Appendix A

ECONOMIC CONSIDERATIONS: LAND VALUES AND OPEN SPACE SYSTEMS

Land Values Associated with Hillside and Open Space Systems

Open space systems, which can include forested hillsides and ridges, generally refer to public or private lands that are conserved from development for various benefits including environmental, aesthetic, recreational and wildlife values. Some public and quasi-public open space systems have been created on ridges and others hillside resources will likely continue to be set aside to some degree, expanding upon the work of the Legacy Parks Foundation (see page 53). Existing open spaces include House Mountain, Seven Islands Wildlife Refuge, and the Urban Wilderness and Historic Corridor.

Public Open Space and Property Values

A review of various studies that analyze the impact of open space systems on surrounding property values shows positive impacts on land values.[1] The studies addressed different types of open space, level and hilly parks and such corridors as greenways. In looking at the studies, staff sees potential value in creating some public or quasi-public hillside and ridge top conservation areas.

The increased value of housing in relation to natural, passive parks is clear. Passive parks, which do not contain ball fields, tennis courts and similar facilities, have a positive relation to property values (see Table A-1). Texas A & M University research has shown that properties abutting passive parks have as much as a 20% increase in value.[2]

If selected hillside and ridge lines become part of a public or quasi-public open space system, the effect is typically more pronounced. Several studies indicate that to maximize increases in property values, open space systems should be linear because such corridors have longer perimeters that allow a larger number of properties to abut or be near open space. A local example of such a system is the linear park along Fort Loudoun Lake in Sequoyah Hills where property values are high both near and farther away from the park, owing in part, to the easy access to the open space.

Table A-1: Summary of Open Space Systems Effect on Property Values

Location	*Effect on Property Values*
Greenville, SC	• Home within 1500' of any park = +6.5% • Homes within 1500' of a small park = +8.5% • Homes 200' to 1500' of a medium to large park = +6%
Minneapolis, MN	• Average increase of $40,000 or a 20% increase in a home's value if adjacent to a park • Increase in home value up to 23% • Property values decrease 8.5% per every 1000' from a greenway • On an average priced home ($188,142) property values increased $42,000 if the neighboring park was a "nature park"
Hocking County, NY	Property values decrease $500 per each 100' the property is away from Watkins Glen State Park.
Hammond, NY	Property values decrease $72 per each 100' the property is away from Keewaydin State Park
Portland, OR	• Property within 1500' of park = $2,105 average increase in property value • Each additional open space acre = +$28.33 for each property • Home within 1500' of a park with large natural open space area = increase $10,648 • Land size of park must exceed 258 acres to maximize the effect on property values
Indianapolis, IN	Homes near Monon Trail sell on the average 11% higher
Boulder, CO	Properties within 3,200' of 3 greenways, values fall $4.20 for every foot a home is from the greenway
Austin, TX	Increase of 12.2% in the average value of all homes adjacent to the Barton Creek Greenbelt
Springfield, OH	Home values decrease $7.05 for each foot increase in distance from the Little Miami Trail
Apex, NC	Greenways (converted rails to trails project) added $5,000 to the price of adjacent homes
Seattle, WA	Homes near greenways hold values 6% higher
Coalition, NY	• 40' distance from park accounted for 33% of the land value • 1000' distance for 9% • 2500' distance for 4.2% at
Front Royal, VA	A developer sold all 50 parcels in 4 months that neighbored a 7-mile stretch along the Big Blue Trail.
San Diego, CA	A developer saw a 25% increase in sales price when he cut back the development 15% and added natural open space.

Summary of Various Studies

Local Economic Benefits

Open space systems positively affect more than property values for the economic gain of a municipality. Other economic benefits include:

- Increased tax base in areas along open space parks and greenways
- Open space systems are a short term cost to municipalities following acquisitions
- Open spaces cost less to provide public service (the average cost of services in open space areas is $0.37 in comparison to $1.15 for residential areas)
- Increase in open space users' expenditures can reach into the hundreds of thousands of dollars (including expenditures in conjunction with use and foot ware, clothing and equipment).

Perceptions of how open space systems affect property values

Various studies have addressed perceptions on how property values are affected by open space. While most people saw no increase or decrease in property value, 20 to 40 percent (depending on which city was studied) believed that the presence of open space systems enhanced their property values. Two studies noted that after the open space systems were created, adjacent landowners felt that their perceptions of potential negative impacts were not as serious as they had anticipated.[3]

Studies specific to hillsides and ridge tops

Two case studies were found that reflect open space systems' effect on property values in hilly forests or ridge lines.

Grand Rapids, Michigan

Statistical studies of properties in Grand Rapids concluded that property in close proximity to urban forest preserves have an increase in value from $5,800 to $8,400. The increase in value accounts for 7% of a home's value and 19% to 35% of a lot's value.

Green Bay, Wisconsin

Empirical studies conclude that lots in the northwest suburbs of Green Bay near ridge trails sell for 26% more than lots farther away.

In the course of Task Force work, various cities and counties were consulted on their hillside and ridge protection programs. While most places have not carried out specific economic analysis, the experiences of administrators of their jurisdictions (see below) indicate that property values have increased or have not been affected by local protection measures.

Fayetteville, Arkansas

John Groddard, of the Fayetteville planning office, acknowledged that before the enactment of their hillside ordinance, there was quite a battle of arguments from landowners about the potential negative impacts of proposed hillside conservation policy. However, after the policy was passed and several years have gone by, no negative feedback or legal issues have resulted from the policy adoption.

Asheville, North Carolina

Shannon Tuch, assistant director of the Asheville planning office, stated that following the enactment of their hillside/ridge top protection ordinance, the general perception is that the ordinance has positively affected the value of land and properties near the protected areas.

Wilbraham, Massachusetts

Jon Pearsall, noted that since the Ridgeline and Hillside District in the Town of Wilbraham was implemented in 1990, there have been no perceived negative impacts upon property values. The Ridgeline and Hillside District was implemented after a company had cleared the slope of the hillside before going into bankruptcy. The slope was left denuded of vegetation for years. The residents welcomed the protection district as the natural views have been maintained which relate to the high market value of properties adjacent to hillsides and ridgelines.

Stowe, Vermont

Tom Jackman has perceived a large positive impact upon property values adjacent to the Ridgeline/Hillside Overlay District (RHOD) as it stopped highly visible development on hillsides and ridgelines, erosion and water quality problems.

Lyme, New Hampshire

The planning commission of Lyme has seen no negative impacts on property values since the adoption of their Steep Slopes Conservation District. The primary goal of the district is to conserve natural space that surrounds Lyme and maintains Lyme's unique town character.

Newberry, New Hampshire

Denise Walter has received no negative feedback after the implementation of Newberry's Skyline/Hillside Conservation Overlay District. Newberry's overlay district focuses on several area hills.

Endnotes

1. Nicholls, Sarah and Crompton, John L. The Impact of Greenways on Property Values: Evidence from Austin, Texas. Journal of Leisure Research. Vol. 37, No. 3. pp. 321-341. 2005.

2. Crompton, John L. Impact of Parks on Property Values: A Review of the Empirical Evidence. Journal of Leisure Research. Vol. 33, No. 1. pp.1-31. 2001.

3. Lindsey, Greg. Property Values, Recreation Values, and Urban Greenways. Journal of Park and Recreation Administration. Vol. 22, No. 3. Fall 2004, Lutzenhiser, Margot and Netusil, Noelwah. The Effect of Open Spaces on a Home's Sale Price. Reed College. Portland, OR.

Appendix B

OVERVIEW OF THE HILLSIDE AND RIDGETOP PROTECTION AREA MODEL

MPC's Geographic Information System (GIS) staff examined several topographic modeling techniques to identify steep hillsides and ridgetops. The purpose of the research was to determine a consistent means to identify those steeper portions of the Knoxville-Knox County's landscape where conservation and development could be brought into better balance.

Several places (such as Asheville and Gatlinburg) use a set elevation, above which their hillside and mountain top protection codes apply. Knox County's hillsides and ridgetops could not be mapped by a constant topographic elevation because of relatively constant decreases in the elevations of streams, rivers and ridges from northeast to west. GIS staff found that the City of Fayetteville, which adopted protection measures several years ago created a modeling technique that could, with adaptations, be used across Knox County. A description of the adaptation process follows.

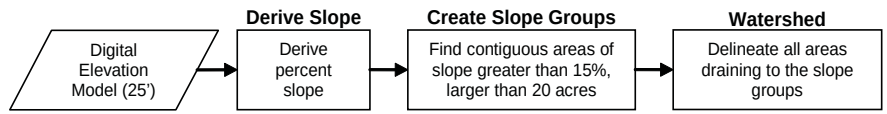
The City of Fayetteville Arkansas worked with the Center For Advanced Spatial Technologies at the University of Arkansas to develop a model which outline a hillside protection overlay. The output of the model serves as their overlay district. The only input to the model is a digital elevation model (DEM). Fayetteville used a 25 foot resolution DEM. That is, their elevation model, gridded the area within their city limits off in 25 foot by 25 foot cells. Higher resolution datasets within exist both in Fayetteville and in the Knox County Geographic Information System (GIS). However, for this type of modeling, a more a generalized set of data is appropriate as it smoothes small undulations and in the surface and helps to minimize the effect of small man made grades and cuts.

