

PRESERVING OPEN SPACE IN THE TRIANGLE:  
WHERE CONSERVATION SUBDIVISION CAN MAKE THE GREATEST DIFFERENCE

BARBARA BEECHWOOD

A Masters Project submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Masters of Regional Planning in the Department of City and Regional Planning.

Chapel Hill

2006

Approved by:

---

Advisor: [REDACTED]

## **ABSTRACT**

**BARBARA BEECHWOOD: Preserving Open Space in the Triangle: Where Conservation**

**Subdivision Can Make the Greatest Difference**

(Under the direction of Dr. Philip R. Berke)

This project is predicated on the need for more effective open space conservation tools in rapidly urbanizing regions. It recognizes the fact that it is essential for any viable solution to incorporate a win-win between development and conservation. Although a misunderstood and under utilized option, conservation subdivision development holds great potential to address multiple concerns for all of the stakeholders in the land development and conservation process.

Employing a systematic method that begins with the national perspective and percolates down to the individual parcel, this study examines where to site conservation subdivision development so that it addresses the majority of factors influencing the open space site selection process (green infrastructure, ranking and priority, economic concerns, relevant policies, smart growth issues). This report will demonstrate how intentionally targeting a location where conservation subdivision can balance multiple interests can result in ecologically sound, cost-effective and civically responsible open space preservation.

## **ACKNOWLEDGEMENTS**

This project was graciously supported by the following generous people:

Dr. Philip R. Berke, Professor of Land Use and Environmental Planning, Director of Graduate Studies, Department of City and Regional Planning, University of North Carolina, Chapel Hill. As my master's project advisor, Dr. Berke's patience was remarkable and his guidance indispensable.

Dr. Dean L. Urban, Professor of Landscape Ecology, Nicholas School of the Environment, Duke University. I am grateful to Dr. Urban for his review of the GIS maps, and his perspectives on the ecological functions of open space corridors.

Dr. George Hess, Associate Professor of Forestry, Department of Forestry and Environmental Resources, North Carolina State University. I am indebted to Dr. Hess for sharing his leadership experience with the Triangle GreenPrint Project.

Dr. Toddi Steelman, Assistant Professor, Department of Forestry and Environmental Resources, North Carolina State University. I am thankful to Dr. Steelman for her knowledge of the state open space and natural resource policy in the Triangle area.

My appreciation to Greg Schuster from the Wake County Parks and Open Space Department for assistance in acquiring Wake County GIS data. Lastly, my gratitude to Laurel Ferejohn for assistance with editing the text.

## *TABLE OF CONTENTS*

<b>ABSTRACT</b> .....	ii
<b>ACKNOWLEDGEMENTS</b> .....	iii
<b>List of Tables and Figures</b> .....	vii
<b>List of Maps and Drawings</b> .....	viii
<b>Chapter 1. Introduction</b> .....	9
<b>1.1 Statement of Purpose</b> .....	<b>9</b>
<b>1.2 Organization of the Paper</b> .....	<b>10</b>
<b>1.3 An Overview of the Issue</b> .....	<b>11</b>
<b>1.4 The Stakeholders</b> .....	<b>11</b>
<b>1.5 Some Possible Causes</b> .....	<b>12</b>
<b>1.6 Potential Solutions</b> .....	<b>12</b>
<b>1.7 Summary</b> .....	<b>13</b>
<b>Chapter 2. The State of Open Space in the US</b> .....	14
<b>2.1 An Introduction to Open Space Conservation</b> .....	<b>14</b>
<b>2.2 The Functions of Open Space in Metropolitan Regions</b> .....	<b>16</b>
<b>2.3 Linking Open Space in Metropolitan Regions</b> .....	<b>17</b>
2.3.1 Regional Open Space Linkage across States .....	18
2.3.2 Metropolitan Area Open Space Linkage.....	19
2.3.3 Local Open Space Corridors.....	21
<b>Chapter 3. Open Space Conservation in the Triangle</b> .....	23
<b>3.1 Land Use Change in the Triangle Area of North Carolina</b> .....	<b>23</b>
<b>3.2 The State of Open Space Conservation in the Triangle</b> .....	<b>25</b>
3.2.1 Plans, Programs and Initiatives: Statewide Efforts .....	25
3.2.2 Plans, Programs and Initiatives: Regional and Local Efforts.....	28
3.2.3 Barriers to Successful Open Space Conservation Efforts .....	31
<b>Chapter 4. Identifying Priority Lands</b> .....	33
<b>4.1 Priority Lands for Conservation across the Nation</b> .....	<b>33</b>
<b>4.2 Priority Lands for Conservation in the Triangle Area</b> .....	<b>34</b>
4.2.1 Triangle Green Infrastructure .....	34
4.2.2 Rank and Priority Protocols.....	35
4.2.2.1 Triangle GreenPrint Ranking Process .....	35



