Box Elder-Silver Maple	red maple	T	P-ES	M-W	P-S
	Virginia creeper	V	ES-C	M-D	A
	white oak	T	C	D-M	A
	flowering dogwood	T	C	M	A
	grape	V	P-ES	D-M-W	S
	black cherry	T	P-ES	M	F-P
	northern red oak	T	ES	M	F
	spicebush	S	P	M-W	A
	tulip poplar	T	ES	M	F-P
	black gum	T	ES	M-W	F
	sassafras	T	P	D-M	F-P
	white ash	T	P-ES	M-W	A
	mockernut hickory	T	C	D-M	F
	poison ivy	V	P-ES	D-M	P-S
	southern arrowwood	S	P	M-W	F-P
	black oak	T	C	D-M	F-P
	pignut hickory	T	C	D-M	A
	brambles	V	P-ES	D-M	F-P
	greenbriars	V	P-ES	D-M-V	A
	ironwood	T	P	M	A
	green ash	T	P-ES	M-W	F
	sycamore	T	P-C	M-W	F-P
	box elder	T	P	M-W	F-P
	silver maple	T	ES	M-W	F-P

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure
Shingle Oak	black oak	T	C	D-M	F-P
	black cherry	T	P-ES	M	F-P
	white oak	T	C	D-M	A
	flowering dogwood	T	C	M	A
	grape	V	P-ES	D-M-W	S
	poison ivy	V	P-ES	D-M	P-S
	red maple	T	P-ES	M-W	P-S
	sassafras	T	P	D-M	F-P
	black gum	T	ES	M-W	F
	shagbark hickory	T	C	D-M	F-P
	greenbriers	V	P-ES	D-M-W	A
	Virginia creeper	V	ES-C	M-D	A
	white ash	T	P-ES	M-W	A
	chestnut oak	T	C	D-M	F-P
	dwarf juniper	S	P-ES	D-M	F-P
	early low blueberry	S	P	D	F-P
	nannyberry	S	ES	M	A
	northern red oak	T	ES	M	F
	redbud	T	P	M	F-P
	spicebush	S	P	M-W	A
	tulip poplar	T	ES	M	F-P
	Virginia pine	T	P	D-M	F
	shingle oak	T	ES-C	D-M	P-5
Chestnut Oak - Post Oak - Blackjack Oak	red maple	T	P-ES	M-W	P-S
	black gum	T	ES	M-W	F
	white oak	T	C	D-M	A
	sassafras	T	P	D-M	F-P
	greenbriers	V	P-ES	D-M-W	A
	American holly	T	C	M-W	A
	Virginia pine	T	P	D-M	F
	black oak	T	C	D-M	F-P
	beech	T	C	M	A
	early low blueberry	S	P	D	F-P
	flowering dogwood	T	C	M	A
	sweet gum	T	P	M-W	F-P

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure
Chestnut Oak-Post Oak -Blackjack Oak	scarlet oak	T	ES	D	F-P
	mockernut hickory	T	C	D-M	F
	Virginia creeper	V	ES-C	M-D	A
	black cherry	T	P-ES	M	F-P
	sweet pignut hickory	T	ES-C	D-M	P-S
	dwarf huckleberry	S	ES	-M	A
	mountain laurel	S	C	D-W	P-S
	southern arrowwood	S	P	M-W	F-P
	tall deerberry	S	P	D	F-P
	chestnut oak	T	C	D-M	F-P
	post oak	T	ES	D-M	F
	blackjack oak	T	ES-C	D	A

Bald Cypress

red maple	T	P-ES	M-W	P-S
sweet gum	T	P	M-W	F-P
green ash	T	P-ES	M-W	F
greenbriers	V	P-ES	D-M-W	A
coast pepperbush	S	P	M-W	F
poison ivy	V	P-ES	D-M	P-S
Virginia creeper	V	ES-C	M-D	A
black gum	T	ES	M-W	F
southern arrowwood	S	P	M-W	F-P
American holly	T	C	M-W	A
common				
winterberry holly	S	P	M-W	A
flowering dogwood	T	C	M	A
grape	V	P-ES	D-M-W	S
sweetbay magnolia	T	ES	M-W	F
common highbush				
blueberry	S	S	P	F-P
elderberry	S	P	M	A
rose	S	P	D-M	F
spicebush	S	P	M-W	A
wax myrtle	S	P-ES	M-W	A
bald cypress	T	ES-C	W	A

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure
River Birch-Sycamore	red maple	T	P-ES	M-W	P-S
	poison ivy	V	P-ES	D-M	P-S
	Virginia creeper	V	ES-C	M-D	A
	greenbriers	V	P-ES	D-M-W	A
	sweet gum	T	P	M-W	F-P
	southern arrowwood	S	P	M-W	F-P
	tulip poplar	T	ES	M	F-P
	spicebush	S	P	M-W	A
	black gum	T	ES	M-W	F
	grape	V	P-ES	D-M-V	S
	ironwood	T	P	M	A
	American holly	T	C	M-W	A
	flowering dogwood	T	C	M	A
	black cherry	T	P-ES	M	F-P
	green ash	T	P-ES	M-W	F
	white oak	T	C	D-M	A
	brambles	V	P-ES	D-M	F-P
	elderberry	S	P	M	A
	slippery elm	T	ES	M-W	F
	sassafras	T	P	D-M	F-P
sycamore	T	P-C	M-W	F-P	
river birch	T	ES-C	M-W	F-P	
Basket Oak-Loblolly Pine	red maple	T	P-ES	M-W	P-S
	sweet gum	T	P	M-W	F-P
	American holly	T	C	M-W	A
	black gum	T	ES	M-W	F
	greenbriers	V	P-ES	D-M-W	A
	white oak	T	C	D-M	A
	coast pepperbush	S	P	M-W	F
	common highbush blueberry	S	S	P	F-P
	willow oak	T	ES	M-W	F
	beech	T	C	M	A
	sassafras	T	P	D-M	F-P

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure	
Basket Oak-Loblolly Pine (cont.)	black oak	T	C	D-M	F-P	
	southern arrowwood	S	P	M-W	F-P	
	scarlet oak	T	ES	D	F-P	
	black highbush blueberry	S	P	M	F-P	
	poison ivy	V	P-ES	D-M	P-S	
	sweetbay magnolia	T	ES	M-W	F	
	Virginia creeper	V	ES-C	M-D	A	
	basket oak	T	ES-C	M	A	
	loblolly pine	T	P-ES	D-W	F	
	Basket Oak	sweet gum	T	P	M-W	F-P
		black gum	T	ES	M-W	F
		white oak	T	C	D-M	A
		greenbriers	V	P-ES	D-M-V	A
red maple		T	P-ES	M-W	P-S	
sassafras		T	P	D-M	F-P	
willow oak		T	ES	M-W	F	
southern arrow wood		S	P	M-W	F-P	
tulip poplar		T	ES	M	F-P	
American holly		T	C	M-W	A	
black oak		T	C	D-M	F-P	
serviceberries		S	P	W-M	A	
black highbush blueberry		S	P	M	F-P	
Virginia creeper		V	ES-C	M-D	A	
coast pepperbush		S	P	M-W	F	
common highbush blueberry		S	P	M	F-P	
flowering dogwood		T	C	M	A	
red cedar		T	P	D-M	F-P	
scarlet oak		T	ES	D	F-P	
Virginia pine		T	P	D-M	F	
black cherry		T	P-ES	M	F-P	
grape		V	P-ES	D-M-W	S	
basket oak		T	ES-C	M	A	

Forest Associations	Associated Species	Form	Seral Stage	Moisture Regime	Sun Exposure
Willow Oak-Loblolly Pine	red maple	T	P-ES	M-W	P-S
	sweet gum	T	P	M-W	F-P
	black gum	T	ES	M-W	F
	American holly	T	C	M-W	A
	greenbriers	V	P-ES	D-M-V	A
	white oak	T	C	D-M	A
	Virginia creeper	V	ES-C	M-D	A
	sassafras	T	P	D-M	F-P
	poison ivy	V	P-ES	D-M	A
	common highbush blueberry	S	P	M	F-P
	flowering dogwood	T	C	M	A
	black oak	T	C	D-M	F-P
	dwarf huckleberry	S	ES	M	A
	tulip poplar	T	ES	M	F-P
	coast pepperbush	S	P	M-W	F
	black cherry	T	P-ES	M	F-P
	Virginia pine	T	P	D-M	F
	grape	V	P-ES	D-M-W	S
	beech	T	C	M	A
	scarlet oak	T	ES	D	F-P
	southern arrowwood	S	P	M-W	F-P
	mockernut hickory	T	C	D-M	F
	loblolly pine	T	P-ES	D-W	F
willow oak	T	ES	M-W	F	
Loblolly Pine	wax myrtle	S	P-ES	M-W	A
	loblolly pine	T	P-ES	D-W	F

Key to Codes

Form : Describes plant type. T= tree S=shrub V=vine
Serai Stage : Indicates most common position in succession occupied by the species. P=pioneer ES=early serai C=climax
Moisture Regime : Refers to the amount of moisture required by a plant for optimal growth. D=dry M=moist W=wet
Sun Exposure : The amount of sun required by the species for optimum or adequate development.
F= full sun P= partial shade S= full shade A= all (full sun, partial shade, full shade)

Sources

Darr, Lonnie. 1990. A Technical Manual for Woodland Conservation with Development in Prince George's County. MNCPPC, Upper Marlboro, MD.
Henderson, Carrol L. 1981. Landscaping For Wildlife. Minnesota Department of Natural Resources. St. Paul, MN.

Plant Species Listed Alphabetically by Common Name

Associated Species

American chestnut
 American holly
 bald cypress
 basket oak
 basswood
 bear oak
 beech
 black birch
 black cherry
 black gum
 black highbush blueberry
 blackjack oak
 black locust
 black oak
 box elder
 brambles
 chestnut oak
 choke cherry
 coast pepperbush
 common highbush blueberry
 common winterberry holly
 coast pepperbush
 dwarf juniper
 dwarf huckleberry
 early low blueberry
 elderberry
 grape
 greenbrier
 flowering dogwood
 hawthorn
 hemlock
 hop hornbeam
 ironwood
 loblolly pine
 mapleleaf viburnum
 mockernut hickory
 mountain laurel
 nannyberry
 northern red oak

Scientific Name

Castanea dentata
Ilex opaca
Taxodium distichum
Quercus Michauxii
Tilia americana
Quercus ilcifolia
Fagus grandifolia
Betula lenta
Prunus serotina
Nyssa sylvatica
Vaccinium atrococcum
Quercus marilandica
Robinia Pseudo-Accia
Quercus velutina
Acer Negundo
Rubus spp.
Quercus Prinus
Prunus virginiana
Clethra alnifolia
Vaccinium corymbosum
Ilex verticillata
Clethra alnifolia
Juniperus communis
Gaylussacia dumosa
Vaccinium vacillans
Sambucus canadensis
Vitis sp.
Simlax sp.
Cornus florida
Crataegus sp.
Tsuga canadensis
Ostrya virginiana
Carpinus caroliniana
Pinus Taeda
Viburnum acerifolium
Carya tomentosa
Kalmia latifolia
Viburnum Lentago
Quercus rubra

Plant Species Listed Alphabetically by Common Name

Associated Species

pignut hickory
poison ivy
redbud
red cedar
red maple
red spruce
river birch
rose
sassafras
scarlet oak
serviceberries
shagbark hickory
shingle oak
southern arrowwood
spicebush
silver maple
slippery elm
striped maple
sugar maple
sweetbay magnolia
sweet gum
sweet pignut hickory
sycamore
tall deerberry
tamarack
tulip popular
Virginia creeper
Virginia pine
wax myrtle
white ash
white oak
white pine
willow oak
witch hazel

Scientific Name

Carya glabra
Rhus radicans
Cercis canadensis
Juniperus virginiana
Acer rubrum
Picea rubens
Betula nigra
Rosa sp.
Sassafras albidum
Quercus coccinea
Amelanchier spp.
Carya ovata
Quercus imbricaria
Viburnum dentatum
Lindera Benzoin
Acer saccharinum
Ulmus rubra
Acer pennsylvanicum
Acer saccharum
Magnolia virginiana
Liquidambar Styraciflua
Carya ovalis
Platanus occidentalis
Vaccinium stamineum
Larix sp.
Liriodendron Tulipifera
Parthenocissus quinquefolia
Pinus virginiana
Myrica cerifera
Fraxinus americana
Quercus alba
Pinus strobus
Quercus Phellos
Hamamelis virginiana