Initial Model Runs

Three major processes were used to delineate the overlay:

1. Derive the slopes
2. Identify "Slope Groups," which are defined as contiguous areas of slope over 15 percent that are larger than 20 acres.
3. Define the watershed of each slope group. This identifies all areas which are uphill of the slope group or all areas which drain to the slope group.

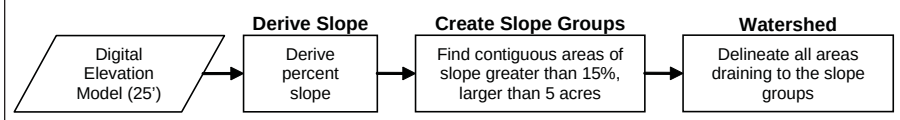
Figure B-1. Fayetteville Model



Model Revision 1

After several runs of the Fayetteville Model, MPC's GIS staff recommended several changes to help improve the consistency of the output. Generally, it was observed that Knox County's topography was more varied and complex than Fayetteville's and that a smaller slope group size was warranted. The slope group size was reduced to five acres and the model output was reevaluated.

Figure B-2. MPC Model Revision 1



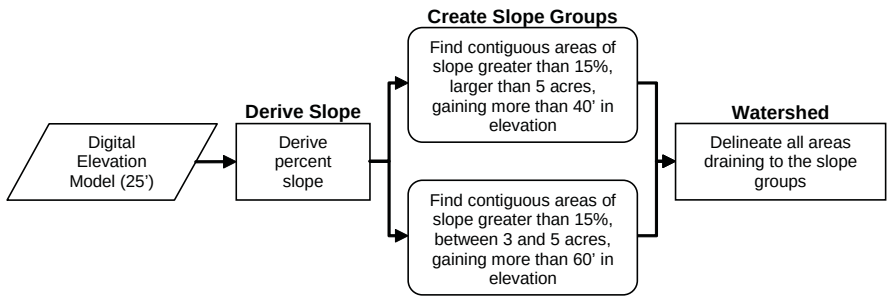
After the output was reviewed using 5 acre slope groups, three patterns emerged. First, the reduction of the slope group size threshold to under 5 acres improved the overall results. Second, some terrain was still not well defined using five acre threshold and that in some cases, lowering the slope group threshold even further would be desirable. Third, some undesirable slope groups were being included, some of which were over the 20 acre threshold. These slope groups included s teep river and stream banks which were long, thin bands of contiguous slope. Others groups were human-made terraces and cuts around features like large building pads and interstate related cut and fill.

Model Revision 2

A second model revision was created to address problems related to low elevation gain features. This version introduced the notion of elevation gain in evaluating the slope groups. In other words, the slope group or hill must be of a minimum height. Two rules would then govern which slope groups were included in the model:

1. Contiguous areas of slope greater than 15%, larger than 5 acres in size with an elevation gain greater than 40'
2. Contiguous areas of slope greater than 15%, between 3 and 5 acres in size with an elevation gain of at least 60'

Figure B-3. MPC Model Revision 2



Model Revision 3

The final revision of the model was created to address anomalies in slope groups such as interstate cuts, large stream banks and river bluffs. This revision inserted a manual slope group classification procedure that divided slope groups into two types: primary and secondary.

Secondary slope groups have one of the following characteristics:

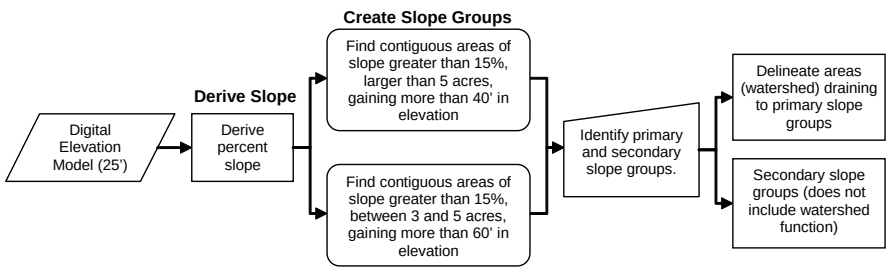
1. Low profile: Primarily encountered along rivers and streams. These are linear shaped portion of a slope group, longer than 500 feet, but with no portion of the spur gaining more than 40 feet.
2. Low profile connecting areas: These are areas greater than 500 feet in length connecting two larger slope group areas, also found along stream and river banks.
3. Low profile slope group: Primarily located along rivers and streams, these groups have an elevation gain more than 40 feet, but no portion of slope group gains more than 40 feet. Areas longer than 500 feet in length are considered secondary.
4. Human-created: Such slope groups are located in areas of significant human disturbance such as quarries, road cuts and areas of major grading.
5. Hydrologic Errors: Areas where a slope group crosses a stream bottom, small valley or minor depressions can cause watershed functions to inappropriately run uphill from the portion of slope group on the opposite side of the depression. Portions of these slope groups are removed.
6. River Bluffs: Slope group areas taller than 40 feet where the base of slope group is formed by a major river (Holston, French Broad, Tennessee or Clinch) and whose uphill area does not interact hydrologically with a slope group on an opposite hill or ridge face or whose slope group does not wrap continuously around to the ridge or hillside's opposite face.

All other slope groups not identified as secondary are considered primary.

Following the slope group classification, the final model output is generated. The final output is the sum of two components:

1. Primary slope groups and all areas which are uphill of the slope group (That is, areas which drain to the slope group).
2. Secondary slope groups (no watershed function is performed).

Figure B-4. MPC Model Revision 3



Appendix C

DEVELOPMENT IMPLICATIONS OF PROPOSED HILLSIDE AND RIDGETOP PROTECTION POLICIES

Introduction

The proposed Hillside and Ridgetop Protection Area is largely composed of moderate and steep slopes (those greater than a 15 percent grade) that rise to the ridge tops. That area is about one-third of Knoxville-Knox County's land resources.

The emphasis of Task Force work has been to find a balance between conservation and development. Steep slope residential density standards, which establish a policy of less density on steeper slopes, will continue to be recommended for rezoning cases. Those standards are:

Table C-1: Proposed Residential Density Standards

Slope Percentage	*Location*	*Density*
15 - 25	City, Urban and Planned Growth Areas	2 dwelling units per acre
25 - 40	City, Urban, Planned Growth and Rural Areas	1 dwelling unit per 2 acres
40 - 50	City, Urban, Planned Growth and Rural Areas	1 dwelling unit per 4 acres
50+	—	No development

The Basic Question

During the course of public input, some individuals observed that they felt that hillside areas are the only places left for future development. A county commissioner asked MPC staff to provide an assessment of the effect of the proposed policies on future land development. Consequently, staff analyzed the implications of the policies and has found that there is an array of opportunities to accommodate new development, both within and outside hillsides areas. The analysis is presented below.

Potential New Residential Development

Within the proposed Hillside and Ridge Top Protection Area, approximately 95 percent is intended for low intensity uses. These include agricultural (including forestry practices), rural residential and low density residential uses as depicted in the land use plans (adopted by MPC, City Council and County Commission).

There are approximately 82,000 acres of undeveloped land within the proposed Hillside and Ridgetop Protection Area. The Task Force has considered various scenarios for housing densities in that area with the basic principle being – the greater the slope, the less amount of housing density. In view of the proposed densities (see above and using 3 dwelling units per acre for slopes less than 15 percent), approximately 82,000 new dwelling units could be accommodated on the vacant land of the Hillside and Ridgetop Area. Those units could house about 205,000 residents. *Note: Using an average detached dwelling household size of 2.5 persons*.