4.2.2.2	Other Ranking and Prioritizing Protocols .....	38
<b>Chapter 5.</b>	<b>Conservation Subdivision Development .....</b>	<b>40</b>
<b>5.1</b>	<b>An Introduction to Conservation Subdivision Development.....</b>	<b>40</b>
5.1.1	The Benefits of Conservation Subdivision Development.....	41
<b>5.2</b>	<b>The Conservation Subdivision Development Design Process .....</b>	<b>43</b>
<b>5.3</b>	<b>Distinctions between Cluster and Conservation Subdivision Development.....</b>	<b>44</b>
<b>5.4</b>	<b>Criticisms of Conservation Subdivision Development .....</b>	<b>45</b>
<b>Chapter 6.</b>	<b>Where Conservation Subdivision Can Make a Difference .....</b>	<b>47</b>
<b>6.1</b>	<b>Selecting a Site to Maximize Benefits .....</b>	<b>47</b>
<b>6.2.</b>	<b>Following the Triangle GreenPrint.....</b>	<b>48</b>
6.2.1	The GreenPrint Ranking Scheme.....	51
6.2.2	Finding the GreenPrint Target Area .....	54
6.2.3	Linking Gaps in the GreenPrint .....	56
6.2.3.1	The Movement of Natural Communities across Gaps .....	58
<b>6.3</b>	<b>Zoning and Subdivision Ordinances.....</b>	<b>58</b>
6.3.1	Zoning and Subdivision Ordinances for Conservation Subdivision .....	58
6.3.2	Current Zoning and Subdivision Ordinances in the Target Area.....	61
6.3.2.1	The Conservation Management District .....	61
6.3.2.2	Conservation Subdivision Ordinances in the Target Area .....	64
<b>6.4</b>	<b>Current Land Use in the Target Area .....</b>	<b>64</b>
6.4.1	Current Subdivision Development in the Target Area.....	65
<b>Chapter 7.</b>	<b>Alternative Scenarios in the Target Area .....</b>	<b>67</b>
<b>7.1</b>	<b>Creating Conditions Favorable to Open Space Linkage.....</b>	<b>67</b>
7.1.1	Designating a Conservation Management District .....	67
7.1.2	Designating a Conservation Subdivision Overlay Zone .....	68
<b>7.2</b>	<b>Bailey’s Landing as a Conservation Subdivision Development .....</b>	<b>69</b>
7.2.1	The Original Bailey’s Landing Tract.....	69
7.2.2	Current Subdivision at Bailey’s Landing.....	71
7.2.3	Conservation Subdivision Development at Bailey’s Landing .....	73
7.2.3.1	Step One - Identifying Conservation Areas .....	73
7.2.3.2	Step Two – Locating House Sites .....	75
7.2.3.3	Step Three – Aligning Streets and Trails .....	77
7.2.3.4	Step Four - Drawing the Lot Lines.....	77
<b>7.3</b>	<b>Increased Open Space Linkage at Meadowood and Crescent Ridge Townhomes .....</b>	<b>80</b>
7.3.1	Current Conditions.....	80
7.3.2	Augmenting the Open Space Linkage .....	82
7.3.3	The Potential for Wildlife Underpasses .....	82
<b>Chapter 8.</b>	<b>Implementation Issues.....</b>	<b>85</b>
<b>8.1</b>	<b>Design Issues and Recommendations .....</b>	<b>85</b>
<b>8.2</b>	<b>Market Issues and Recommendations .....</b>	<b>86</b>
<b>8.3</b>	<b>Smart Growth Issues and Recommendations .....</b>	<b>87</b>
<b>8.4</b>	<b>Environmental Issues and Recommendations .....</b>	<b>88</b>
<b>8.5</b>	<b>Conclusion .....</b>	<b>88</b>

<b>Appendix One: Principles for Green Infrastructure</b> .....	90
<b>Appendix Two: Conservation Organizations</b> .....	94
<b>Appendix Three: Examples of Conservation Subdivision Development</b> .....	97
<b>Bibliography</b> .....	98