Appendix H

Exotic and Invasive Species

Exotic or Invasive Plants

These species may displace native vegetation and disrupt forest ecosystems

HERBACEOUS PLANTS

Common Name	Scientific Name	Common Name	Scientific Name
Garlic Mustard	<u>Alliaria officinalis</u>	Day-lily	<u>Hemerocallis fulva</u>
Musk (nodding) thistle	<u>Arthraxon hispidus</u>	Purple Loosestrife	<u>Lythrum alatum</u>
Plumeless thistle	<u>Carduus nutans</u>	Moneywort	<u>Lysimachia nummularia</u>
Spotted knapweed	<u>Carduus acanthoides</u>	Wild reed	<u>Myosoton aquaticum</u>
Bull thistle	<u>Centuria maculosa</u>	Japanese knotweed	<u>Phragmites australis</u>
Canada thistle	<u>Cirsium vulgare</u>	Asian tearthumb	<u>Polygonum</u>
Crown vetch	<u>Cirsium arvense</u>	Russian thistle	<u>Polygonum perfoliatum</u>
Beefsteak Mint	<u>Coronilla varia</u>	Johnson grass	<u>Salsola iberica</u>
	<u>Eulalia vimineus</u>	Cocklebur	<u>Sorghum halepense</u>
			<u>Xanthium spp.</u>

VINES

Porcelain Berry	<u>Ampelopsis brevipedunculata</u>
Oriental Bittersweet	<u>Celastrus orbiculatus</u>
Climbing Euonymus, Wintercreeper	<u>Euonymus fortunei</u>
English Ivy	<u>Hedera helix</u>
Japanese Honeysuckle	<u>Lonicera japonica</u>
Kudzu	<u>Pueraria lobata</u>
Periwinkle	<u>Vinca minor</u>
Wisteria	<u>Wisteria floribunda, W. sinensis</u>

SHRUBS

Japanese Barberry	<u>Berberis thunbergii</u>	Common Buckthorn	<u>Rhamnus Cathartica</u>
Russian Olive	<u>Eleagnus angustifolium</u>	European Buckthorn	<u>Rhamnus frangula</u>
Autumn Olive	<u>Eleagnus umbellata</u>	Multiflora Rose	<u>Rosa multiflora</u>
Winged Euonymus, Winged Wahoo	<u>Euonymus alatus</u>	Strawberry-raspberry, Balloonberry	<u>Rubus illecebrosus</u>
Privet	<u>Ligustrum sp.</u>	Wineberry	<u>Rubus phoenicolasius</u>
Bush Honeysuckles, including Belle Honeysuckle	<u>Lonicera sp.</u>	Japanese Spiraea	<u>Spiraea japonica</u>
Amur Honeysuckle	<u>Lonicera x bella</u>	Coralberrry	<u>Symphoricarpos orbiculatus</u>
Morrow's Honeysuckle	<u>Lonicera maackii</u>		
Tartarian Honeysuckle	<u>Lonicera morrowii</u>		
	<u>Lonicera tatarica</u>		

TREES

Norway Maple	<u>Acer platanoides</u>
Tree of Heaven	<u>Allanthus altissima</u>
(Catalpa	<u>catalpa sp.)*</u>
Russain Olive	<u>Eleagnus angustifolia</u>
(White Mulberry	<u>Morus alba)*</u>
Empress Tree	<u>Paulownia tomentosa</u>
(White Spruce	<u>Picea glauca)*</u>
Sweet Cherry, bird Cherry	<u>Prunus avium</u>

*Species in parenthese are minor problems (Maryland Natural Heritage Program , 25 July 199).

Appendix I

Forest Borders for Wildlife

Forest Borders for Wildlife

A border established along the edge of a forest will create a more diverse habitat for wildlife. Many wildlife species thrive in the edge, or zone, where two different habitat types join. A forest border can provide two edges, one between the open area and the border, and the other between the border and the forest.

Naturally occurring forest edges contain a variety of small trees, shrubs and herbaceous vegetation that require full sun-light to grow. This diversity of plants offers wildlife many sources of food and shelter. A human-created edge can be as effective as a naturally occurring edge in creating wildlife habitat and protecting the trees in the forest. There are two methods which can be used to create an edge.

1. Forest border plantings to create an edge.
2. Selective cutting to thin the forest and allow the understory to develop.

The planted border should be at least 25 feet wide and should provide a gradual change from the open area to the forest. Small trees should be planted adjacent to the forest. Then, shrubs should be planted next to the small trees. Finally, herbaceous vegetation should be planted next to the shrubs. This border will soften the forest edge and make it more attractive for wildlife.

Many species of trees, shrubs and vines can be used. Flowering dogwood, crabapple, serviceberry, American holly and apple trees are some small trees well adapted for use in borders. Trees should be planted 10 to 12 feet away from the forest edge. Blackberry, viburnums, blueberry, sumac, elderberry and bayberry are some of the shrub species that can be planted. Shrubs should be planted beyond the planted trees. For vines, grape, Virginia creeper, trumpet vine and morning glory do well. Herbaceous vegetation may include grasses, legumes and wildflowers. Vines and herbaceous vegetation should be planted in the zone between the shrubs and the open area.

Selective cutting can thin the forest and open the tree canopy to allow sunlight to reach the forest floor. This will allow a more diverse layer of vegetation to grow in the forest. As a general rule, trees which produce nuts or berries, such as oak, hickory, cherry, dogwood, holly or walnut, should be retained. The trees within 30 feet of the edge should be thinned. Any dead trees should be felled to reduce to possibility of property damage. Dead trees beyond the 30 foot limit should be left standing.

Vines and shrubs growing naturally in the forest should be left untouched. The branches from trees that are cut can be piled to create nesting and cover areas for the wildlife. As the piles decay, other vegetation will grow and provide the necessary shelter. The best time to selectively cut to create the border is in the late fall or winter when the trees are dormant.

The border will require periodic maintenance. In planted borders, the shrub and herbaceous vegetation must be mowed every 2 to 4 years in mid-July to reduce density and prevent larger trees from taking over. In selectively cut areas, thinnings may be required every 10 years to maintain an open canopy.

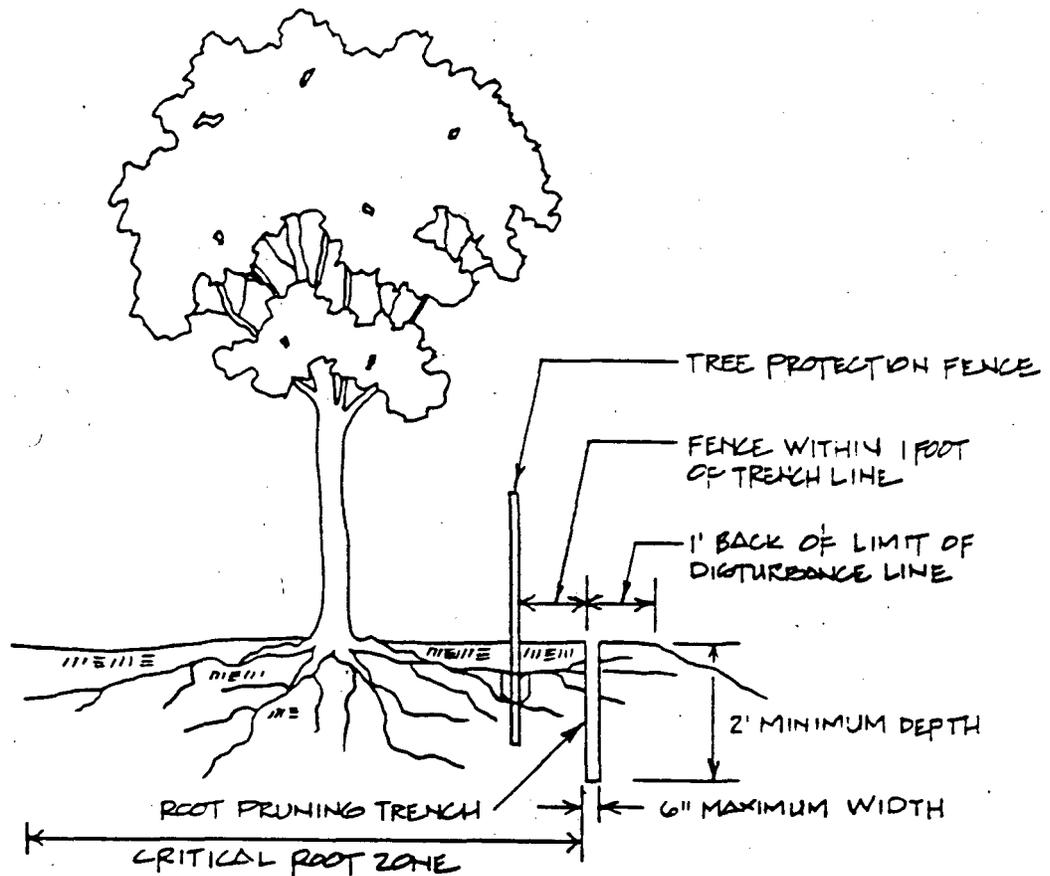
On development sites where some of the forests are being cleared and some retained, borders would be a valuable asset to the community and to the wildlife. Creating borders can count toward the afforestation mitigation. A forest management plan will be required if selective cutting is the chosen method. Planted borders would require a landscaping plan.

Appendix J

Forest Protection Specifications

Figure J-1

Root Pruning



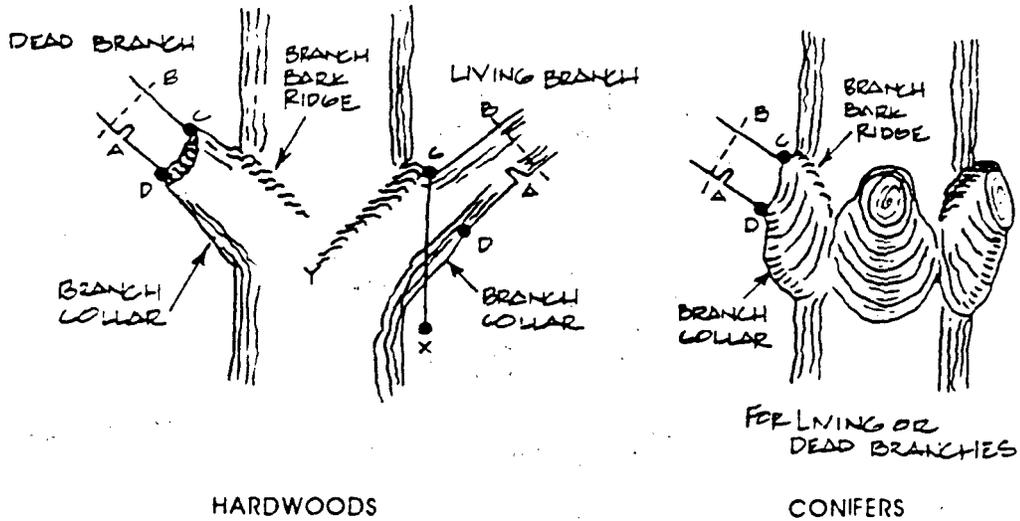
Notes:

1. Retention Areas will be set as part of the review process
2. Boundaries of Retention Areas should be staked flagged prior to trenching
3. Exact location of trench should be identified
4. Trench should be immediately backfilled with soil removed or other high organic soil
5. Roots should be cleanly cut using vibratory knife or other acceptable equipment

Source: City of Galtherburg, Maryland: City Tree Manual

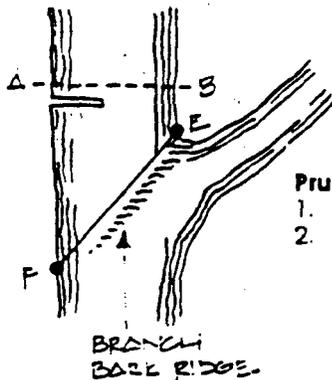
Figure J-2

Crown Reduction



Pruning a Branch

1. Remove branch weight by undercutting at A and remove limb by cutting through at B.
2. Remove stub at CD (line between branch bark ridge and outer edge of branch collar).
3. If D is difficult to find on hardwoods, drop vertical from C (line CX). Angle $XCY = XCD$.