Land Below the Hillside and Ridgetop Protection Area

There are about 70,000 acres of vacant land that is below the Hillside and Ridgetop Protection Area. (Farragut's land is not included in this number.) Current land use plans can be used to evaluate the potential office, commercial and residential development in that area, which is generally more level and extends from a roadway to the toe of a hillside. About 36,700 acres are in the Rural Area; if one-fourth of that area is developed for rural residential use, approximately 9,200 houses would be built, accommodating more than 23,000 people. *Note: Based on one acre lot sizes and 2.5 persons per household.*

There are almost 900 acres of vacant land for apartment development in the area, which could accommodate more than 12,000 new apartment units and could house approximately 20,000 people. In addition, there are approximately 3,000 vacant acres of land designated for office and mixed use (allowing a combination of office and medium density residential and sometimes retail uses). If one third of that land is developed for medium density residential uses, 14,000 dwelling units could be accommodated, housing over 23,000 residents. *Note: These figures are based on 1.7 people per medium density dwelling household and an average apartment density of 14 units per acre.*

There are about 22,700 vacant acres of land designated for low density residential uses, enough to accommodate more than 68,000 dwelling units and an estimated population of 170,000 in Knoxville-Knox County. *Note: An average housing density of 3 dwelling units per acre and an average household size of 2.5 persons were used in this estimate.*

Redevelopment of Rural Residential Parcels Outside the Hillside and Ridgetop Protection Area

Some rural residential uses (defined as an existing house on a two to ten acre parcel) will be redeveloped for higher intensity residential purposes. This is more likely along arterial road corridors or in growing urban or suburban areas, particularly when the value of the house is exceeded by potential value of new development. There are almost 9,000 acres of rural residential parcels in the City, its Urban Growth Boundary and the County's Planned Growth Area that are depicted for future low density residential or medium density purposes. More than 8,500 of the acres are depicted in sector plans for low density residential uses. If one-quarter of that land is redeveloped for low density residential uses (at four dwelling units per acre), there would be a net gain of 8,500 dwelling units on the level land outside the hillside area, enough units to accommodate 18,700 people. Almost 300 rural residential acres are depicted for medium density uses in sector plans. Redevelopment of one-fourth of those parcels would result in approximately 1,000 apartment or condominium units, enough to house over 1,700 people. *Note: At 14 dwelling units per acre and 1.7 persons per household*

Bottom Line on Housing for a Growing Population

existing vacant land proposed for housing within and outside the proposed Hillside and Ridgetop Protection Area is enough to construct approximately 185,000 dwelling units, enough housing for more than 435,000 people.

Redevelopment of a portion of the rural residential land proposed that is proposed for higher densities of housing in adopted plans would result in approximately 9,500 new dwelling units, enough housing for approximately 20,000 people.

Other Considerations

New Commercial Space

There are more that 1,900 vacant acres or rural residential uses that are proposed for commercial uses in adopted land use plans. That acreage can supply about 21 million square feet of new commercial space (or the equivalent of 175 new commercial centers). *Note: To provide a view of the extent of the opportunities, each of those centers could hypothetically contain a 60,000 square foot supermarket and an additional 60,000 square feet of shops and restaurants.*

Areas Not Considered with Significant Development Potential

Not all of the potential development and redevelopment opportunities in Knox County were examined in this overview. Other development opportunities include continued development in Farragut, mixed use development projects such as Northshore Town Center, and mixed use redevelopment projects, such as South Waterfront. All of which are substantial in adding housing, offices and retail space.

Appendix D

BEST MANAGEMENT PRACTICE: HILLSIDE RESTORATION

Cut Slope Stabilization and Reforestation

This is an approach to grading and tree planting on steep topography where forest cover is lost due to construction of buildings, structures and roads. It has been demonstrated to be an effective means for avoiding soil compaction and difficulties that can arise from trying to achieve tree growth on conventionally graded slopes. The method, which relies on reuse of organic matter, top soil, and rock fosters significant stormwater infiltration and woodland regeneration. It has been tested in the Appalachian region by scientists from the University of Kentucky and Virginia Tech, and is now the standard practice in surface mine site restoration.

Suitable Applications

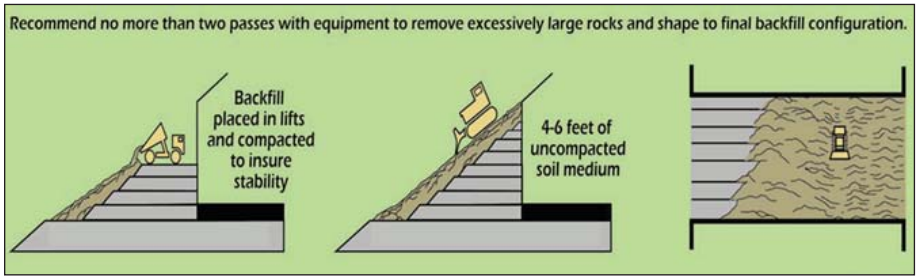
- This practice should be used in preparing a site for building construction that is at the edge of or within a hillside protection area, particularly in grading a natural slope of 15 percent or more.
- Road or facility construction at the toe of a forested slope may also be considered.

Proposed Hillside Forest Reclamation Process

Before clearing and grading a site, consider the following site priming practices to better support reforestation

Step 1.
Save topsoil and rock material from the disturbed areas of the site to create a rooting medium that is suitable for good tree growth. The medium should be comprised of topsoil and/or a topsoil and rock mixture and at a depth of 4 feet (lesser depths may be acceptable with compatible tree species).

Step 2.
Loosely grade (maximum of 2 passes with heavy grading equipment) the topsoil or topsoil and rock mixture established in step one to create a non-compacted growth medium. Trees will not survive in heavily compacted soils.



Step 3.
Mimic natural landforms when creating cut and fill areas, rather than heavily benched/terraced patterns. The majority of the backfill should be placed and compacted using standard engineering practices – but not as the final surface.

That surface layer ,which will form the forest's soil, should be at least four feet deep (lesser depths may be acceptable with compatible tree species) and only lightly graded (no more than 2 passes with equipment). Surface grading on longer and steeper slopes should be minimized, provided that doing so does not jeopardize stability.

To re-establish a healthy, native forest after disturbance, final grading must minimize surface compaction. This can be achieved by:

- dumping and leveling in separate operations,
- leveling with the lightest equipment available, using the fewest passes possible, and during dry conditions, and
- permanently removing all equipment from an area after leveling.

"Tracking in" operations (bulldozer treads creating depressions to trap seeds and water) actually compact the soil and hinder tree-growth, and should be avoided unless necessary for slope stability. Rubber tired equipment should not be used in final grading.

Step 4.
Use groundcovers that are compatible with growing trees. Groundcover for reforestation requires a balance between erosion control and competition for the light, water and space required by trees.

This can be achieved through the use of grasses and legumes that are slow growing, have sprawling growth forms and are tolerant of a wide range of soil conditions. Recommended mix examples include:

- Grasses - red top and perennial ryegrass
- Legumes – birdsfoot trefoil, white clover

This groundcover mix increases seedling survival and controls erosion in the long term as trees mature and the forest forms.

Step 5.
Plant two types of trees - early successional species for wildlife and soil stability, and native trees. The species should be mixed throughout the site, not planted in single-species blocks.

A mix of the following types of trees are recommended:

- Large maturing trees - oaks, black cherry, sugar maple, white ash and/or other native species (see the Tree Conservation and Planting Plan species list).
- Open site thriving trees – bristly locust, redbud, dogwood and crab apple (use those best suited for the area).

Step 6.
Use proper seedling care and tree planting techniques. Poor tree survival is often due to improper seedling handling or planting. Seedlings should never be allowed to dry out during storage and handling prior to planting, and should be kept dormant until planting. Seedlings should be:

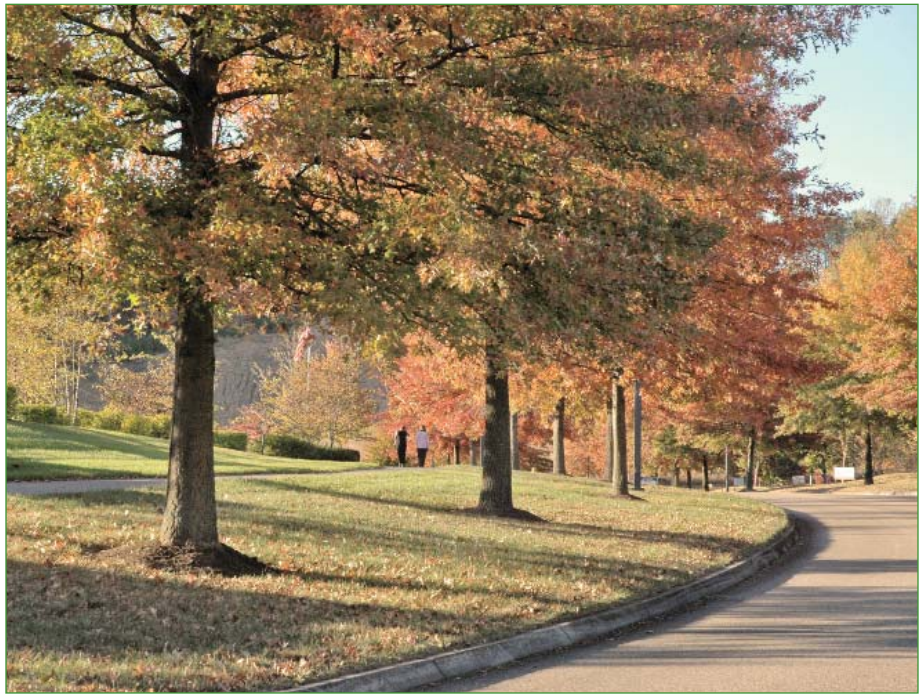
- Kept cool, but do not allow freezing
- Protected from direct sunlight
- Not exposed to high temperatures
- Planted in late winter to early spring
- Planted at a proper depth and firmly enough to ensure survival

Reputable and experienced tree planting crews are recommending for broad-scale operational tree planting.