**List of Tables and Figures**

Table 1. Sources of Newly Developed Land Across the US in Thousands of Acres.....15

Figure 1. Triangle Land Use and Cover, 1987-1997.....24

Figure 2. Developed Land per 1000 People Living in the Triangle’s Urbanized Areas from 1950  
– 1990. ....25

Figure 3. Progress Towards NC’s Goal of a Million Acres of Permanently Protected Open Space  
by 2009.....29

**List of Maps and Drawings**

Map 1: Existing Protected Open Space.....48

Map 2: The Triangle GreenPrint .....49

Map 3: Wake County GreenPrint Rankings.....52

Map 4: Wake County GreenPrint – West Raleigh Greenspace Connector.....54

Map 5: Lake Johnson – Yates Mill Corridor.....56

Map 6: Target Area Zoning.....62

Map 7: Target Subdivisions.....65

Map 8: Baileys Landing Tract– 1999 Orthographic Photo.....69

Map 9: Baileys Landing-Current Conditions.....71

Map 10: Meadowood Crossing and Crescent Ridge.....80

Map 11: Meadowood Crossing and Crescent Ridge-Alternate Design.....82

Drawing 1: Baileys Landing- Step One - Identifying Conservation Areas.....73

Drawing 2: Baileys Landing- Step Two – Locating House Sites.....75

Drawing 3: Baileys Landing- Step Three – Aligning Streets and Trails.....77

Drawing 4: Baileys Landing- Step Four – Drawing the Lot Lines.....78

## **Chapter 1. Introduction**

### **1.1 Statement of Purpose**

Where can conservation subdivision development, a seldom used and much misunderstood tool for open space preservation, make the most difference in the rapidly urbanizing Triangle region of North Carolina, where open space is fast disappearing? Can it be sited in such a way to provide multiple benefits to a variety of stakeholders? This master's project investigates the use of conservation subdivision development primarily as a tool for extending the open space infrastructure. However, it will also examine the use of conservation subdivision as a tool for controlling and directing development, as an opportunity for developers seeking to maximize amenities while minimizing costs, and as an attractive option for homebuyers. I propose this process of site selection as a series of deliberate choices that will lead to multiple benefits and I will illustrate it with several local examples.

To do this, I will (1) identify those open space areas that are proposed for protection within the regional GreenPrint network, (2) using a ranking protocol to focus protection on those areas with the highest open space significance. Within these areas of highest open space significance, I will then (3) identify a specific location where conservation would potentially have the most positive impact on directing growth. Within this locale, I will (4) find the tracts that remain available for development and (5) examine the applicable zoning and subdivision ordinances that are beneficial to land conservation. The resultant parcels should be ideally suited to extend the value of the ecological services rendered by the open space network while also providing economic benefits to developers and municipalities, and addressing consumer

preferences, which I will recommend to be placed within a Conservation Subdivision Development Overlay Zone. I will also examine parcels at this locale that were *not* developed under conservation subdivision design standards and offer an alternative scenario.

## **1.2 Organization of the Paper**

Chapter 1 presents a statement of purpose, the organization of the paper, an overview of the issue, who is affected, and potential causes and solutions. Chapters 2 and 3 review the present and future magnitude of the issue, and why it is critical. They look at the state of open space nationally, regionally, and locally and the emerging trend of green infrastructure planning. Chapter 2 also explores the particular problems of linking open spaces in urban environments, while chapter 3 addresses common barriers to open space preservation. The selection process is often the most contentious part of the open space conservation effort. Consequently, any discussion of open space conservation needs to consider the ranking and prioritizing protocols that are available, and particularly those that are germane to the locality under investigation. This is done in chapter 4. Chapter 5 offers an overview of conservation subdivision development as a tool for open space conservation, its benefits and drawbacks, and some common misconceptions. The application of conservation subdivision development is the subject of chapter 6, following the trail of a systematic decision process. Here are gathered the various components (green infrastructure, ranking and priority, relevant policies, land use issues) of the site selection process as they play out on the ground. In addition to targeting a location where conservation subdivision can make the most extensive difference, Chapter 6 addresses several missed opportunities in the area and illustrates an example of conservation subdivision design for comparison. Chapter 7

concludes the discussion with recommendations for implementation and implications for other areas. Particular attention is given to the role civic leadership and commitment. Following the chapters, there are three appendices that may interest the reader that give details on the principles, processes and organizations involved in this study.