Pruning a Leader or To Reduce Size

1. Remove top weight by cutting at A&E.
2. Remove stub at EF parallel to the Branch Bark Ridge.

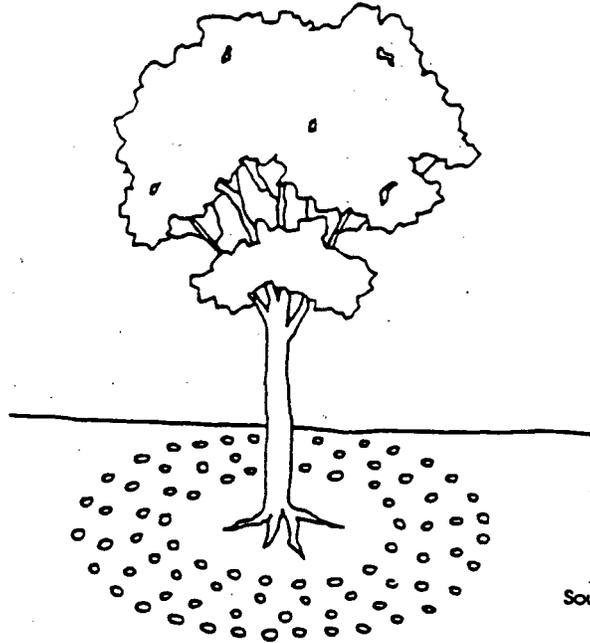
Source: Fairfax County, Virginia
Vegetation Preservation & Planting

Notes:

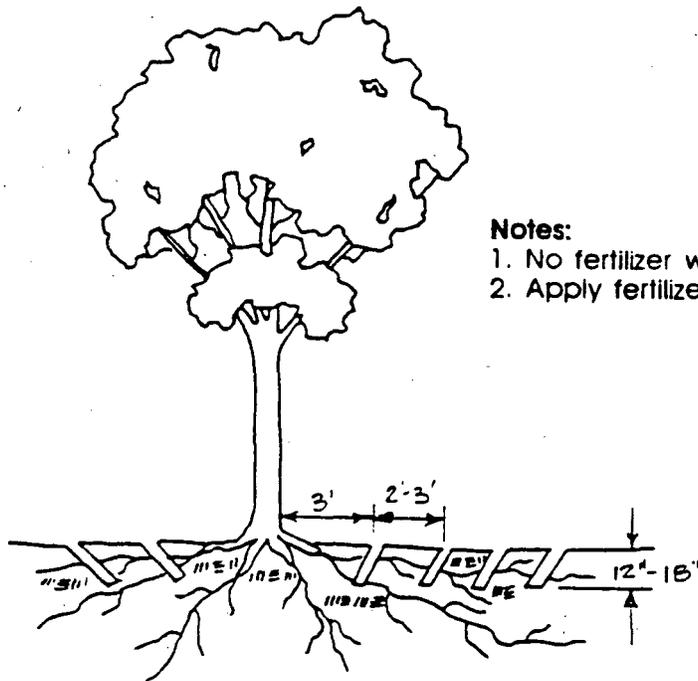
1. Only prune at specified times
2. No more than 30% of crown to be removed at one time.

Figure J-3

Application of Fertilizers by Injection



Source: Pirone, 1978

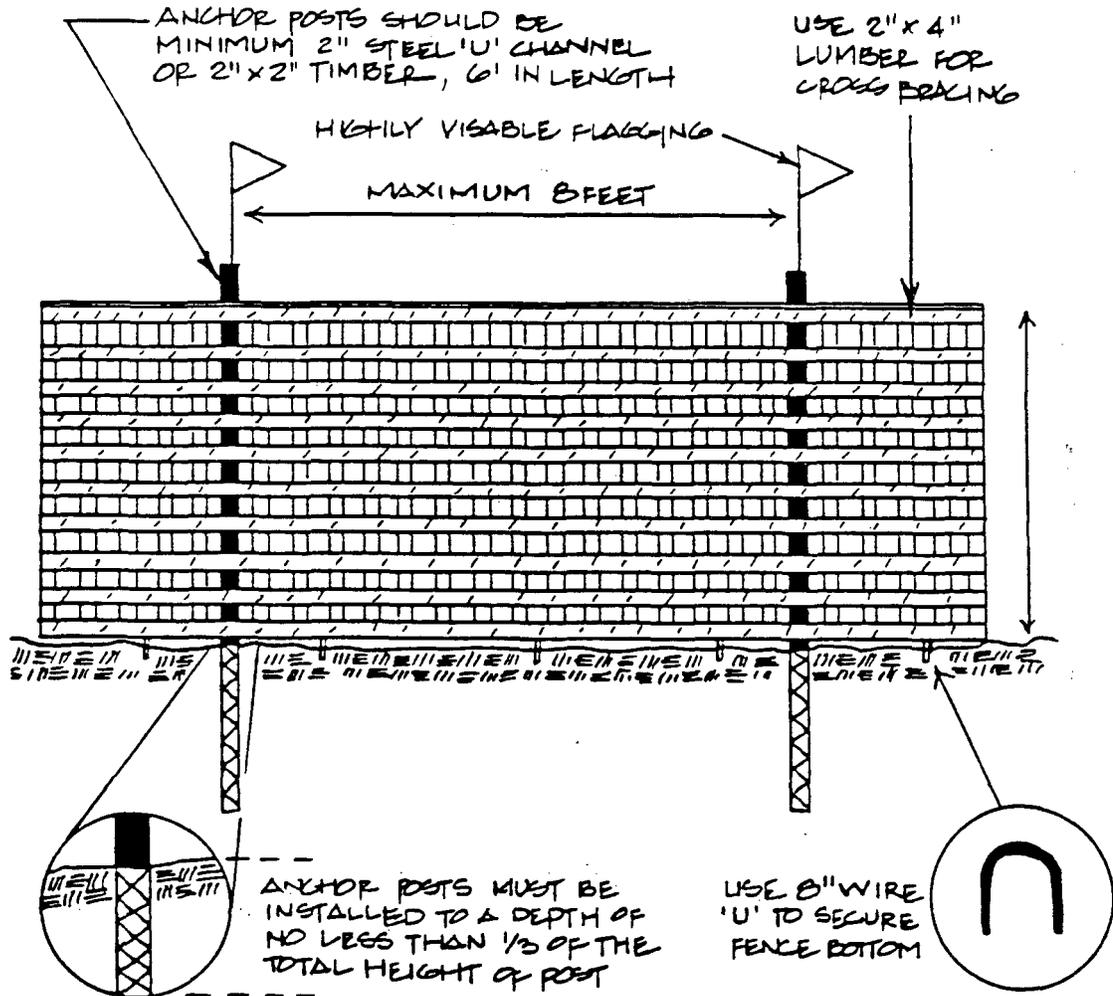


Notes:

1. No fertilizer within 3 feet of trunk
2. Apply fertilizer to entire critical root zone

Figure J-4

Blaze Orange Plastic Mesh



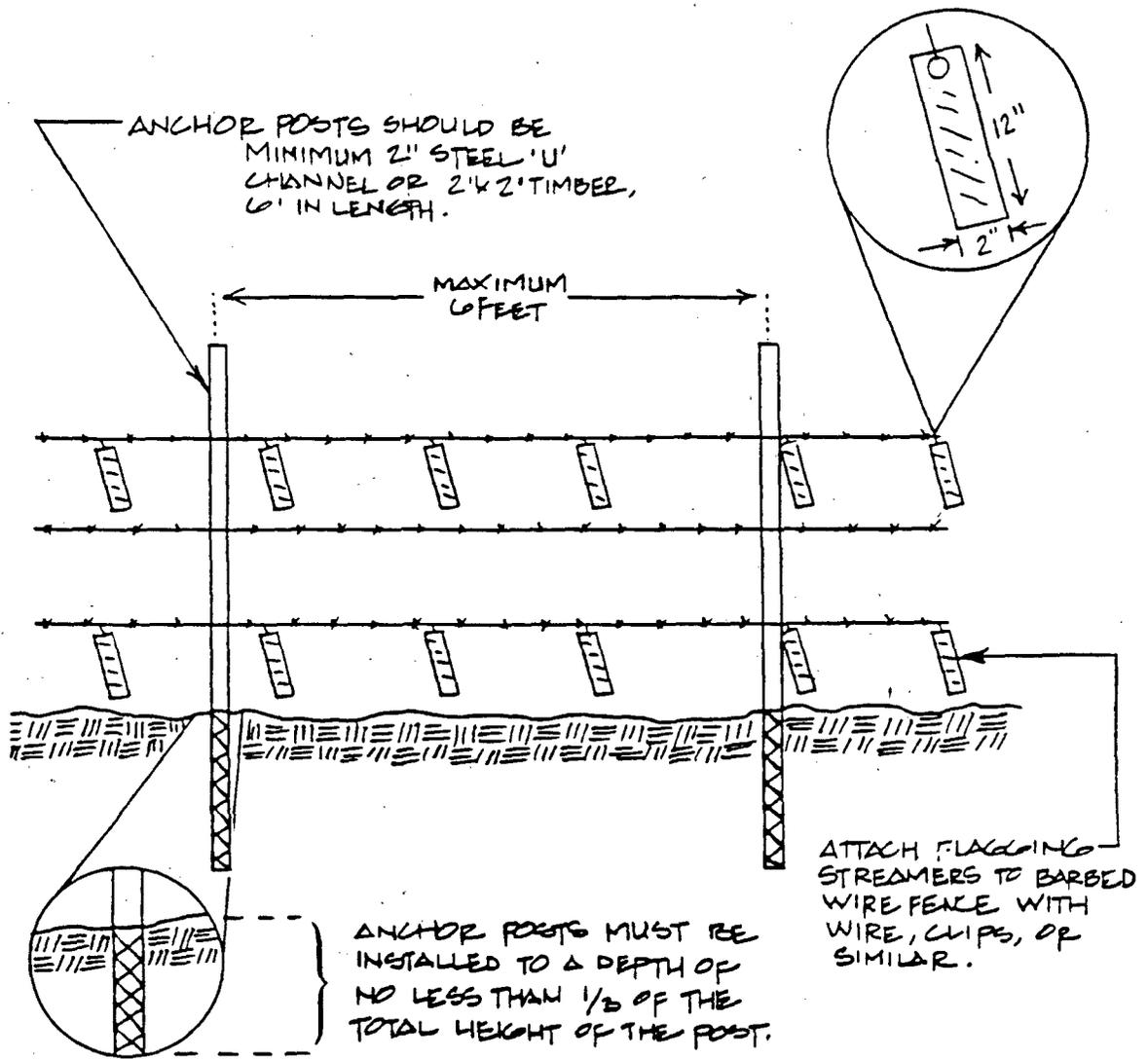
Notes

1. Forest protection device only.
2. Retention Area will be set as part of the review process.
3. Boundaries of Retention Area should be staked and flagged prior to installing device.
4. Root damage should be avoided.
5. Protective signage may also be used.
6. Device should be maintained throughout construction.