Appendix E

BEST MANAGEMENT PRACTICE: RECOMMENDED TREES FOR STREETSCAPES, PARKING LOTS, YARDS AND REFORESTATION

The following tree species recommendations, which are organized by the size of the trees at maturity, have been adopted in several plans, including the Knoxville Knox County Tree Conservation and Planting Plan. The lists are also recommended by the Task Force on Ridge, Slope and Hillside Development and Protection, Tennessee Technology Corridor Development Authority and the Knoxville Tree Board, particularly to establish disease-tolerant, native trees for landscaping, water quality protection, habitat improvement and slope stabilization.



Suitable Applications

- Landscaping along streets and highways, including trees for median and sidewalk-related beautification and shading
- Selecting proper trees for use under or near overhead utility lines to avoid long term conflicts with the provision of electricity and related services
- Planting trees that will avoid conflicts with sight distance, such as a driver's ability to see vehicles and pedestrians at intersections
- Establishing native trees in reforestation and slope stabilization projects
- Providing developers, homeowners, and park, public works and horticulture officials with a list of trees that are suitable for parking lot and yard landscaping

LARGE TREE GROUP **Mature Height More than 50'**	Table E-1: LARGE TREE SPECIES RECOMMENDATIONS							
	Interchanges/ Grade Separations	**Medians**	**Parking Lots or Similar 'Hardscape'**	**Near Sidewalks**	**Under Utility Lines**	**Visibility Concern Areas****	**Yards**	**Hillside Reforestation *****
American Basswood (Linden)*	YES	YES	YES	YES	NO	YES	YES	YES
White Basswood (Linden)	YES	YES	YES	YES	NO	YES	YES	YES
American Beech*	YES	YES	NO[B]	NO[B]	NO	YES	YES	YES
European Beech	YES	YES	NO[B]	NO[B]	NO	YES	YES	YES
Blackgum*	YES	YES	NO	NO	NO	YES	YES	YES
Yellow Buckeye	YES	NO	NO	NO	NO	YES	YES	YES
Bald Cypress*	YES	YES	NO	NO	NO	YES	YES	NO
American Elm	YES	YES	YES[C]	YES[C]	NO	YES	YES	YES
Hackberry*	YES	YES	NO	NO	NO	YES	YES	YES
European Hornbeam	YES	YES	YES	NO	NO	NO	YES	NO
Ginkgo	YES	YES	NO[D]	NO	NO	YES	YES[E]	NO
Red Maple*	YES	YES	YES	YES	NO	YES	YES	YES
Sugar Maple*	YES	YES	YES	YES	NO	YES	YES	YES
Black Oak	YES	YES	NO	NO	NO	NO	YES	YES
Bur Oak	YES	YES	NO[B]	NO[B]	NO	YES	YES	YES
Chestnut Oak*	YES	YES	YES	YES	NO	YES	YES	YES
Chinkapin Oak*	YES	YES	NO[B]	NO[B]	NO	YES	YES	YES
English Oak	YES	YES	YES	YES	NO	YES	YES	NO
Northern Red Oak*	YES	YES	YES	YES	NO	YES	YES	YES
Post Oak	YES	YES	NO	NO	NO	NO	YES	YES
Sawtooth Oak	YES	YES	YES	YES	NO	YES	YES	NO
Scarlet Oak*	YES	YES	YES	YES	NO	YES	YES	YES
Shumard Oak*	YES	YES	YES	YES	NO	YES	YES	LIMITED
Southern Red Oak*	YES	YES	YES	YES	NO	YES	YES	LIMITED
White Oak*	YES	YES	YES	YES	NO	YES	YES	YES
Willow Oak*	YES	YES	YES	YES	NO	YES	YES	YES
Loblolly Pine*	YES	NO	NO	NO	NO	NO	YES	LIMITED
Pitch Pine	YES	YES[A]	NO	NO	NO	NO	YES	YES
Shortleaf Pine*	YES	YES[A]	NO	NO	NO	NO	YES	YES
White Pine*	YES	YES[A]	NO	NO	NO	NO	YES	YES
London Planetree/Sycamore*[F]	YES	YES	NO	NO	NO	YES	NO	NO
Tulip Poplar*	YES	YES	YES	YES	NO	YES	YES	LIMITED
Dawn Redwood	YES	YES[A]	NO	NO	NO	NO	YES	NO
Sweetgum*	YES	YES	NO[B]	NO[B]	NO	YES	YES	LIMITED
Black Cherry*	NO	NO	NO	NO	NO	NO	YES	YES
Virginia Pine*	NO	YES[A]	YES	NO	NO	NO	YES	YES
Laurel Oak	YES	YES	NO	YES	NO	NO	YES	NO
Winged Elm	YES	YES	YES	NO	NO	NO	YES	YES
Eastern Hemlock	NO	NO	NO	NO	NO	NO	YES	NO

A. If site does not obstruct visibility and median width is acceptable
B. Large nuts can cause difficulties under foot
C. If hybrid, disease-resistant variety is used
D. Because of slow-growing nature and 'stick-like' appearance
E. Male trees, only
F. Two different species; both can produce pollen, causing allergies

* Native to south central United States
**Tree placement and maintenance procedures should be respectful of sight distance
***Yes = well suited for shallow, poor soil quality on distrubed hillsides;
No = non natives, slow growth rate or riparian-oriented species;
Limited = better suited for good soil conditions and north-facing slopes

MEDIUM TREE GROUP **Mature Height 30' - 50'**	Table E-2: MEDIUM TREE SPECIES RECOMMENDATIONS							
	Interchanges/ Grade Separations	**Medians**	**Parking Lots or Similar 'Hardscape'**	**Near Sidewalks**	**Under Utility Lines**	**Visibility Concern Areas****	**Yards**	**Hillside Reforestation *****
Arborvitae*	YES	YES	YES	NO	NO	NO	YES	LIMITED
River Birch*	YES	YES	NO	NO	NO	YES	YES	NO
Catalpa*	YES	YES	NO	NO	NO	NO	YES	YES
Atlantic White Cedar	YES	YES[A]	YES[B]	NO	NO	NO	YES	NO
Deodar Cedar	YES	YES[A]	YES[B]	NO	NO	NO	YES	NO
YESEastern Red Cedar*	YES	YES[A]	YES[B]	NO	NO	NO	YES	YES
Kentucky Coffeetree	YES	YES	NO	NO	NO	YES	YES	YES
Amur Cork Tree	YES	YES	YES	YES	NO	YES	YES	NO
Cryptomeria	YES	YES	YES[B]	NO	NO	NO	YES	NO
Lace-bark Elm	YES	YES	YES	YES	NO	YES	YES	NO
Smooth Leaf Elm	YES	YES	YES	YES	NO	YES	YES	NO
Eastern Hemlock*	YES	YES[A]	YES[B]	NO	NO	NO	YES	NO
American Holly*	YES	YES	YES[B]	NO	NO	NO	YES	NO
Thornless Honeylocust	YES	YES	YES	YES	NO	YES	YES	YES
American Hornbeam*	YES	YES	YES	NO	NO	YES	YES	NO
Eastern Hophornbean*	YES	YES	YES	NO	NO	YES	YES	NO
Little-leaf Linden*	YES	YES	YES	YES	NO	YES	YES	NO
Silver Linden*	YES	YES	YES	YES	NO	YES	YES	NO
Black Locust*	YES	YES	YES	NO	NO	YES	YES	YES
Southern Magnolia*	YES	YES[A]	NO	YES	NO	NO	YES	NO
Sweetbay Magnolia*	YES	YES	YES[B]	YES	NO	NO	YES	NO
Hedge Maple	YES	YES	YES	YES	NO	YES	YES	NO
Trident Maple	YES	YES	YES	YES	NO	YES	YES	NO
Austrian Pine	YES	YES[A]	YES[B]	NO	NO	NO	YES	NO
Japanese Red Pine	YES	YES	YES	NO	NO	NO	YES	NO
Chinese Pistache	YES	YES	YES	YES	NO	YES	YES	NO
Sassafras*	YES	YES	NO	YES	NO	YES	YES	YES
Sourwood*	YES	YES	NO	YES	NO	YES	YES	LIMITED
Colorado Blue Spruce	YES	YES[A]	YES[B]	NO	NO	NO	YES	NO
White Spruce	YES	YES	YES[B]	NO	NO	NO	YES	NO
Weeping Willow[C]	YES	NO	NO	NO	NO	NO	YES	NO
Yellowwood*	YES	YES	YES	YES	NO	YES	YES	NO
Zelkova	YES	YES	YES	YES	NO	YES	YES	NO

A. Avoid planting where there are breaks in median for turning across travel lanes. Plant where a screen from on-coming car headlights is needed.
B. Use at edges of parking lots for border or buffering purposes. Do not use in islands or medians of parking lots.
C. Avoid near septic systems and similar problem areas.