### **1.3 An Overview of the Issue**

In regions experiencing intense growth pressure, like the Triangle area of North Carolina, the task of preserving the remaining open space is challenging. Although open space is quickly disappearing in the Triangle area, there is still undeveloped land beyond the outer ring subdivisions that is available for conservation and opportunities still exist to piece together parcels of open space within more densely developed areas. However, the window of opportunity to acquire the remaining open space is quickly closing because of aggressive development and sharply rising land values.

### **1.4 The Stakeholders**

Efforts to preserve open space are hampered by lack of funding, lack of leadership, lack of landowner education, and a lack of creativity on the part of developers. Cash-strapped municipal agencies find it hard to justify outright purchases. Elected officials are loathe to raise taxes. Landowners are slow to trust the easement process, even if they do understand it. Developers continue to focus their residential and commercial projects on the less expensive green fields at the periphery of metropolitan areas, consuming great quantities of open space in

the process. They can either leapfrog over existing growth boundaries or take their projects to communities with less land controls in place. Although homebuyers increasingly indicate that they prefer the amenities that accrue from open space near where they live and work, developers feel that the consumers will not pay the price premium required to provide it. Environmental, economic and social losses across the Triangle are the result.

### **1.5 Some Possible Causes**

Outdated zoning and subdivision regulations bear much of the responsibility for the damage both to smart growth strategies and to creative approaches to open space conservation. In addition, most comprehensive plans have failed to address the situation adequately. “Each time a property is developed, an opportunity exists for adding some of that land to a community-wide network of open space. Although such opportunities are seldom taken in many municipalities, this situation could be reversed fairly easily by making several small but significant changes to the comprehensive plan, the zoning ordinance and the subdivision and land development ordinance.”<sup>1</sup>

### **1.6 Potential Solutions**

Most people assume that in the struggle between land conservation and development, it will always amount to a win-loose proposition. Either development spells doom for the environment, or open space conservation depresses the commercial and residential building market. However, certain open space acquisition tools have been used successfully in other parts



of the country to create a win-win between development and conservation. Among the most successful, yet least understood and practiced, is conservation subdivision development. Hallmark strategies of conservation subdivision design are an initial environmental inventory, a typical open space set-aside of between 40-60% of the total parcel for permanent conservation, and a clustering of the buildable sites into a modest footprint. These open space easements could be sited in such a way as to link, augment or buffer the regional green space network. There are benefits for all stakeholders in the conservation subdivision process - landowners, developers, consumers, conservation organizations, municipal staff and elected officials - not to mention benefits for the environment.

## **1.7 Summary**

Employing a wide array of open space planning techniques simultaneously, over an extended period, can significantly improve an urban community's success. Their open space conservation "toolbox" should contain a variety of conservation techniques including the purchase of development rights; donations of sales to conservancies; the transfer of development rights; and "landowner compacts" involving density shifts among contiguous parcels. However, these strategies are time and money intensive. Since it is likely that most parcels of land in any given community will eventually be developed anyway, "employing conservation subdivision design along with other preservation strategies offers communities the most practical, doable way of protecting large acreages of land in a methodical and coordinated manner".<sup>2</sup>

---

<sup>1</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).

<sup>2</sup> *ibid*

## Chapter 2. The State of Open Space in the US

This chapter will provide a brief introduction to open space and an overview of the state of the science across the nation. The special functions of open space in metropolitan regions will be examined with emphasis on the particular difficulties of linking open space in densely urbanized areas.

### 2.1 An Introduction to Open Space Conservation

In the last two decades of the 21<sup>st</sup> century, about 34 million acres of rural lands were converted to developed uses. That equals an area of open space the size of Illinois. By 2001, the total developed area in the contiguous United States was slightly more than 106 million acres.<sup>3</sup> The rate of rural land conversion continues to increase. The rate of development between 1992 and 2001 averaged 2.2 million acres per year. This was an escalation from the 1.4 million acres per year developed in the previous decade (1982 - 1992). The most recent trend of significance has been the spread of development primarily into forested land. Of the 9 million acres developed between 1997 and 2001, 46 percent came from forestland.<sup>4</sup> During this same period, the conversion of cropland, pastureland and rangeland continued their steady decline (See Table 1). In brief, we are losing green space, especially forested land, to the built environment at an accelerating clip.