Source: Prince George's County, Maryland: Woodland Conservation Manual

Figure J-5

Three Strand Barbed Wire



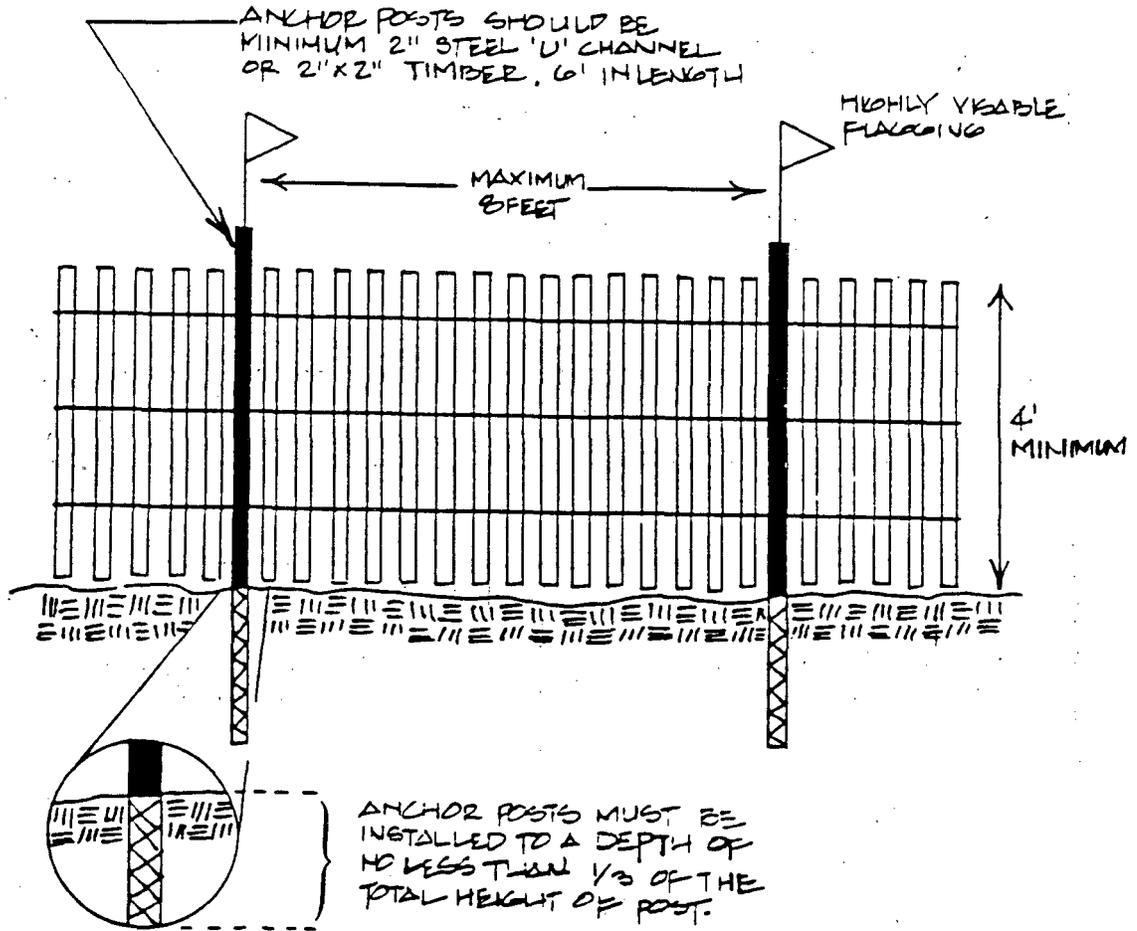
Notes

1. Forest protection device only
2. Retention Area will be set as part of the review process.
3. Boundaries of Retention Area should be staked and flagged prior to installing device.
4. Avoid root damage when placing anchor posts.
5. Barbed wire should be securely attached to posts.
6. Device should be properly maintained during construction.
7. Protective signage is also recommended.

Source: Prince George's County, Maryland: Woodland Conservation Manual

Figure J-6

Snow Fence



Notes:

1. Forest protection device only
2. Retention area will be set as part of the review process
3. Boundaries of Retention Area should be staked prior to installing protective device
4. Avoid root damage when placing anchor posts
5. Device should be properly maintained during construction
6. Protective signage is also recommended

Source: Prince George's County, Maryland: Woodland Conservation Manual

Figure J-7

Signage

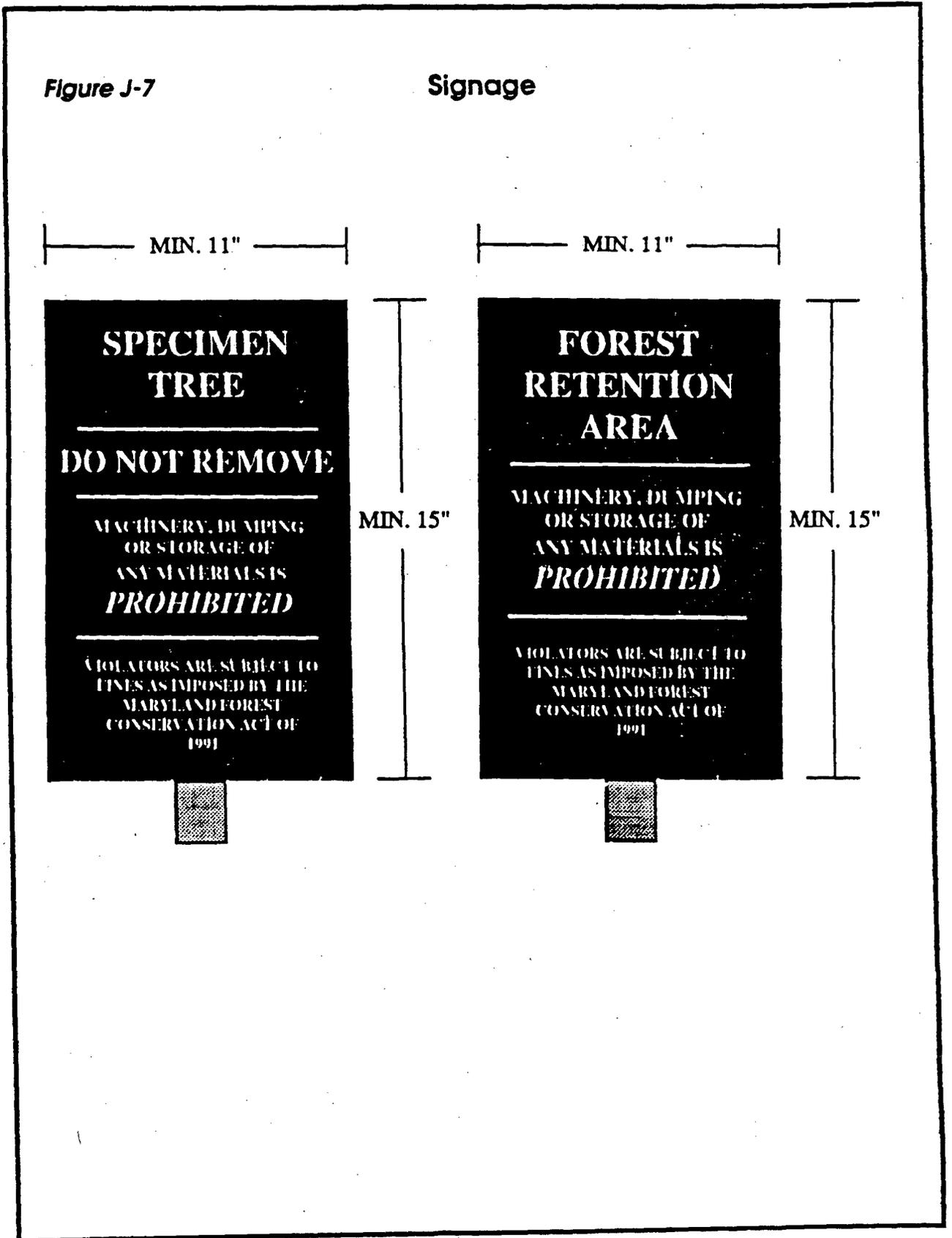
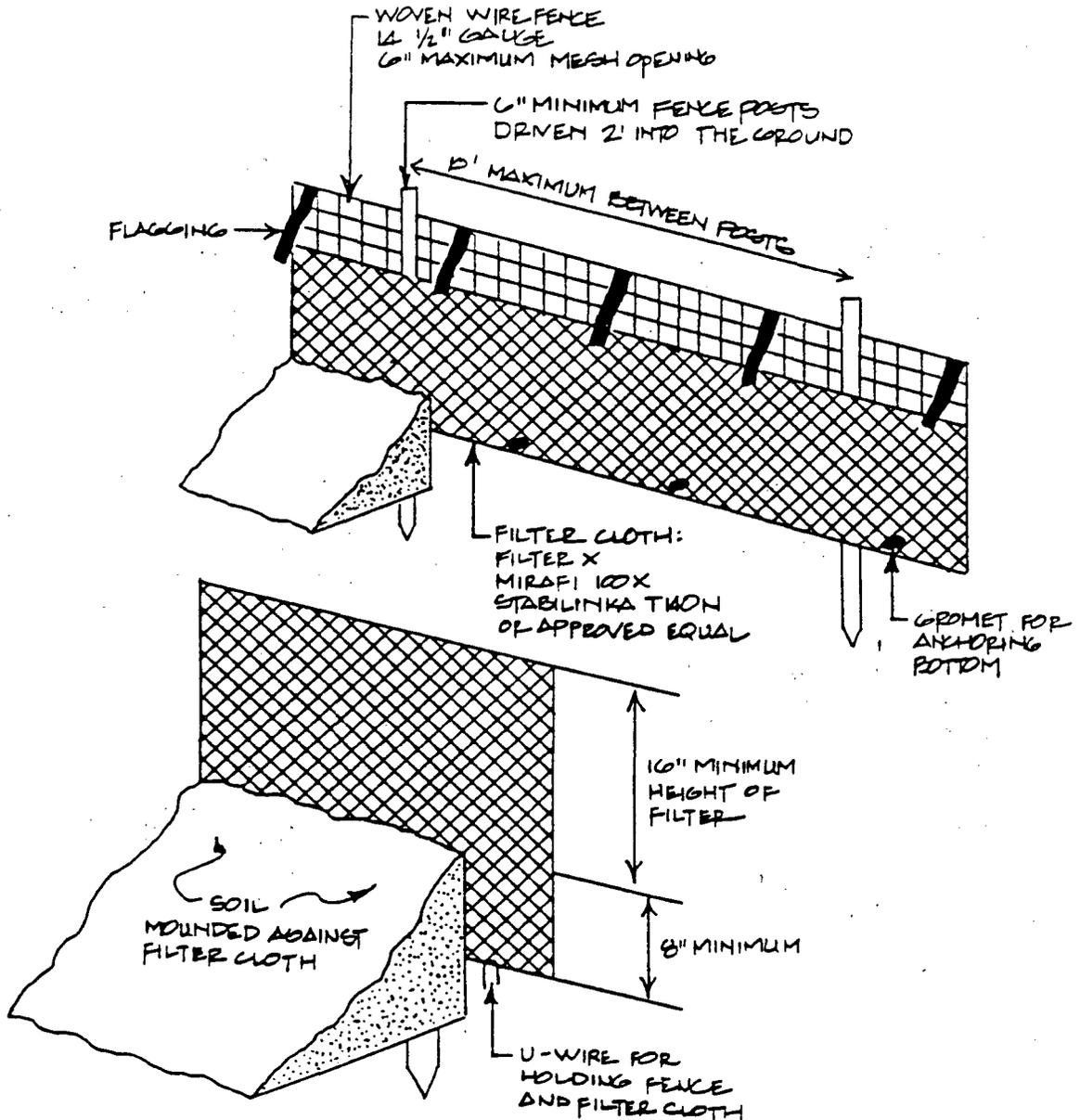


Figure J-8

Filter Cloth on Wire Mesh



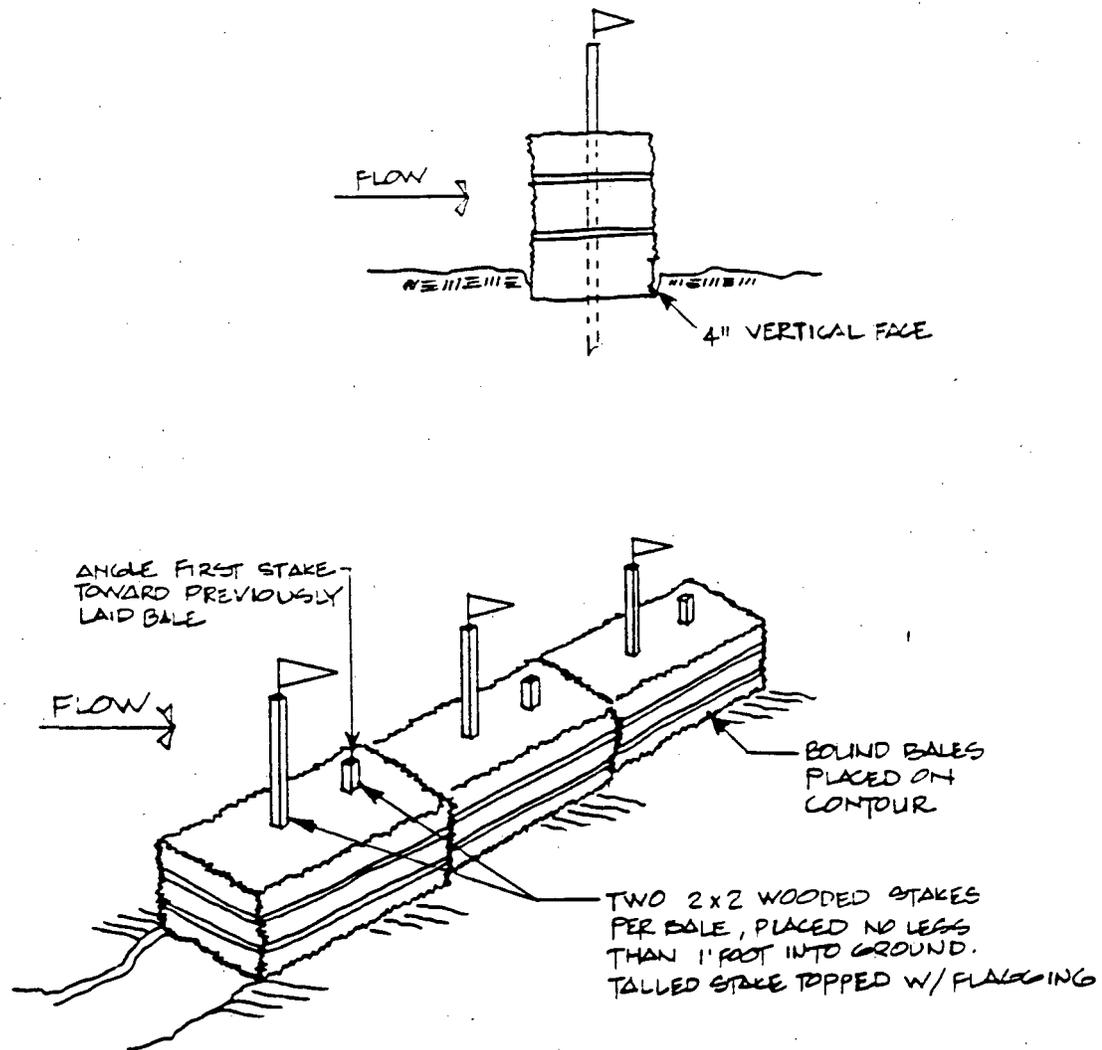
Source: Prince George's County, Maryland:
Woodland Conservation Manual