* Native to south central United States
** Tree placement and maintenance procedures should be respectful of sight distance
*** Yes = well suited for shallow, poor soil quality on distrubed hillsides;
No = non natives, slow growth rate or riparian-oriented species;
Limited = better suited for good soil conditions and north-facing slopes

SMALL TREE GROUP **Mature Height Less than 30'**	Table E-3: SMALL TREE SPECIES RECOMMENDATIONS							
	Interchanges/ Grade Separations	**Medians**	**Parking Lots or Similar 'Hardscape'**	**Near Sidewalks**	**Under Utility Lines**	**Visibility Concern Areas****	**Yards**	**Hillside Reforestation *****
Blackhaw*	YES	YES	YES[A]	NO	YES	YES[B]	YES	LIMITED
Rusty Blackhaw*	YES	YES	YES[A]	NO	YES	YES[B]	YES	LIMITED
Red Buckeye*	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Carolina Buckthorn*	YES	YES	YES[A]	YES	YES	YES[B]	YES	LIMITED
Oriental Cherries	YES	YES	YES[A]	NO	YES	YES[B]	YES	YES
Carolina Cherrylaurel*	YES	YES	YES[A]	YES	YES	YES[B]	YES	LIMITED
Flowering Crabapple[C]	YES	YES	YES[A]	NO	YES	YES[B]	YES	LIMITED
Crepe Myrtle	YES	YES	YES[A]	YES	YES	YES[B]	YES	LIMITED
Flowering Dogwood*	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Kousa Dogwood*	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Pagoda Dogwood	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Autumn Flametree	YES	YES	YES[A]	YES	YES	YES[B]	YES	YES
American Fringetree*	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Chinese Fringetree	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Golden Raintree	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Cockspur Hawthorn	YES	YES	YES[A]	YES	YES	YES[B]	YES	LIMITED
Foster Holly	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Amur Maple	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Japanese Maple	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Pawpaw*	YES	YES	YES[A]	NO	YES	YES[B]	YES	LIMITED
Eastern Redbud*	YES	YES	YES[A]	YES	YES	YES[B]	YES	YES
Service Berry*	YES	YES	YES[A]	YES	YES	YES[B]	YES	LIMITED
Carolina Silverbell*	YES	YES	YES[A]	YES	YES	YES[B]	YES	LIMITED
European Smoketree	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
American Smoketree*	YES	YES	YES[A]	YES	YES	YES[B]	YES	YES
Sourwood*	YES	YES	YES[A]	YES	YES	YES[B]	YES	LIMITED
Mountain Stewartia	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Witch-hazel*	YES	YES	YES[A]	YES	YES	YES[B]	YES	NO
Southern Crabapple	YES	YES	YES[A]	NO	YES	YES[B]	YES	YES
Hawthorns[D]	YES	YES	YES[A]	NO	YES	YES[B]	YES	LIMITED

A. Should not be used for more than 25% of parking lot trees. Do not use in parking lot islands. May be used in parking lot medians
B. If properly trimmed. Some species will need to be pruned in their early years to allow space for pedestrian traffic; additional trimming may be needed.
C. Note that Flowering Crabapple and Red Cedar should not be planted near each other because of potential cedar apple rust disease.
D. Examples include Washington and Wintering Hawthorns

* Native to south central United States
** Tree placement and maintenance procedures should be respectful of sight distance
*** Yes = well suited for shallow, poor soil quality on distrubed hillsides;
No = non natives, slow growth rate or riparian-oriented species;
Limited = better suited for good soil conditions and north-facing slopes

Appendix F

MODEL CONSERVATION SUBDIVISION ORDINANCE

The following draft is the basis for a conservation subdivision ordinance that should be considered by Knox County interests. A similar ordinance will be prepared for the City of Knoxville. The elements of a conservation subdivision ordinance are discussed on pages 41-42.

Knox County Conservation Subdivision Ordinance

SECTION 1.1 PURPOSE

This regulation has been created to realize the following purposes:

A. To provide flexibility in design in agricultural and residential zoning districts to promote environmental resource conservation and efficient uses of the land.
B. To preserve in perpetuity unique or sensitive natural, historic and archaeological resources such as forested areas, steep slopes, ridgetops, prime farmlands, floodplains, wetlands, stream corridors, wildlife habitats, and places recognized on local, state and national registers of historic places.
C. To permit clustering of houses and structures on less environmentally sensitive areas.
D. To reduce the amount of infrastructure, including paved surfaces and utility easements, necessary for residential development.
E. To reduce erosion and sedimentation by minimizing land disturbance and removal of vegetation during residential development.
F. To promote interconnected open spaces throughout the community, particularly for wildlife and habitat protection.
G. To encourage street designs that reduce traffic speed and the amount of pavement.
H. To promote construction of convenient walking trails and bike paths both within the subdivision and connected to neighboring communities, businesses and community facilities to reduce reliance on automobiles, especially to provide subdivision residents the means to reach parks and schools.

SECTION 1.2 GENERAL REGULATIONS

A. **Applicability of Regulations.** The Conservation Subdivision option is available for zoning districts classified as Agricultural and Low Density Residential, including planned residential districts. Applicants shall comply with all other provisions of the zoning code and all other applicable laws, except those that are incompatible with the provisions contained herein.
B. **Ownership of Development Site.** The tract of land to be subdivided may be held in single and separate ownership or in multiple ownership. If held in multiple ownership, however, the site shall be developed according to a single plan with common authority and common responsibility.
C. **Housing Density Determination.** The allowable number of units in a Conservation Subdivision shall be determined using the Net Density Calculation or the Yield Plan method. Density bonuses may be allowed up to 20% over the Allowed Units per Acre. Qualifying bonuses are outlined in Section 1.2.C.3.
   1. **Net Density Calculation:**
      This calculation can only be used for zoning districts where a specified units per acre has been determined (for example, Planned Development zoning districts). Density is determined by multiplying the net acres on the site by the approved number of units per acre (plus the applicable density bonus). The net acres of a site is the total acres (gross acres) minus the acreage of the following:
      a. Floodways,
      b. Bodies of water over 5000 square feet of contiguous area,
      c. Wetlands that meet the definition of the Army Corps of Engineers pursuant to the Clean Water Act,
      d. The areas of slope over 50 percent,
      e. Cemeteries and burial grounds.
   2. **Yield Plan:**
      This method determines how many detached, single-dwelling unit lots could be developed on a site using zoning and subdivision standards required for the site under a conventional development scenario. The number of lots in this plan will determine the density in the conservation subdivision before any density bonuses are applied.
      The Yield Plan must be prepared as a conceptual layout plan in accordance with the standards of the Minimum Subdivision Regulations,

containing proposed lots, streets, right-of-way, and other pertinent features. Although it must be drawn to scale, it need not be based on a field survey. However, it must be a realistic layout reflecting a development pattern that could reasonably be expected to be implemented, taking into account the presence of wetlands, floodplains, steep slopes, existing easements or encumbrances and, if unsewered, the suitability of soils for subsurface sewage disposal.

3. **Density Bonus Provision:**
   Density bonuses are awarded when a development plan incorporates one or more of the following:
   a. 50% or more of the required open space is protected in perpetuity by a legal instrument pursuant to Section 1.4.G.1.a of the Conservation Subdivision Ordinance -- 10% bonus;
   b. Land that is dedicated for public purposes. The decision whether to accept an applicant's offer to dedicate lands for public usage within a proposed subdivision shall be at the discretion of the County, or with a conservation organization (such as a parks foundation) acceptable by the County to hold the land in perpetuity for public use. The density bonus will be determined by the Planning Commission, based on park needs determined through adopted plans for the area -- up to a 10% bonus ;
   c. The dedicated open space is 60% in all zones other than Agricultural, in which case 70% is required and a 10% bonus may be provided as determined by the planning commission, taking into account the size of the conserved farm land.

D. **Road Width and Design Provisions.** In order to reduce the impact of stormwater runoff, conserve natural features of the site and reduce monetary and energy costs associated with road development and maintenance, the following road design standards may be used in creating conservation subdivisions:
   1. Road pavement width (and on-street parking, Average Daily Traffic/ADT) requirements:
      a. 20 feet (no parking, <350 ADT)
      b. 20 to 22 feet (no parking, 350 to 1000ADT)
      c. 22 to 26 feet (parking on one side, <350ADT)
      d. 26 feet (parking on both sides, <350 ADT)
      e. 26 feet (one side, 350 to 1000 ADT);
   2. Rather than curb and gutter, grass-lined roadside swales may be used to handle storm water runoff when appropriate and approved by the County Engineering Department;
   3. Roads shall not traverse slopes greater than a 25 percent slope. If the applicant can demonstrate a hardship created by this requirement, the Planning Commission may approve such crossings.
   4. An ADA compliant sidewalk or walking path system shall be provided along streets within the subdivision. Linkages of the pedestrian system shall be made to pedestrian systems adjacent to the subdivision. Sidewalks shall be constructed of concrete, or asphalt (if separated from road pavement by four or more feet). Walking trails may be constructed of asphalt, crusher run or other approved material.