---

<sup>3</sup> Natural Resources Conservation Service, *National Resources Inventory 2001: Urbanization and Development of Rural Land* (Washington, DC: NRCS,[2003]).

<sup>4</sup> Natural Resources Conservation Service, *National Resources Inventory 2001: Urbanization and Development of Rural Land* (Washington, DC: NRCS,[2003]).

**Table 1. Sources of Newly Developed Land Across the US in Thousands of Acres.**

Year	Cropland	Pastureland	Rangeland	Forest Land	All Other Land Uses	Total
1982 to 1992 (10 years)	3,900 ± 160	2,270 ± 120	1,950 ± 190	5,600 ± 170	360 ± 50	14,080 ± 330
1992 to 1997 (5 years)	2,880 ± 110	1,930 ± 100	1,270 ± 130	4,740 ± 140	470 ± 50	11,290 ± 250
1997 to 2001 (4 years)	1,830 ± 170	1,470 ± 170	1,210 ± 290	4,150 ± 340	280 ± 70	8,940 ± 550

(Source: National Resources Inventory)

On a national scale, are efforts to protect open space keeping pace with the number of green fields lost to development? Is there some kind of meaningful measure to determine how much dedicated open space is enough? These are not easy questions to answer. Figures on how many total acres of open space are under protection in the US are not readily available.

There are approximately 650 million acres of federally owned natural resource lands across the country:

- 192 million acres managed by the Forest Service
- 270 million acres managed by the Bureau of Land Management
- 80 million acres managed by the National Park Service
- 90 million acres managed by the U.S. Fish and Wildlife Service

However, federal ownership does not imply permanent protection and in fact, extensive commercial use and exploitation of natural resources on federally owned lands is very common.

The national parks and wildlife refuges (Grand Canyon National Park, Arctic National Wildlife Refuge) are the closest thing to federally owned protected open space. Beyond that, the federal government does not appear to be tracking their protected open space. Part of the issue is in

drawing the distinction between the many levels of protection. The use of our public lands is a hot topic across the nation and on Capitol Hill.

A reliable figure for regional, state, local and privately held conservation lands is no easier to arrive at. An increasing number of states have statewide open space initiatives, but most still do not.

One indication of the national interest in open space preservation might be the recent upwelling of new conservation organizations and land trusts. For a list of national land conservation organizations, see Appendix 2. There are a few regional open space conservation efforts, with some of the larger ones encompass several states. Typically, these regional initiatives target a specific conservation priority area. A list of regional land conservation organizations can be found in Appendix 2.

## 2.2 The Functions of Open Space in Metropolitan Regions

Open space has long been synonymous with park and recreation development. Historically, much of the open space protection and conservation strategies of local governments has been closely associated with the provision of park and recreation lands and facilities. However, in order to provide the kind of “green network” upon which communities can build and grow, open space will need to be thought of in broader terms. Open space is the infrastructure that protects groundwater recharge areas, providing communities with clean water. Open space absorbs floodwaters and mitigates the effects of floods on people and property. Open space provides the land area necessary to grow healthy stands of native trees, which clean air and moderate climate. It also provides wildlife and native plant habitat as well as protects the

viability of working lands.<sup>5</sup> Besides these ecological functions, open space also defines a sense of place and celebrates regional heritage. Trees and town commons have traditionally been a defining element in the American urban landscape.<sup>6</sup> Rivers and streams have historically served as transportation and commerce networks linking communities within watersheds corridors to a common identity.

Open space can also function as a development management tool, where designated green spaces are strategically located to act as a barrier to growth. One of the most ambitious and well-known examples is the green belt surrounding Toronto, Ontario.<sup>7</sup> Dubbed “The Greater Golden Horseshoe”, this type of greenbelt is serving as an urban growth boundary. While they are intended as areas of reduced density, greenbelts are not explicitly conservation tools and certainly not an indicator of permanent ecological protection. Green belts are typically used to:

- Check the unrestricted sprawl of built-up areas
- Safeguard the surrounding countryside from further encroachment
- Prevent neighboring towns from merging into one another
- Preserve the special character of historic towns
- Assist in urban regeneration

### 2.3 Linking Open Space in Metropolitan Regions

Green Infrastructure is the Nation's natural life support system - a strategically planned and managed network of wilderness, parks, greenways, conservation easements, and working

---

<sup>5</sup> Thomas Campanella, ed., *The Republic of Shade*, First ed. (New Haven, CT: Yale University, 2003).