Notes:

1. Combination sediment control and protective device
2. Retention area will be set as part of the review process
3. Boundaries of Retention Area should be staked prior to installing protective device
4. Root damage should be avoided
5. Mound soil only within the limits of disturbance
6. Protective signage is also recommended
7. All standard maintenance for sediment control devices apply to these details

Figure J-9

Staked Straw Bale Dike



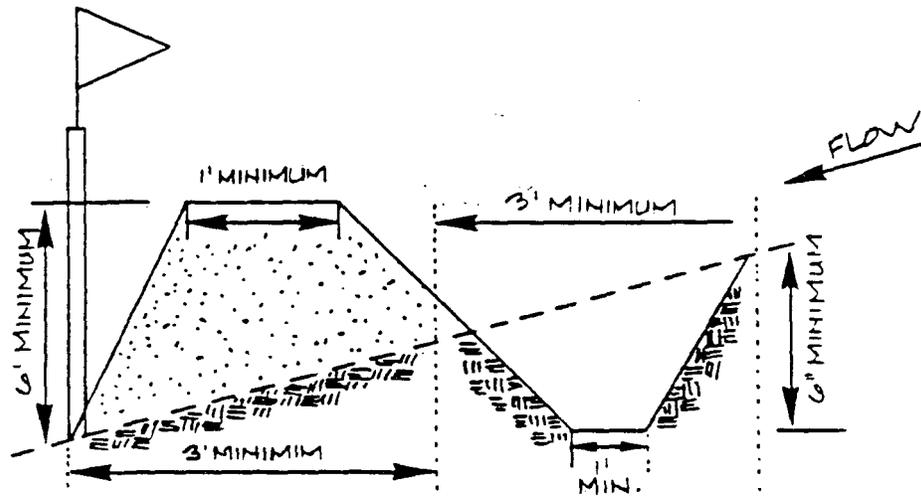
Source: Prince George's County, Maryland:
Woodland Conservation Manual

Notes:

1. Combination sediment control and protective device
2. Retention area will be set as part of the review process
3. Boundaries of Retention Area should be staked prior to installing protective device
4. Root damage should be avoided
5. This device should only be placed within the limit of disturbance
6. Protective signage is also recommended
7. All standard maintenance for sediment control devices apply to these details

Figure J-10

Earthen Dike and Swale



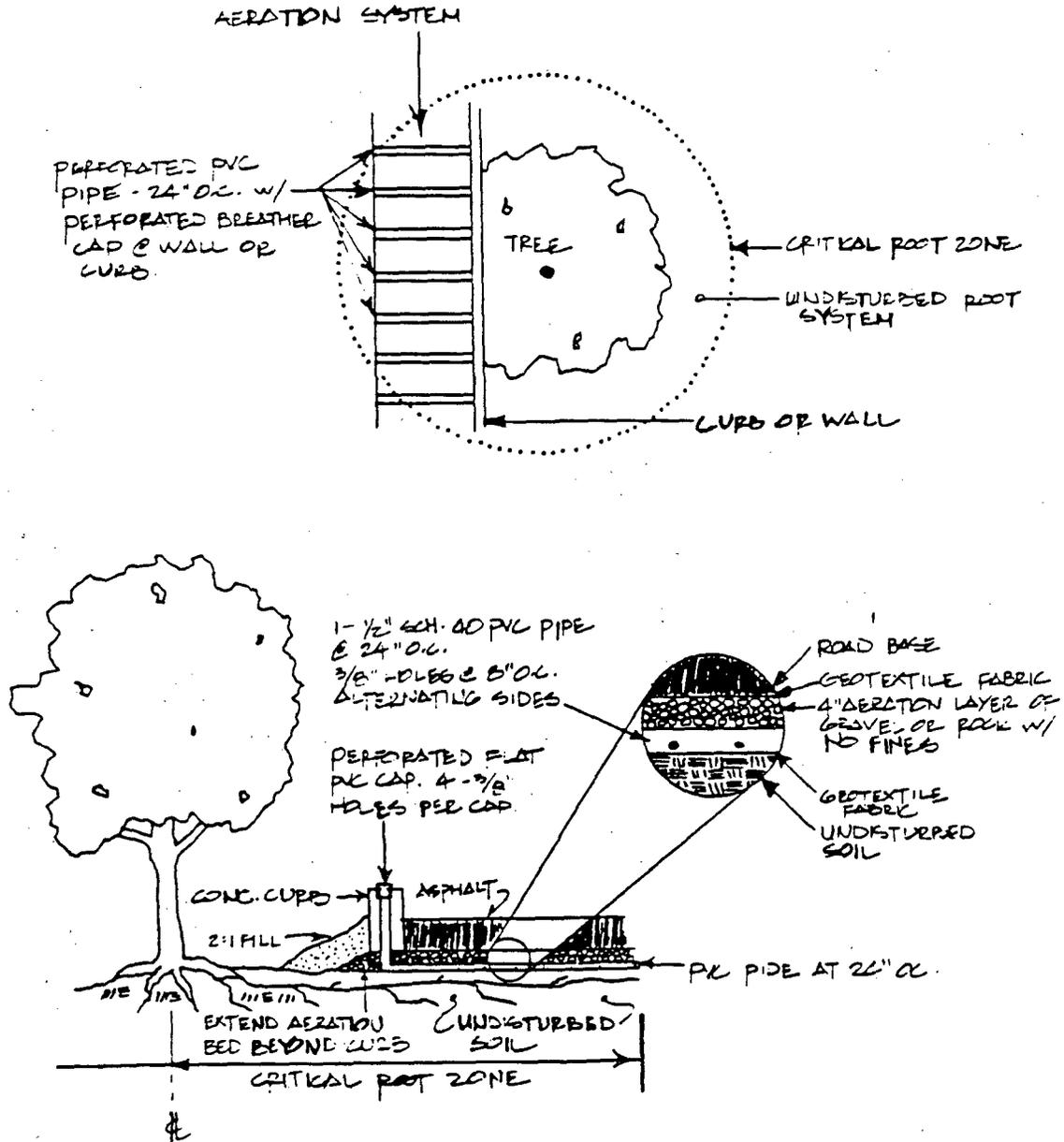
Notes:

1. Combination sediment control and protective device
2. Retention area will be set as part of the review process
3. Boundaries of Retention Area should be staked prior to installing protective device
4. Root damage should be avoided
5. The top or toe of slope should be within the limit of disturbance
6. Equipment is prohibited within critical root zone of retention area; place dike accordingly
7. All standard maintenance for earthen dikes and swales apply to these details
8. All standard reclamation practices for earthen dikes and swales shall apply to these details

Source: Prince George's County, Maryland: Woodland Conservation Manual

Figure J- 11

Aeration System



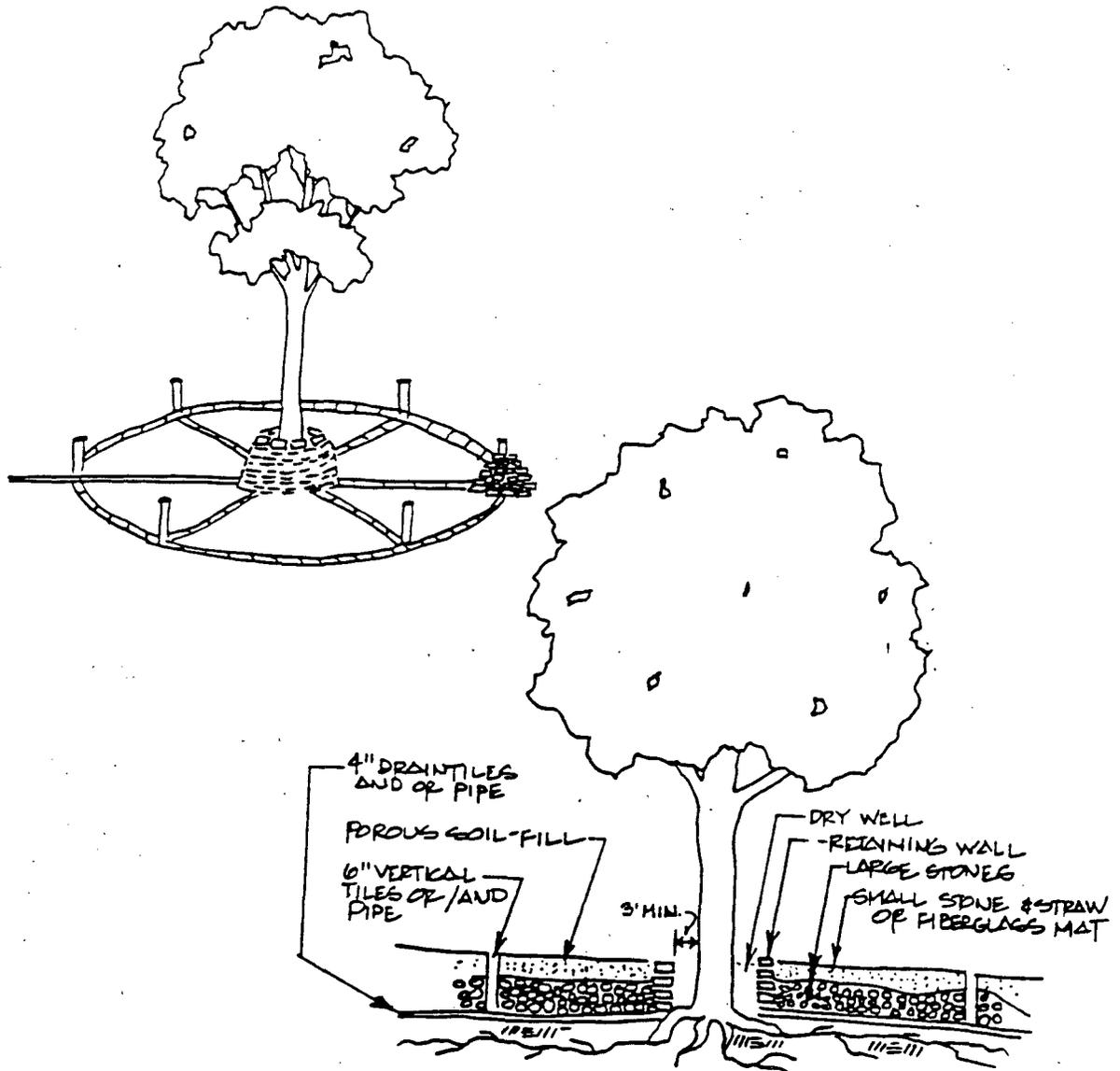
Notes:

1. Bed preparation should not exceed two inches.
2. Vertical pipe should be capped with a perforated cap with 4-3/8 inch holes per cap.
3. Gravel or rock should contain no fines.
4. Can also be used when critical root zone is covered by fill instead of asphalt.