E. **Lot Width and Depth, Setbacks and Size Requirements.**
   1. The following two development approval options are available for properties with zoning that does not require development plan review. Properties with zoning that requires development plan review will use the same approval process as required by the zoning district:
      a. The zoning district lot size and setback and lot coverage requirement can be modified as shown in Table 3, however, lot sizes must be approved by the Health Department when using septic systems. Common areas may be considered outside the lots for wastewater systems.

Table 1			
Zoning Classification	Lot Size	Setbacks	Lot Coverage
	Reduce Minimum Requirement by:		Increase Maximum to:
Agricultural	60%	50%	45%
Low Density Residential	30%	30%	45%

      b. A development plan can be created using the same development approval requirements as the Planned Development zoning districts where the dimensional standards will be determined as part of the development plan approved by the Planning Commission, County Board of Zoning Appeals and any other regulating authority (for example, Health Department).
   2. All new dwellings shall meet the following building setback requirements:
      a. From all external roads ROW: 100 feet
      b. From all other tract boundaries: 75 feet
      c. From all cropland or pasture land: 100 feet
   3. All new lots that are on private septic/sewer must be approved by the Knox County Health Department. Off site septic systems are acceptable in Conservation Subdivisions with the appropriate agencies.

F. **Height:** As required by the applicable zoning district.

G. **Tree Protection Areas.** Areas designated for tree protection that are located outside of the dedicated open space shall be indentified on the site plan. These areas shall include the critical root zone and greatest extent of the dripline for the trees included in the area to be protected.

H. **Off-Street Parking:** As required by the applicable zoning district. Credits may be approved for on-street parking, subject to approval by the Planning Commission.

SECTION 1.3 APPLICATION REQUIREMENTS

A. **Concept Plan.** In addition to the requirements of a Concept Plan (roads, lots, drainage, etc) in the Minimum Subdivision Regulations, the following information is required:
   1. Site Analysis Map. The purpose of this map is to ensure that the important site features have been adequately identified prior to the creation of the concept plan, and that the proposed open space will meet the requirements of this article. The site analysis map shall include the following features:
      a. Property boundaries;
      b. All streams, rivers, lakes, wetlands, flood plains, sinkholes and other hydrologic features;
      c. Topographic contours of no less than 4-foot intervals
      d. Hillside and ridgetop protection district boundary;
      e. General vegetation characteristics (forested areas, grasslands, etc);
      f. Primary and locally important farmland soils;
      g. Soils prone to slippage;
      h. Existing roads and structures;
      i. Potential connections with existing or proposed public greenways, parks and facilities;
      j. Wildlife habitats;
      k. Scenic views.
   2. Conservation Areas Map. All Primary and Secondary Conservation Areas labeled by type, as described in Section 1.4 of this Article;
   3. Open Space Map. The planned location of protected open space as required in Section 1.4.B.

B. **Design Plan.** In addition to the engineering design, construction drawing and related requirements of a Design Plan in the Minimum Subdivision Regulations, the following information is required:
   1. The designated open space.
   2. Tree protection area(s) located outside a dedicated open space.

C. **Final Plat.** In addition to the requirements of a Final Plat in the Subdivision Regulations, the following information is required:
   1. All areas designated as open space (lots and/or easements) must be labeled as open space.
   2. Plan for Management of Open Space and Operation of Common Facilities. An open space management plan, as described in Section 1.4.F, shall be prepared and submitted.
   3. Instrument of Permanent Protection. An instrument of permanent protection, such as a conservation easement or permanent restrictive covenant as described in Section 1.4, shall be placed on the open space and recorded prior to final plat certification for recording.

D. Other Requirements. The Applicant shall adhere to all applicable requirements of the underlying zoning and the subdivision regulations that are not in conflict with the Conservation Subdivision regulations.

SECTION 1.4 OPEN SPACE

A. **Definition.** Open space is the portion of the conservation subdivision that has been set aside for permanent protection. Activities within the open space are restricted in perpetuity through the use of an approved legal instrument. Yards shall not be counted as open space.

B. **Open Space Requirement.** The required open space may be more than the minimum if the acreage of Primary Conservation Areas is more than the minimum required.
   a. Low Density Residential Zones – The minimum restricted open space shall comprise at least 40% of the gross tract area when public sewer and water is provided.
   b. Agricultural Zones – The minimum restricted open space shall comprise at least 60% of the gross tract area.

C. **Standards to Determine Open Space.**
   1. Primary Conservation Areas - The following are required to be included within the open space, unless the applicant demonstrates that this provision would constitute an unusual hardship and be counter to the purposes of this article:
      a. The 100-year floodplain;
      b. Riparian zones of at least 75 foot width from the bank of all waterbodies regulated by the applicable stormwater ordinance of the County;
      c. Slopes above 25 percent of at least a 20,000 square foot contiguous area;
      d. Wetlands that meet the definition used by the Army Corps of Engineers pursuant to the Clean Water Act;
      e. Known populations of endangered or threatened species, or habitat for such species;
      f. Archaeological sites and Native American burial grounds.
   2. Secondary Conservation Areas - The following should be included within the open space to the maximum extent feasible:
      a. Historic sites on the local, state or national registers;
      b. Existing healthy, native forests of at least one acre of contiguous area;
      c. Individual existing healthy trees greater than 8 inches caliper, as measured from four and half (4.5) feet above the ground;
      d. Other significant natural features and scenic viewsheds such as ridge lines, peaks and rock outcroppings, particularly those that can be seen from public roads or places;
      e. Existing trails that connect the tract to neighboring areas;
      f. Prime and locally important farmland soils;

g. Slopes 15 percent or more of at least 1 acre in contiguous area;
h. Areas within a designated hillside and ridgetop area;
i. Wildlife habitats;
j. Sinkholes.

3. Above-ground utility rights-of-way and small areas of impervious surface may be included within the protected open space, but cannot be counted towards the 40% minimum area requirement (with the exception of historic structures and existing trails, which may be counted). Large areas of impervious surface shall be excluded from the open space.
4. The Planning Commission may require that at least 10% of the open space consist of land that is suitable for active recreation space such as playfields.
5. The open space should adjoin any neighboring areas of open space, other protected areas, and non-protected natural areas that would be candidates for inclusion as part of a future area of protected open space, such as adjacent steep slopes or prime farmlands.
6. The open space shall be directly accessible to the largest practicable number of lots within the subdivision. Non-adjoining lots shall be provided with safe, convenient access to the open space, such as a walking trail. Such access shall be provided outside of a driving lane.

D. **Permitted Uses of Open Space.**

1. Uses of open space may include the following:
   a. Conservation of natural, archeological or historical resources; or similar conservation-oriented areas;
   b. Walking or bicycle trails;
   c. Passive recreation areas, such as open fields;
   d. Active recreation areas, provided that they are limited to no more than 10% of the required open space and are not located within Primary Conservation Areas. Active recreation areas may include impervious surfaces. Active recreation areas in excess of this limit must be located outside of the protected open space.
   e. Agriculture, horticulture, silviculture or pasture uses, provided that all applicable stormwater best management practices are used to minimize environmental impacts, and such activities are not conducted within Primary Conservation Areas;
   f. Landscaped stormwater management facilities, community wastewater disposal systems and individual wastewater disposal systems located on soils particularly suited to such uses. Such facilities shall be located outside of Primary Conservation Areas;
   g. Easements for drainage, access, and underground utility lines;
   h. Wetlands and/or bioretention areas created as part of stormwater quality improvements with an operations and maintenance plan recorded with the deed as required by the applicable stormwater ordinance of the County;
   i. Other conservation-oriented uses that the Planning Commission determines to be compatible with the purposes of this ordinance.