<sup>6</sup> Greenways Incorporated, *Wake County Consolidated Open Space Plan* (Raleigh, NC: ,[2003]).

lands with conservation value that supports native species, maintains natural ecological processes, sustains air and water resources, and contributes to the health and quality of life for America's communities and people (See Appendix 1 – Principles for Green Infrastructure). The Green Infrastructure network encompasses a wide range of landscape elements, including natural areas - such as wetlands, woodlands, waterways, and wildlife habitat; public and private conservation lands - such as nature preserves, wildlife corridors, greenways, and parks; and public and private working lands of conservation value - such as forests, farms, and ranches. It also incorporates outdoor recreation and trail networks.<sup>8</sup>

### 2.3.1 Regional Open Space Linkage across States

Linking large open space tracts (state forests, wildlife reserves and game lands) on a regional level is challenging. It is especially so in urbanizing areas and where they cross state lines. Consider the coordination required between various governmental departments and agencies, as well as non-profits. When states are leveraging federal funds, it complicates matters further. In this arena, the leadership of elected officials is mandatory.

An excellent illustration is “Natural Connections: Green Infrastructure in Wisconsin, Illinois & Indiana”, a collaboration to support natural resource protection and land preservation efforts across parts of three states.<sup>9</sup> Regional cooperation on this scale relied on the generosity and collaboration of scores of individuals and associations: over 50 partner-organizations are

---

<sup>7</sup> Ontario Ministry of Public Infrastructure Renewal, "Places to Grow," [http://www.pir.gov.on.ca/userfiles/HTML/cma\\_4\\_40902\\_1.html](http://www.pir.gov.on.ca/userfiles/HTML/cma_4_40902_1.html) (accessed March, 2006).

<sup>8</sup> L. McDonald and others, "Green Infrastructure Plan Evaluation Frameworks," *Journal of Conservation Planning* 1, no. 1 (March, 2005), <http://www.journalconsplanning.org>.

listed. During the early planning process, the Natural Connections initiative identified obstacles to protecting natural resources that cross state lines and strategies for overcoming them. For example, lack of information about natural resources across jurisdictional lines was a major obstacle to cooperative efforts to protect the resources. Land use data was inconsistent from county to county, much less from state to state. One of the greatest needs was for a map and regional database that provided foundational information on green infrastructure across the three-state / fourteen county region. Five teams of green infrastructure experts were brought together. Massive data collection was undertaken, ultimately resulting in 175 layers of data. Because different agencies collect their data at different scales and projection levels, it all had to be normalized to a uniform projection and scale—a task that had never been done before on that level. The results consisted of an accessible data archive and maps identifying the most promising opportunities for bi-state cooperation, highlighting important resources that lie along the Wisconsin-Illinois and the Indiana-Illinois borders. All of this work was the necessary prelude to making specific recommendations for protecting and managing these resources through cross-border coordination. The Natural Connections project will significantly facilitate regional decision-makers across the tri-state area in their efforts to conserve open space effectively.

### 2.3.2 Metropolitan Area Open Space Linkage

Successful "green infrastructure" efforts require non-traditional, broad-based alliances and approaches that cross boundaries and jurisdictions, connect people to the land in a variety of ways, and use a variety of approaches. Linking large open space tracts between or within local

---

<sup>9</sup> Natural Connections, "Green Infrastructure in Wisconsin," <http://www.greenmapping.org/>

municipal boundaries is especially challenging in urbanizing areas. However, with the reduced levels of bureaucracy, it is not as formidable as regional open space planning across state lines. The same coordination is required between various governmental departments, agencies and non-profits. The same committed leadership of elected officials is needed to champion the project and contribute funding.

Typically, motivation to cooperate usually comes from a mutually identified priority land that lies athwart a shared boundary. The New Hope Creek Corridor Open Space Master Plan (1991) and the Little River State Park (2005) are two examples of the joint efforts of Orange and Durham Counties. These two counties are located in the Triangle of North Carolina, a swiftly urbanizing area. However, these two examples are stand-alone parks, not linkage efforts. Additionally, they are examples of riparian land conservation, which usually garners more support than other forms of open space due to the higher visibility of water quality concerns. Linking existing city parks, lakes and preserves has proven more daunting when it is not along a riparian corridor. The obvious hurdle is the existing development (residential, commercial or industrial) that separates the public lands attempting to be linked.