Source: Steve Clark & Associates

Figure J -12

Tree Well



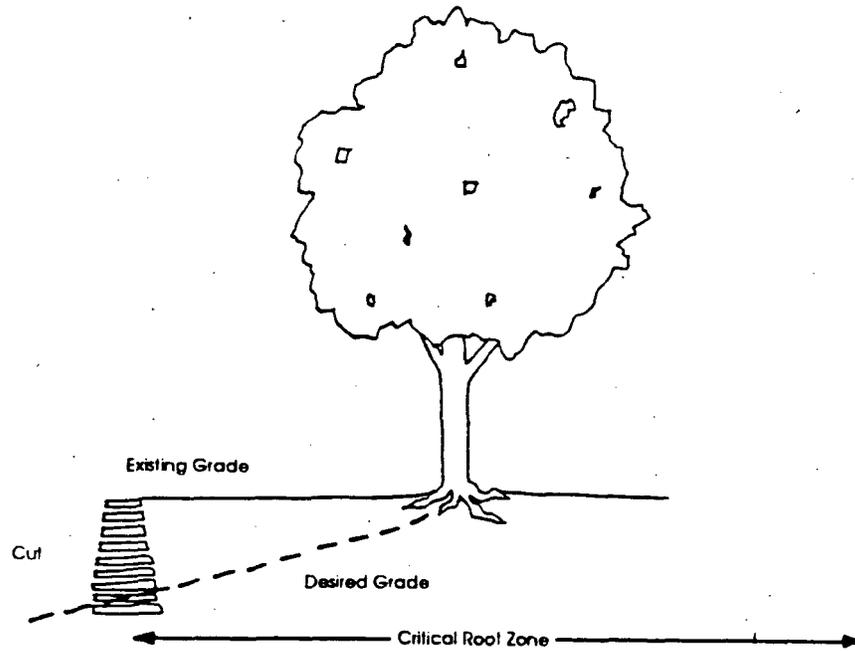
Notes:

1. Well wall should be no closer than 3 feet from tree trunk or more for smaller trees.
2. Drainage pipe layout should extend beyond the critical root zone
3. Vertical pipes shall be capped with a perforated flat cap with 4-3/8 inch holes per cap
4. Radiating spokes should be on 3 foot centers at the well wall

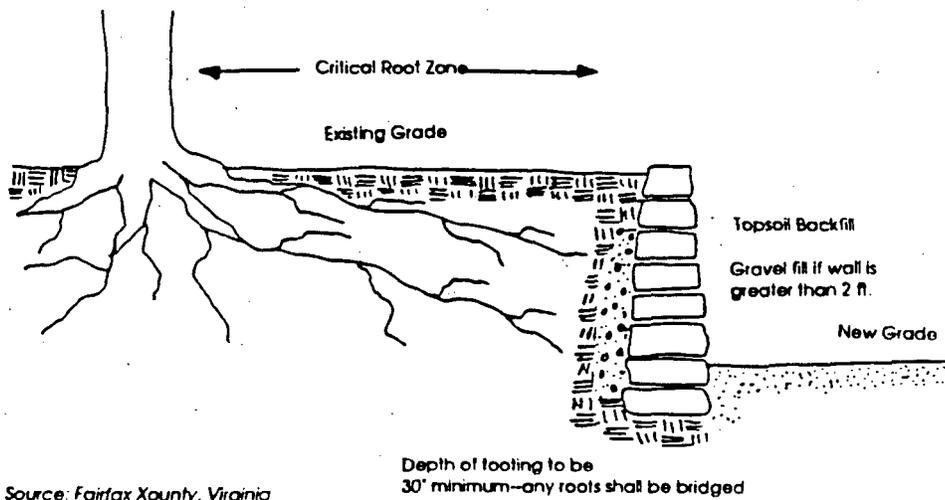
Source: Fairfax County, Virginia: Vegetation Preservation & Planting

Figure J- 13

Retaining Walls



Source: Fulton County, Georgia
Tree Preservation Ordinance



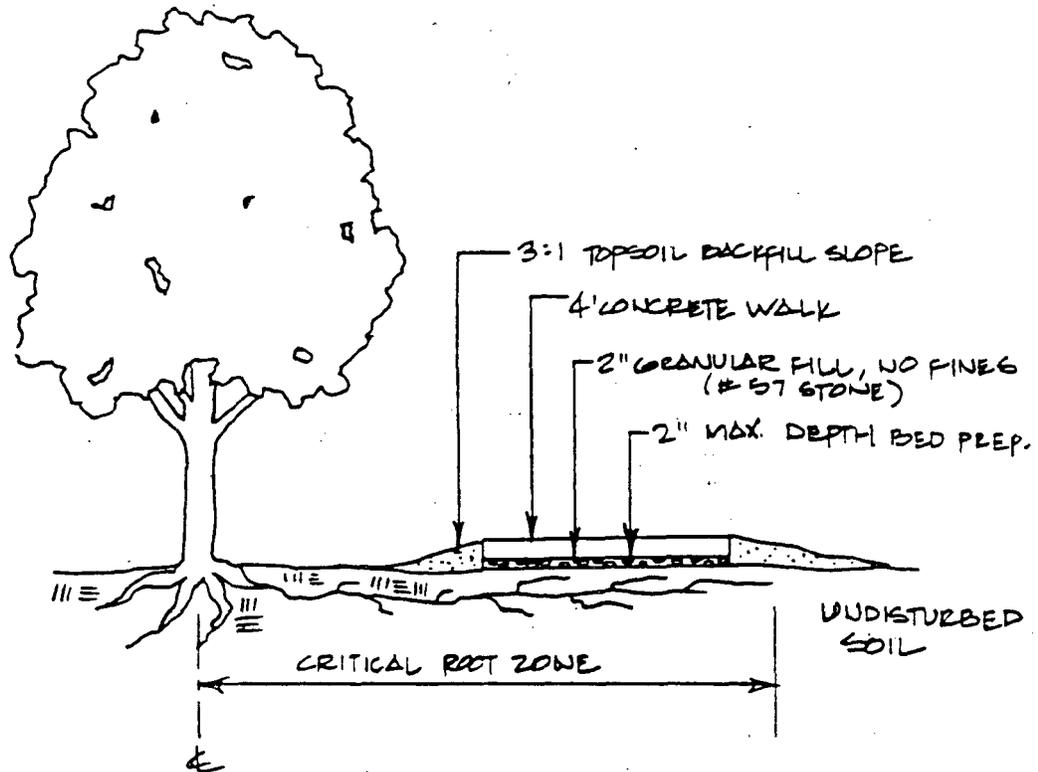
Source: Fairfax County, Virginia
Vegetation Preservation & Planting

Note:

1. Wall should be constructed outside the critical root zone.

Figure J-14

Raised Sidewalk



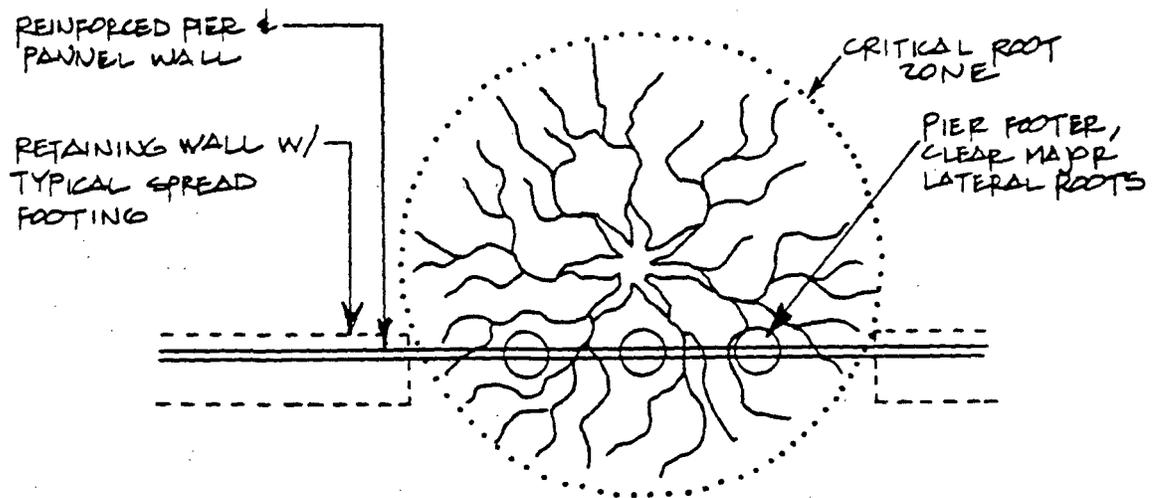
Notes:

- 1. Bed preparation should not exceed 2 inches
- 2. Granular fill should contain no fines
- 3. Minimize width of sidewalk; should be no wider than 4 feet

Source: City of Gaithersburg, Maryland: City Tree Manual

Figure J-15

Reinforced Pier and Panel Wall



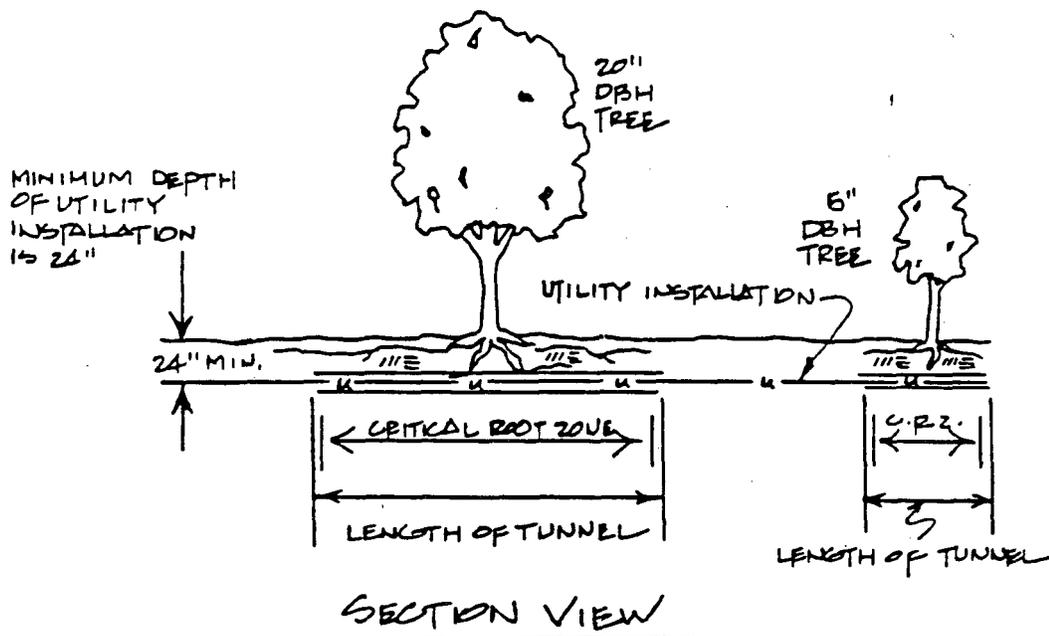
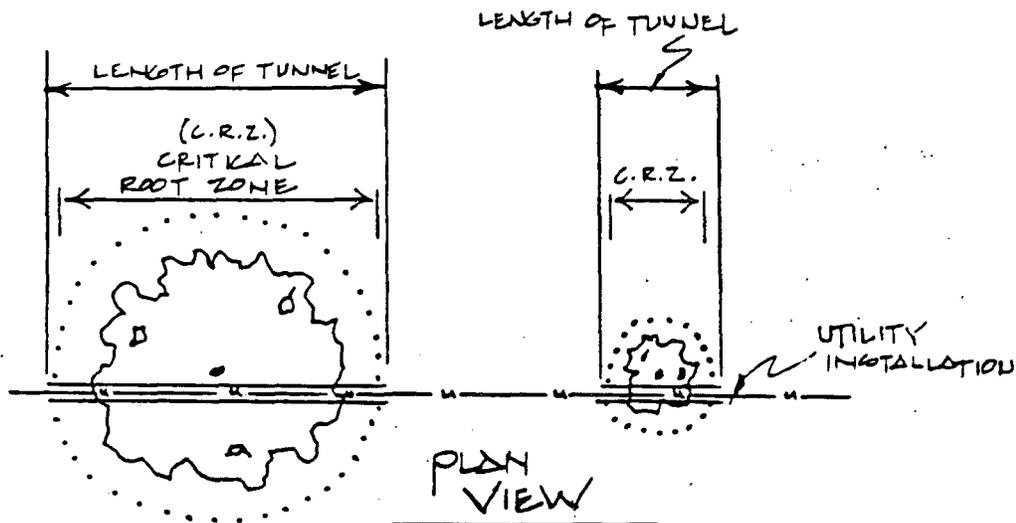
Notes:

1. Area of disturbance should be minimized
2. Care should be taken to avoid major lateral roots
3. Roots should be cleanly cut using a vibratory knife or other similar equipment

Source: Steve Clark & Associates

Figure J- 16

Tunnelling



Notes:

- 1. Tunnel under critical root zone
- 2. Tunnel should be 24 inches deep at a minimum
- 3. When tunnelling, aim for the trunk of the tree
- 4. When trenching, tunnel through the critical root zone

Adapted from: Fairfax County, Virginia: Vegetation Preservation & Planting

Appendix K

Sequential Reforestation Methods Evaluation Criteria

Sequential Tree Planting Methods Evaluation Criteria

Selective Clearing and Supplemental Planting

Depending on the extent of the disturbance, the residual forest may need specialized treatments to enable it to withstand the changes imposed on it. Selective clearing and supplemental planting is a method of restabilizing these altered forest stands.