E. **Prohibited Uses of Open Space.**

1. Golf course acreage;
2. Roads, parking lots and impervious surfaces, except as specifically authorized in the previous sections;
3. Impoundments such as retention and detention basins (does not include wetlands and bioretention areas as outlined in Section 1.4 D.1.h);

F. **Ownership and Management of Open Space.**

Ownership

1. All required open space shall be permanently restricted from future subdivision and development. Under no circumstances shall any development be permitted in the open space at any time, except for those uses listed in Section 1.4D.
2. Ownership of open space may be one or more of the following:
   a. Fee Simple Dedication to the County: The County may, but shall not be required to, accept a portion of the common facilities, provided that:
      i. There is no cost of acquisition to the County; and,
      ii. The County agrees to and has access to maintain such facilities.
   b. Condominium Association: Common facilities may be controlled through the use of condominium agreements. Such agreements shall be in accordance with relevant state law. All open land and common facilities shall be held as "common elements."
   c. Homeowner Association: Common facilities may be held in common ownership by a homeowner association subject to all of the following being met:
      i. Membership in the association shall be automatic (mandatory) for all purchases of dwelling units therein and their successors in title.
      ii. The association shall be responsible for maintenance and insurance of common facilities.
      iii. The bylaws shall confer legal authority on the association to place a lien on the real property of any member who falls delinquent in dues. Such shall be paid with the accrued interest before the lien may be lifted.
      iv. Written notice of any proposed transfer of common facilities by the association or the assumption of maintenance for common facilities must be given to all members of the association and to the County no less than thirty (30) days prior to such event.

d. Private Conservation Organization: An owner may transfer either fee simple title of the open space or easements of the open space to a private non-profit conservation organization provided that:
   i. The conservation organization is acceptable to the County and is a bona fide conservation organization intended to exist indefinitely;
   ii. The conveyance contains appropriate provisions for proper reverter or retransfer in the event that the organization becomes unwilling or unable to continue carrying out its functions;
   iii. The open space is permanently restricted from future development through a conservation easement and the County is given the ability to enforce these restrictions; and
   iv. A maintenance agreement acceptable to the County is established between the owner and the organization.

e. Dedication of Easements to the Local Government: The County may, but shall not be required to, accept easements for public use of any portion of the common land or facilities. In such cases, the facility remains in the ownership of the condominium association, homeowner association, or private conservation organization while the easements are held by the County. In addition, the following regulations shall apply:
   i. There shall be no cost of acquisition to the County.
   ii. Any such easements for public use shall be accessible to the residents of the County.
   iii. A satisfactory maintenance agreement shall be reached between the owner and the municipality.

Management

1. Unless otherwise agreed to by the County, the cost and responsibility of maintaining common facilities and open space shall be borne by the property owner, condominium association, homeowner association, or conservation organization.
2. The applicant shall submit and the Planning Commission shall approve a Plan for Management of Open Space and Operation of Common Facilities ("Plan") in accordance with the following requirements:
   a. The plan shall define ownership;
   b. The plan shall establish necessary regular and periodic operation and maintenance responsibilities for the various kinds of open space (for example: lawns, playing fields, woodlands, pastures, croplands, meadows, etc.);
   c. The plan shall estimate staffing needs, insurance requirements, and associated costs and define the means for funding the maintenance of the open space and operation of any common facilities on an ongoing basis. In addition, the plan shall include the means for funding long-term capital improvements as well as regular yearly operating and maintenance costs;
   d. At the County's discretion, the applicant may be required to escrow sufficient funds for the maintenance and operation costs of common facilities for up to one year; and
   e. Any changes to the management plan shall be approved by the County, and in the case of areas dedicated to a local government by County Commission, following a recommendation of County Park Board, or its successor.
3. In the event that the organization established to maintain the open space and the common facilities, or any successor organization thereto, fails to maintain all or any portion thereof in reasonable order and condition, the County may assume responsibility for maintenance and may enter the premises and take corrective action, including extended maintenance. The costs of such corrective action may be charged to the property owner, condominium association, homeowner association, conservation organization, or individual property owners who make up a condominium or homeowner association and may include administrative costs and penalties. Such costs shall become a lien on said properties.

G. **Legal Instrument for Permanent Protection.**
1. The open space shall be protected in perpetuity by a binding legal instrument that is recorded with the deed. The instrument shall be one of the following:
   a. A permanent conservation easement pursuant to section 170(h) of the Internal Revenue Code, as amended, in favor of either:
      i. A land trust or similar conservation-oriented non-profit organization with legal authority to accept such easements. The organization shall be bona fide and in perpetual existence and the conveyance instruments shall contain an appropriate provision for retransfer in the event the organization becomes unable to carry out its functions; or
      ii. A governmental entity with an interest in pursuing goals compatible with the purposes of this ordinance.
   b. A permanent restrictive covenant for conservation purposes in favor of a governmental entity.
   c. An equivalent legal tool that provides permanent protection, if approved by the County.
2. The instrument for permanent protection shall include clear restrictions on the use of the open space. These restrictions shall include all restrictions contained in this article, as well as any further restrictions the applicant chooses to place on the use of the open space.

DEFINITIONS

The definitions of the Knox County Zoning Ordinance and Knoxville – Knox County, Tennessee Minimum Subdivision Regulations shall apply, with the following additions.

Conservation Easement: A nonpossessory interest of a holder in real property imposing limitations or affirmative obligations on the owner of the servient estate, the owner's heirs, and assigns with respect to the use and management of the servient land, structures or features thereon, and/or activities conducted thereon, which limitations and affirmative obligations are intended to preserve, maintain or enhance the present condition, use or natural beauty of the land, the open-space value, the air or water quality, the agricultural, forest, recreational, geological, biological, historic, architectural, archeological, cultural or scenic resources of the servient estate and is recorded in the register's office of the county in which the easement is located.

Conservation Areas, Primary: Lands upon which primary resources are located in conservation subdivisions. All Primary Conservation Areas are required to be located within the Open Space.

Conservation Areas, Secondary: Lands containing secondary resources that are conserved as part of the Open Space.

Critical Root Zone: The minimum area beneath a tree that must be left undisturbed in order to reserve a sufficient root mass to give a tree a reasonable chance of survival. The critical root zone is typically represented by a concentric circle centering on the tree trunk with a radius equal in feet to one and a half (1.5) times the number of inches of the trunk diameter at four and a half (4.5) feet above the ground: (CRZ in ft = 1.5 x D in.).

Holder: ***a.*** A public body empowered to hold and interest in real property under the laws of the state or the United States; or ***b.*** a charitable corporation, charitable association, or charitable trust, the purposes or powers of which include retaining or protecting the natural, scenic, or open-space values of real property, assuring the availability of real property for agricultural, forest, recreational, or open-space use, protecting natural resources, maintaining or enhancing air or water quality, or preserving the historical, architectural, archeological, or cultural aspects of real property.

Open Space: A parcel or parcels of land and/or water, within a conservation subdivision, set aside for the protection of natural and cultural resources. Greenway land consists of Primary and Secondary Conservation Areas and is permanently restricted against further development.

Tree Protection Area: Areas where trees, or strands of trees, are to be preserved and protected during project development.

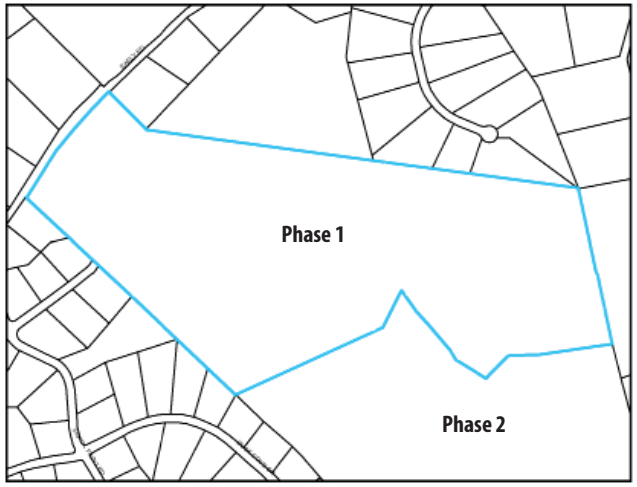
Appendix G

LAND DISTURBANCE CALCULATION

This example depicts the calculation method that would be used for future rezoning cases and use on review cases. The "Planned Zones" (for example, Planned Residential) would be recommended by MPC staff for any hillside-related case. Because the proposed development is to be considered via use on review (requiring site plan approval by MPC after both staff and public review), the rationality of the proposed clearing can be further considered in relation to the steepest forested slopes, water resources and similar concerns that may be inherent with specific sites.

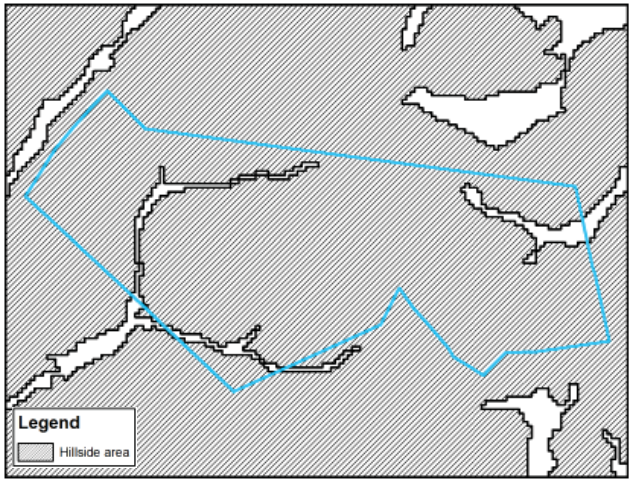
The following steps detail the process for determining how much land disturbance will be recommended in rezoning cases and for how land disturbance can be allocated throughout the site when drafting a site development plan within the Hillside and Ridgetop Protection Area.