Any linkage of open space across municipal boundaries will need a green infrastructure plan or a green print similar to that created by the Natural Connections initiative in Illinois to guide the local decision makers. Over the past five years, the Triangle J Council of Governments (TJGOG) has accomplished this - a green print for the Triangle area of North Carolina. Although on a greatly reduced scale, the Triangle GreenPrint provides an accessible data archive and maps identifying the most promising opportunities for open space preservation in the Triangle.<sup>10</sup> It is North Carolinas first attempt at a regional green infrastructure and is discussed more fully in

---

<sup>10</sup> Triangle J Council of Governments, *Triangle GreenPrint Open Space Assessment* (Raleigh, NC: ,[2002]).



Chapter 3. A larger, statewide green infrastructure database is in process, compiled by One North Carolina Naturally.<sup>11</sup>

A comprehensive national resource for green infrastructure projects can be found at [www.greeninfrastructure.net](http://www.greeninfrastructure.net). This site includes examples of green infrastructures from around the country. It is a partnership between The Conservation Fund and the USDA Forest Service and is a clearinghouse for green infrastructure information.

### 2.3.3 Local Open Space Corridors

Greenways are becoming one of the most popular forms of urban open space. Part of the reason for this is that they fill multiple open space needs as they connect people and places together. These corridors of land are commonly thought of as places to walk or bike within an urban environment, and trails are often their central component. However, beyond park and trail amenities, these ribbons of open space can also serve as a "green infrastructure" component of communities. Greenways conserve open space close to where people live and work, soften the patterns of urban growth, mitigate water and air pollution, protect wildlife habitat, promote economic growth and improve the quality of everyday life. They are often situated to buffer creeks and rivers, reducing the impacts of flooding in floodplain areas. They are sometimes used to link larger open space tracts. Greenways can also protect cultural and scenic resources such as historic canal corridors and celebrated view sheds. Greenways are popping up across the county in combination with Rails-to-Trails projects.

---

<sup>11</sup> One North Carolina Naturally, "Statewide GIS Mapping Tool," <http://www.cep.unc.edu/oncn/index.html2006>).

Greenways can incorporate positive outcomes for:

- Recreation
- Transportation
- Health
- Economic revitalization
- Education
- Environmental concerns
- Floodplain management
- Quality of life<sup>12</sup>

Taking a comprehensive look at the state of open space at multiple of scales set the stage for a discussion of regional green infrastructure and how open space functions in metropolitan areas, along with its particular challenges. The following chapter will continue to extrapolate this information down to the local level.

---

<sup>12</sup> The Conservation Fund and Ed McMahon, *Greenways. A Guide to Planning, Design, and Development* (Washington, DC: Island Press, 1993).

## Chapter 3. Open Space Conservation in the Triangle

In order to grasp the various regional, metropolitan and local open space efforts in the Triangle (the focal area for this project), a review of the dynamic character of land use in the area is needed. The Triangle Region is a rapidly urbanizing area in the Piedmont of North Carolina whose population has tripled since 1950. Currently more than 1.3 million call this region home, and that number is expected to swell to 1.5 million by the end of this decade.<sup>13</sup>

### 3.1 Land Use Change in the Triangle Area of North Carolina

The pace of population growth and its associated development are transforming the Triangle, a region with over 2 million acres of land divided among the counties of Chatham, Durham, Johnston, Lee, Orange, and Wake.<sup>14</sup> Between 1987 and 1997, the Triangle Region converted 190,500 acres of previously undeveloped land into new residential subdivisions, office parks, shopping malls, highways, schools and other commercial uses (See Figure 1). This represents a 70% increase of developed land in one decade. Following the national trend, the majority of this newly built environment (68%) came from forested land.<sup>15</sup> The lush countryside of forests and fields that once covered this region is quickly being replaced by hardscape.

Protected open space makes up a much smaller portion of this region than developed land. Of the 2.1 million acres of land in the Triangle, 22% is developed land (residential, industrial, commercial, and institutional) and only 6% is protected open space, according to 1997

---

<sup>13</sup> State Demographics Unit, "North Carolina Demographics," <http://demog.state.nc.us/> (accessed March, 2006).

<sup>14</sup> George Hess, Kate Dixon and Mary Woltz, *The State of Open Space 2000* (Raleigh, NC: ,[2000]).