Description: the management of residual tracts of forest through selective thinning and supplemental plantings in an effort to stabilize the smaller forest tract created during development.

**Evaluation
Criteria:¹**

Does the stand include dominant trees that are taller than the smallest lateral dimension of the stand?

Is the acreage of the stand less than 1/2 acre?

Has there been significant grade changes or soil compaction adjacent to sensitive species (such as tulip poplar) (See Table 3.4.1)

Does the stand include a strong regenerative population that would respond to release? (see Stand Summary Sheet data)

Design Guidance:

Trees whose height is greater than the width of the narrowest lateral dimension of the stand should be removed if a healthy understory exists.

Tulip poplars or other grade sensitive species may need to be removed if subjected to significant grade changes within their critical root zone.

If sun-sensitive species are abundant on stand margin, supplemental planting of tolerant plant materials is recommended, or these species may be removed. (See

¹If the responses to any of the evaluation criteria is affirmative, then this may be an appropriate use of selective clearing.

Appendix I)

If species prone to wind-throw (ex. Virginia pine) are within 1 tree height of structures, these species may be removed.

Snags 6-8 feet in length may be left for the benefit of wildlife, with consideration of safety.

Requirements:

Applicant must show selective clearing is the best alternative for the site.

Selective clearing objectives must be clearly defined in the reforestation plan. Selective clearing is not acceptable for purely aesthetic reasons.

Specific trees targeted in the selective clearing must be noted on plans.

Selective clearing must be done in such a manner that remaining trees and understory are not disturbed in the process.

Stumps should not be removed under any circumstance.

Selectively cleared areas must be planted with supplemental plant materials as described in Appendix I.

Transplant of Local Plant Materials

The use of transplanted materials is generally encouraged due to the hardiness and adaptability of local plant materials to local conditions. The risks associated with this practice are related to the methods used for transplanting, storing and planting transplanted materials.

Description: the use of on-site or locally obtained² plant materials which are transplanted for use on-site.

Evaluation

Criteria: Is the material to be transplanted amenable to disturbance? (See Table K-1)

Is the plant material suited for planting site (sunlight, soils, moisture regime)?

Design Guidance:

Climax species in general, are less tolerant than pioneer or early successional species (See Table K-1).

Larger trees (>6" dbh) need specialized care and equipment. Investigative root diggings are recommended for larger trees.

Best times for transfer is late fall (after leaf fall)/early winter.

Transplants are not recommended in spring after the buds start to grow.

Soft rooted species not recommended for transplant with frozen root ball. (See Table K-2)

Open grown trees grown in heavy or clay soils are preferred for transplant. Their rooting patterns are typically denser than forest grown trees.

Requirements:

Transplant of local materials must be shown to be the best alternative for the site.

² Within 100 mile radius of site.

Soils must be prepared in a field pit fashion, with proper amendments.

Root balls must meet or exceed standard nurserymen specifications.

Species stocking requirements described in section 3.6 must be met.

If tree banks are used, the location, treatment and schedule for banking and transplant must be described.

Nursery Stock

The use of nursery stock is also an option for reforestation. Of primary concern is the hardiness of the nursery stock for the climate and conditions of the planting site. For this reason, there is a preference for the preservation of local genetic stock.

Description: The use of plant material transported from local (within a 100 mile radius) nurseries for reforestation or afforestation.

Evaluation Criteria:

Species must be adapted to conditions of planting site.

Requirements:

Species native to Maryland shall be used unless shown to be unavailable. Local native genetic stock are recommended for better survivability.

Stock must meet standard nurserymen specifications.

Landscaping

Landscaping can be counted towards the reforestation or afforestation requirement. This method may be most appropriate for high use areas adjacent to structures or as visual barriers to adjacent land uses.

Description: the planting of a mixture of trees or shrubs with a primary intent of creating an aesthetic vegetated area adjacent to structures.

Evaluation Criteria:

Is the site 2500 square feet or greater in size with a minimum width of 35 feet?

Is the area adjacent to human structures?

Design Guidance:

These areas may be appropriate adjacent to park-like settings, picnic areas or playgrounds.

Native plant materials or cultivars of native plants are recommended.

Requirements:

For every 2500 sq. ft. of area, there must be no less than 7 major shade trees, and 20 shrubs.

Natural Regeneration

Under natural conditions, the lands of this region have remarkable abilities to regenerate forests. When humans attempt to encourage or recreate this phenomena, the results are much less impressive. The problems lie in the numerous variables which effect the success of this process and the number of unknowns.

Description: the preparation and management of cleared areas to allow for the regeneration of forests through natural recruitment by seed bank, standing seed crop or asexual sprouting.

Evaluation Criteria:

Does the site have suitable regenerative source and distribution mechanism for a stable population of target species?

Are the physical conditions (soils, sunlight, moisture, and cover) and suitable for encouraging natural regeneration or suitable plant growth?

Design Guidance

Best used in low visibility, low use areas.

Treatment is extremely species and site specific. Therefore, it is recommended that the plan must be prepared by professional Forester.

Management and monitoring of these areas should be intensive for these areas.

Requirements:

Plan must describe in detail how the above factors will be addressed and detailed information on the method of regeneration and the target forest association being designed.

Construction equipment must be prohibited from this area, through signage, fencing and plan delineation.

If using soil seed bank for regeneration, the original seed bed, or other local suitable seed source must not be disturbed.

Soils must be stabilized with an appropriate cover material (non-turf building).

Table K-1

General Transplant Tolerance

High Transplant Tolerance

Malus spp. (apple)
Fraxinus spp. (ash)
Ulmus spp. (elm)
Celtis occidentalis (hackberry)
Tilia spp. (linden)
Plantanus occidentalis (sycamore)
Populus spp. (poplar)
Salix spp. (willow)
Gleditsia triacanthos (honey locust)
Quercus palustris (pin oak)

Low Transplant Tolerance

Carya spp. (hickory)

Juglans spp. (walnut)
Juglans cinerea (butternut)
Sassafras albidum (sassafras)
Nyssa sylvatica (tupelo)
Quercus alba (white oak)

Table K-2

Transplanting Tolerance -- Frozen Root ball

High Transplant Tolerance

Malus spp. (apple)
Ulmus spp. (elm)
Gleditsia triacanthos (honey locust)
Tilia spp. (linden)
Acer spp. (maple)
Pinus resinosa (red pine)
Pinus strobus (white pine)
Pinus sylvestris (Scotch pine)

Low Transplant Tolerance

Betula spp. (birch)
Cornus spp. (dogwood)
Tsuga spp. (hemlock)
Magnolia spp. (magnolia)
Quercus spp. (oak)
Liquidambar (sweet gum)
Liriodendron tulipifera
(tulip tree)

Appendix L

Soil Treatment Guidance

SOIL TREATMENT GUIDANCE

PROBLEMATIC RANGE¹²

Soil Characteristics	Low	Medium	High	Corrective Measures for Consideration
<u>Chemical</u>				
ph'				
Acid Soils	<7-6	<6.0	<4.0	Add lime, select low pH-adapted species
Alkaline Soils	7-<7.5	>7.5	>8.5	Add OM, sulfur, and acidifying fertilizers, select high pH-adapted species
Cation Exchange Capacity' (CEO) meg/100g	>10	>5	<3	Add OM and soil amendments with high CEC; fertilize regularly
Fertility'		variable		Test N, P, and K levels and micro-nutrients commonly deficient or toxic; add OM and encourage micro-organism growth; adjust the pH; use low demand, adapted plants; if deficient, DO NOT over water; leach if toxic levels occur.
Chemically Polluted' Soils	numerous chemicals & concentrations			Identify the polluting chemicals; detoxify, leach, remove or abandon site; train personal to prevent; stockpile construction materials and chemicals off site; void spilling pollutants; monitor storage tanks for leaks, repair immediately

1. Approximately determinations, subject to site parameters and subjective judgement
 2. Adapted from: USDA Forest Service, Urban and Community Forestry, p. 181-184, 1990.
 3. Requires determination in a soil testing laboratory

PROBLEMATIC RANGE¹

Soil Characteristics	Low	Medium	High	Corrective Measures for Consideration
<u>Physical</u> Soil Textures Sand	<50%	>75%	>90%	Add OM, irrigate frequently
Clay, Kaolinitic ²	<25%	>50%	>65%	Add OM, DO NOT over irrigate, reduce traffic and compaction
Clay, Expandable ²	none	any	>10%	Reclaim with gypsum and leaching, DO NOT plant perennials until reclaimed
Clay & Silt	<30%	>50%	>75%	Add OM, irrigate correctly, deep till, aerate and reduce compaction and traffic
Structure,		variable		Eliminate compaction, traffic, add OM; manage beneficial micro-organism and root growth; reduce sodium concentrations; DO NOT over roto till, especially at high RPMs
Bulk Density ² , Mg/m ³ Clay	<1.1	<1.4	>1.5	Add OM; deep till
Loam	<1.2	>1.5	>1.7	Same as above
Soil Crusting		variable		DO NOT leave bare soil; add OM and mulch; grow groundcovers; eliminate traffic reduce droplet size of irrigation spray
Aeration Porosity ² , & large	>5	<2	<1	Add OM; deep till, eliminate traffic and pore volume compaction; increase earthworm population
Soil Permeability, Infiltration and Percolation Rates, in/hr.	>0.50	<0.25	<0.20	Add OM; deep till, aerate; use mulches, adjust irrigation rates accordingly
Debris and Litter		variable		Remove from soil surface and profile where possible

PROBLEMATIC RANGE!

Soil Characteristics	Low	Medium	High	Corrective Measures for Consideration
Depth to bedrock	>10'	<4'	<2'	Add top soil
Seasonal Water Depth	>10'	<4'	<2'	Remove source, improve surface drainage, install subsoil drains, Select trees tolerant of short-term standing water
Apparent Water Table Depth	>10'	<6'	<4'	Same as above
Restrictive Horizons	>10'	<6'	<4'	Deep till to break up or same as above or both
Impermeable layers	>10'	<6'	<4'	Deep till break up or same as above or both
Disturbed and Mixed Horizons and Profiles		variable		Add organic matter (OM) and mix well, DO NOT bring subsoil to surface
Cuts, Remaining Top Soil Depth	>4'	<2'	<1'	Replace top soil (blend into top of subsoil), DO NOT remove topsoil to subsoil
Fill Soil		variable		Match new texture and structure with and blend into existing soil; deep, uniform till is best
Wet, Putrid Soils	Brown	Tan	Gray, Black	Remove source of stagnant water; install surface and subsoil drainage then incorporate coarse OM
Soil Structure Massive, Platy	present vs. absent			Provide drainage, incorporate coarse OM, deep till

Appendix M

Planting Plan and Inspection Form

PLANTING PLAN (Example)

SITE NAME: _____

COUNTY: _____

DATE: _____

PREPARED BY: _____

PHONE#: _____

CONTACT PERSON: _____

PHONE#: _____

SITE LOCATION: _____

ACREAGE OF PLANTING: _____

SITE ASSESSMENT: _____

TYPE OF SITE PREP NEEDED: _____

<u>SPECIES</u>	<u># SEEDLINGS</u>		<u>B&B</u>	<u>*SOURCE</u>
	w/tree shelters	w/o tree shelters		
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

- (1) Draw a map of the planting site on the back of this form indicating planting pattern.
- (2) Include planting specifications.