Step 1: Determine site area.



The site area for development is not the entire parcel. In this case, the development has multiple phases. Only phase 1 will be reviewed for compliance with the land disturbance limitations since phase 2 will not be developed at this time.

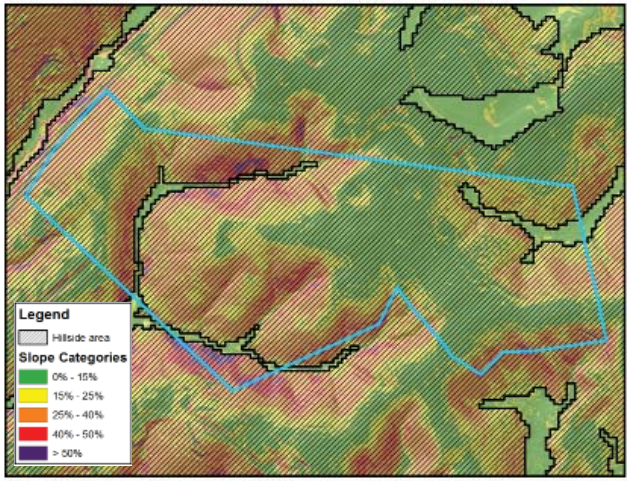
Step 2: Determine the Hillside and Ridgetop Protection Area within the designated development area.



This site is almost entirely within the Hillside and Ridgetop Protection Area. The site topology is that of a rolling hill with a relatively flat area on top. This site does not have an area that would be classified as a ridgetop.

The total acreage of the site is 82 acres, with 78 acres within the Hillside and Ridgetop Protection Area.

Step 3: Determine how many acres are in each slope category, within the Hillside and Ridgetop Protection Area.



Slope Category	Acres
0 - 15%	22.62
15% - 25%	22.47
25% - 40%	27.83
40% - 50%	4.65
>50%	0.70

Step 4: Calculate land disturbance limitations.

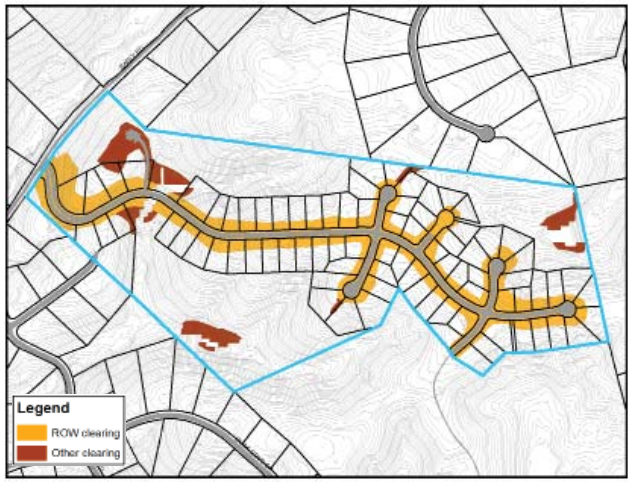
Land Disturbance Limitations within the Hillside & Ridgetop Protection Area			
Slope Category	**Disturbance Allocation**	**Acres**	**Allowed Disturbance**
0 - 15%	100%	22.62	22.62
15% - 25%	50%	22.47	11.24
25% - 40%	15%	27.83	4.17
40% - 50%	10%	4.65	0.47
>50%	0%	0.70	0
Ridgetop	15%	0	0
Total Acres of Disturbance Allowed			**38.49**

Each slope category has a certain disturbance allocation, as shown in the table. The acres in each slope category are multiplied by the disturbance allocation to give the allowed disturbance. The allowed disturbance for each slope category is added together to give the allowed disturbance for the entire site.

Of the 78 acres within the Hillside and Ridgetop Protection Area, 38.49 acres can be disturbed, as shown in the table.

While this disturbance could possibly be anywhere on the site, not being limited to certain slope groups, staff will consider such factors as very severe slopes to make recommendations regarding the most appropriate disturbance areas. Disturbance outside the Hillside and Ridgetop Protection Area does not count against the disturbance allowed.

Step 5: Determine a road and lot layout that minimizes land disturbance with the Hillside and Ridgetop Protection Area, and determine other disturbance needs within this area. (Example: detention ponds and utility installation)



In this example, the development density is 1 dwelling unit per acre.

- ROW clearing = 18.14 acres
- Other clearing = 3.37 acres

This leaves 16.98 acres that can be disturbed for other disturbance needs, like building houses on individual lots.

Note: This development has approximately 37 acres in open space.

Step 6: Determine how much land disturbance to allocate to each lot. On average, 32% of each lot can be disturbed outside of what was disturbed to install the infrastructure.

When determining the disturbance allowed per lot, the developer may want to take into consideration the size, topography, and previous disturbance on a lot.

For example:

During the installation of infrastructure, lot 1 had 94% disturbance and lot 2 had 15% disturbance.

The developer may want to allow lot 2 to disturb a high percentage of the lot, while allowing lot 1 to disturb a very low percentage.

Appendix H

SUMMARY OF DEVELOPMENT INCENTIVES

Reduced Setbacks and Peripheral Boundaries

In order to reduce slope cuts, provide:

1. Allowances for reduced front yard setbacks for hillside residential, and
2. Consideration of reduced peripheral setback in zones, such as planned commercial, that require use on review.

Means to implement the incentive: *Make an addition to supplementary regulations with references to specific zoning districts.*

Reduced Road and Right of Way Widths

In order to reduce hillside cuts and create cost savings, reduce:

1. Local road width standard in hillside protection area from 26 feet to 20 feet, and
2. Required right of way from 50 feet to 40 feet (this still allows utilities to either side of pavement).

Means to Implement the Incentive: *Make an additional provision in subdivision regulations and cross-reference in supplementary zoning regulations.*

Conservation Subdivision Ordinance

In order to set aside forested steep slopes and other natural areas, and provide the means to reduce development costs, develop conservation subdivision regulations that provide:

1. Allowances for smaller lots and reduced setbacks, enabling the establishment of the open space areas,
2. Allowances for reduced road widths, and opportunities for a density bonus, including a 10% bonus for conserving open space in perpetuity and up to an additional 10% bonus for land dedicated for public purposes.

Means to Implement the Incentive: *Adopt ordinance (see draft in Appendix F) with appropriate references in zoning and subdivision codes.*

Reduced Required Parking

In order to reduce hillside clearing and offer an opportunity for cost savings provide developers the opportunity to reduce parking areas, including:

1. Consideration of minimum and maximum standards, and
2. Reduction in parking stall size (county) from 200 square feet.

An example of a means to reduce parking requirements is a minimum and maximum option. (Derived from the *Tennessee Technology Corridor Development Authority Design Guidelines*, 2010).

Off-Street Parking Space Requirements*		
Land Use	**Minimum Number of Spaces Required**	**Maximum Number of Spaces Allowed**
Restaurant	7.5 per 1000 sq. ft. of Gross Floor Area	15 per 1000 sq. ft. of Gross Floor Area
Office	3 per 1000 sq. ft. of Gross Floor Area	4.5 per 1000 sq. ft. of Gross Floor Area
Retail Establishments	3 per 1000 sq. ft. of Gross Floor Area	4.5 per 1000 sq. ft. of Gross Floor Area
Office Park, Multi-tenant Office Bldg.	2 per 1000 sq. ft. of Gross Floor Area	3.5 per 1000 sq. ft. of Gross Floor Area
Shopping Center	2 per 1000 sq. ft. of Gross Floor Area	3.5 per 1000 sq. ft. of Gross Floor Area
Research & Development Facility, Lab	2 per 1000 sq. ft. of Gross Floor Area	3.5 per 1000 sq. ft. of Gross Floor Area
All Other Non-Residential Uses	2 per 1000 sq. ft. of Gross Floor Area	3.5 per 1000 sq. ft. of Gross Floor Area
Warehousing, with Office Space	1 per 1000 sq. ft. of Gross Floor Area	1.5 per 1000 sq. ft. of Gross Floor Area
Industrial and Manufacturing	1 per 1000 sq. ft. of Gross Floor Area	1.5 per 1000 sq. ft. of Gross Floor Area
Hotel, Motel	1 per Room or Suite	1.5 per Room or Suite
Church or similar place of worship	1 per 4 seats in Main Worship Area	1 per 3 seats in Main Worship Area

** On-street parking spaces may be used to reduce either the minimum number required or the maximum number allowed for off-street parking spaces.*

Means to Implement the Incentive: *Make an addition to supplementary regulations.*

KNOXVILLE·KNOX COUNTY

MPC

METROPOLITAN PLANNING COMMISSION

TENNESSEE