Planting Inspection Form (Example)

SITE NAME: _____

INSPECTED BY: _____

COUNTY: _____

INSPECTION DATE: _____

SITE LOCATION: _____

ACERAGE OF PLANTING: _____ **% SURVIVAL:** _____

IS REINFORCEMENT PLANTING NEEDED?: **YES** **NO**

CAUSE OF MORTALITY: _____

COMMENTS: _____

Appendix N

Maryland State Champion Trees 1990

Maryland State Champion Trees

1990

Trees are one of the outstanding features in our landscape. Almost everyone likes trees for one reason or another. Trees vary in size. Some species do not attain a large size such as dogwoods or alder, yet their place in the landscape is just as important as an oak or yellow poplar.

In order to ensure fair comparisons for champion trees, certain measuring procedures are used. To qualify as a tree champion, the tree must have a single stem or trunk for at least 4.5 feet above ground level and have a total height of at least 15 feet. In multiple stemmed trees, only the largest stem should be measured.

The required information necessary to nominate or measure a big tree is:

1. Species - scientific name and common name
2. Location - county, town or road
3. Circumference - the girth, in inches, of the trunk at 4.5 feet above ground
4. Height - total perpendicular height of the tree, in feet
5. Crown Spread - the average of two measurements of the crown spread taken at right angles to each other, in feet
6. Condition - the general condition and health of the tree

The formula is: Total Points = Circumference(inches) + Height(feet) + 25% of the Average Crown Spread(feet)

Our list is constantly changing. The search for the biggest tree of each species continues. This list will be updated as more champion tree candidates are discovered. For the most up to date list, please call the Maryland Department of Natural Resources, Forestry Division at (301)974-3776.

STATE CHAMPION TREES

Scientific Name	Common Name	Diameter(Inches)
<i>Abies balsamea</i>	Balsam fir	32.2
<i>Abies concolor</i>	White fir	23.2
<i>Abies fraseri</i>	Fraser Fir	22.0
<i>Abies nordmanniana</i>	Nordman fir	35.0
<i>Acer negundo</i>	Boxelder	54.1
<i>Acer ornatum dentatum</i>	Cutleaf maple	4.5
<i>Acer palmatum</i>	Japanese maple	45.9
<i>Acer palmatum ornatum dentatum</i>	Japanese cutleaf weeping maple	7.0
<i>Acer platanoides</i>	Norway maple	61.5
<i>Acer pseudoplatanus</i>	Sycamore maple	32.5
<i>Acer rubrum</i>	Red maple	58.0
<i>Acer saccharinum</i>	Silver maple	97.1
<i>Acer saccharum</i>	Sugar maple	85.7
<i>Aesculus glabra</i>	Ohio buckeye	54.1
<i>Aesculus hippocastanum</i>	Horse chestnut	55.4
<i>Aesculus octandra</i>	Yellow buckeye	47.8
<i>Allianthus altissima</i>	Allanthus	45.5
<i>Albizia julibrissin</i>	Mimosa	27.4
<i>Alnus serrulata</i>	Hazel alder	3.2
<i>Ameianchier aborea</i>	Serviceberry	38.5
<i>Aralia spinosa</i>	Hercules club	4.8
<i>Asimina triloba</i>	Paw paw	8.9
<i>Betula nigra</i>	River birch	36.9
<i>Betula populifolia</i>	Grey birch	32.8
<i>Broussonetia papyrifera</i>	Paper mulberry	22.6
<i>Buxus sempervirens</i>	Boxwood	9.6
<i>Carpinus caroliniana</i>	Musclewood	10.8
<i>Carya cordiformis</i>	Bitternut hickory	50.0
<i>Carya glabra</i>	Pignut hickory	28.3
<i>Carya illinoensis</i>	Pecan	58.6
<i>Carya laciniata</i>	Shellbark hickory	40.1
<i>Carya ovalis</i>	Red hickory	29.3
<i>Carya ovata</i>	Shagbark hickory	56.4
<i>Carya pallida</i>	Pale-leaved hickory	29.9
<i>Castanea crenata</i>	Japanese chestnut	43.0
<i>Castanea dentata</i>	American chestnut	18.2
<i>Castanea mollissima</i>	Chinese chestnut	57.0
<i>Catalpa bignonioides</i>	Catalpa	65.6
<i>Catalpa speciosa</i>	Northern catalpa	62.4
<i>Cedrus atlantica</i>	Blue atlas cedar	36.6
<i>Cedrus deodara</i>	Deodar cedar	32.2
<i>Cedrus libani</i>	Lebanon cedar	43.3
<i>Celtis occidentalis</i>	Hackberry	61.1
<i>Chamaecyparis lawsoniana</i>	Port-ortford cedar	14.3
<i>Chamaecyparis thyoides</i>	Atlantic white cedar	33.1
<i>Chionanthus virginicus</i>	Fringe-tree	7.5
<i>Cladrastis lutea</i>	Yellow wood	42.7
<i>Cornus florida</i>	Flowering dogwood	32.2
<i>Cornus kousa</i>	Kousa dogwood	8.0
<i>Cotinus americanus</i>	Smoke tree	5.4
<i>Cryptomeria japonica</i>	Cryptomeria	15.0
<i>Cryptomeria japonica tobbii</i>	Cryptomeria	22.9
<i>Diospyros virginiana</i>	Persimmon	21.0
<i>Fagus grandifolia</i>	American beech	67.5

Scientific Name	Common Name	Diameter(Inches)
<i>Fagus sylvatica</i>	Copper beech	73.2
<i>Fagus sylvatica atropunicea</i>	Purple beech	49.0
<i>Fagus sylvatica heterophylla</i>	Cutleaf beech	38.2
<i>Fagus sylvatica pendula</i>	Weeping beech	54.1
<i>Fagus sylvatica purpurea</i>	Purple beech	43.3
<i>Fraxinus americana</i>	White ash	65.3
<i>Fraxinus excelsior</i>	European ash	55.1
<i>Fraxinus pennsylvanica</i>	Green ash	36.0
<i>Ginkgo biloba</i>	Ginkgo	65.9
<i>Gleditsia triacanthos</i>	Honey locust	45.9
<i>Gymnocladus dioica</i>	Kentucky coffeetree	43.3
<i>Hibiscus syriacus</i>	Althea	1.9
<i>Hovenia dulcis</i>	Japanese raisin tree	15.9
<i>Ilex opaca</i>	American holly	38.5
<i>Juglans cinerea</i>	Butternut	34.7
<i>Juglans nigra</i>	Black walnut	79.9
<i>Juglans regia</i>	English walnut	41.7
<i>Juniperus virginiana</i>	Eastern red cedar	49.4
<i>Kalmia latifolia</i>	Mountain laurel	2.9
<i>Lagerstroemia indica</i>	Crepemyrtle	9.2
<i>Larix decidua</i>	European larch	33.1
<i>Larix laricina</i>	Eastern Larch	43.3
<i>Libocedrus decurrens</i>	Incense cedar	52.2
<i>Lindera benzoin</i>	Spicebush	34.4
<i>Liquidambar styraciflua</i>	Sweetgum	67.2
<i>Liriodendron tulipifera</i>	Yellow poplar	95.5
<i>Maclura pomifera</i>	Osage orange	67.8
<i>Magnolia acuminata</i>	Cucumber magnolia	79.6
<i>Magnolia fraseri</i>	Fraser magnolia	22.6
<i>Magnolia grandiflora</i>	Southern magnolia	36.3
<i>Magnolia macrophylla</i>	Big leaved magnolia	29.0
<i>Magnolia soulangeana</i>	Saucer magnolia	29.9
<i>Magnolia virginiana</i>	Sweetbay magnolia	5.7
<i>Malus angustifolia</i>	Crabapple	30.6
<i>Metasequoia glyptostroboides</i>	Dawn redwood	29.9
<i>Morus alba</i>	White mulberry	44.9
<i>Morus nigra</i>	Black mulberry	79.0
<i>Morus rubra</i>	Red mulberry	47.8
<i>Nyssa sylvatica</i>	Black gum	103.2
<i>Paulownia tomentosa</i>	Paulownia	55.7
<i>Picea abies</i>	Norway spruce	53.2
<i>Picea pungens</i>	Blue spruce	24.5
<i>Picea rubens</i>	Red spruce	34.7
<i>Pinus echinata</i>	Shortleaf pine	21.7
<i>Pinus griffithii wallichiana</i>	Himalayan white pine	40.8
<i>Pinus nigra</i>	Austrian pine	41.4
<i>Pinus palustris</i>	Longleaf pine	17.8
<i>Pinus rigida</i>	Pitch pine	27.1
<i>Pinus strobus</i>	White pine	42.7
<i>Pinus taeda</i>	Loblolly pine	51.0
<i>Pinus virginiana</i>	Virginia pine	30.3
<i>Platanus occidentalis</i>	Sycamore	97.1
<i>Populus alba</i>	White poplar	37.3
<i>Populus deltoides</i>	Eastern cottonwood	71.3
<i>Populus grandidentata</i>	Bigtooth aspen	22.6
<i>Prunus avium</i>	Sweet cherry	31.5
<i>Prunus edoensis</i>	Japanese yoshino cherry	45.9
<i>Prunus serotina</i>	Black cherry	86.0
<i>Prunus subhirtella</i>	Weeping cherry	19.1

Scientific Name	Common Name	Diameter(Inches)
<i>Pterocarya fraxinifolia</i>	Caucasian wing nut	36.6
<i>Pyrus calleryana</i>	Bradford pear	17.8
<i>Pyrus communis</i>	Pear	43.6
<i>Pyrus malus</i>	Common apple	27.1
<i>Quercus acutissima</i>	Sawtooth oak	24.5
<i>Quercus alba</i>	White oak	119.1
<i>Quercus bicolor</i>	Swamp white oak	61.8
<i>Quercus coccinea</i>	Scarlet oak	61.5
<i>Quercus falcata</i>	Southern red oak	105.4
<i>Quercus falcata v pagodaefolia</i>	Cherrybark oak	45.9
<i>Quercus laevis</i>	Turkey oak	60.8
<i>Quercus lyrata</i>	Overcup oak	86.9
<i>Quercus macrocarpa</i>	Burr oak	58.9
<i>Quercus marilandica</i>	Blackjack oak	31.8
<i>Quercus michauxii</i>	Swamp chestnut oak	85.0
<i>Quercus muehlenbergii</i>	Chinquapin oak	51.6
<i>Quercus nigra</i>	Water oak	43.0
<i>Quercus palustris</i>	Pin oak	65.3
<i>Quercus phellos</i>	Willow oak	88.9
<i>Quercus prinus</i>	Chestnut oak	79.3
<i>Quercus rubra</i>	Northern red oak	70.4
<i>Quercus stellata</i>	Post oak	47.1
<i>Quercus velutina</i>	Black oak	66.9
<i>Rhus vernix</i>	Poison sumac	7.3
<i>Robinia pseudoacacia</i>	Black locust	70.1
<i>Salix babylonica</i>	Weeping willow	68.5
<i>Sassafras albidum</i>	Sassafras	50.3
<i>Taxodium distichum</i>	Baldcypress	65.9
<i>Taxus baccata</i>	English yew	58.3
<i>Taxus baccata stricta</i>	Irish yew	49.0
<i>Thuja occidentalis</i>	Arborvitae	24.2
<i>Tilia americana</i>	American basswood	59.6
<i>Tilia cordata</i>	Littleleaf linden	58.3
<i>Tilia europaea</i>	European linden	47.1
<i>Tilia heterophylla</i>	White basswood	56.1
<i>Tilia platyphyllos</i>	Big leaf linden	53.2
<i>Tsuga canadensis</i>	Eastern hemlock	46.8
<i>Tsuga caroliniana</i>	Carolina hemlock	13.4
<i>Ulmus americana</i>	American elm	76.4
<i>Ulmus campestris</i>	English elm	68.2
<i>Ulmus carpinifolia pendula</i>	Smooth leaved elm	44.3
<i>Ulmus parvifolia</i>	Chinese elm	42.0
<i>Ulmus rubra</i>	Slippery elm	32.2
<i>Viburnum prunifolium</i>	Black haw	6.7

Appendix O

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