<sup>15</sup> *ibid*

figures. More importantly, the rate of green fields being consumed by development is significantly outpacing the rate of green space being conserved. In 2000, there was a total of 146,068 acres of protected open space in the combined Triangle counties of Chatham, Durham, Johnston, Lee, Orange, and Wake.<sup>16</sup> By 2005, the Triangle had a total of 163,600 acres of protected green space.<sup>17</sup> That represents an average of 3500 acres protected per year. By

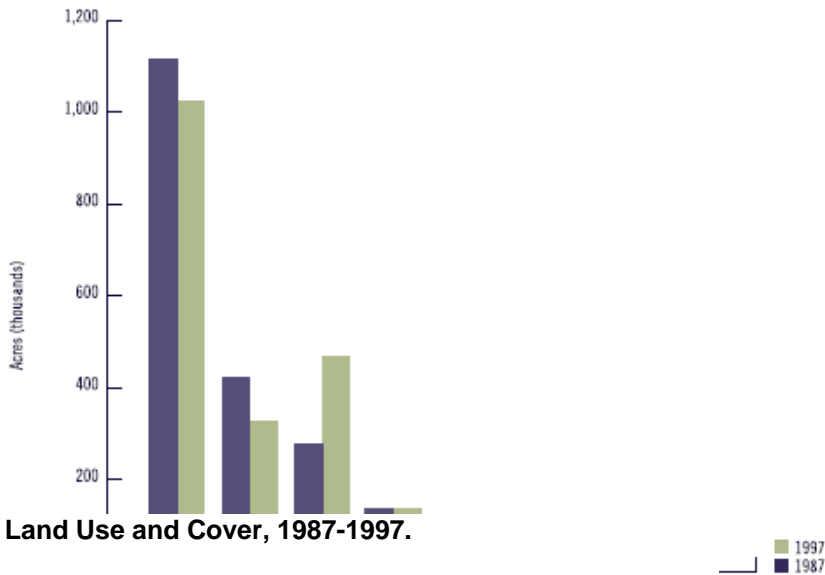


Figure 1. Triangle Land Use and Cover, 1987-1997.

(Source: State of Open Space 2000)

contrast, the Triangle area lost 2 acres per hour of rural lands to development during the same period.<sup>18</sup>

One of the forces driving rapid land conversion in the Triangle is that development per

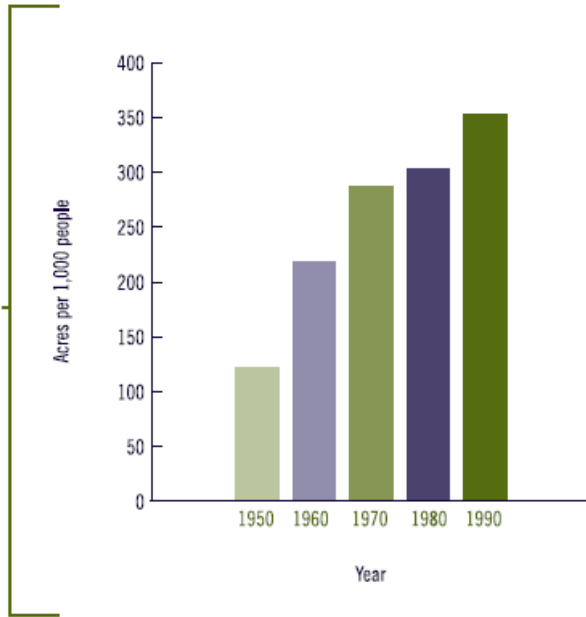
capita has soared. In other words, not only has the Triangle’s population tripled since 1950, but also three times as much land is urbanized for each new person living in the Triangle’s urbanized areas. Simply put, people in urbanized areas are using increasingly more land with each successive decade.<sup>19</sup> (See Figure 2)

<sup>16</sup> *ibid*

<sup>17</sup> Triangle J Council of Governments, *Triangle GreenPrint Progress Report* (Raleigh, NC: ,[2005]).

<sup>18</sup> Triangle J Council of Governments, *Triangle GreenPrint Open Space Assessment*

<sup>19</sup> Hess, Dixon and Woltz, *The State of Open Space 2000*



**Figure 2. Developed Land per 1000 People Living in the Triangle’s Urbanized Areas from 1950 – 1990.**

(Source: US Census Bureau)

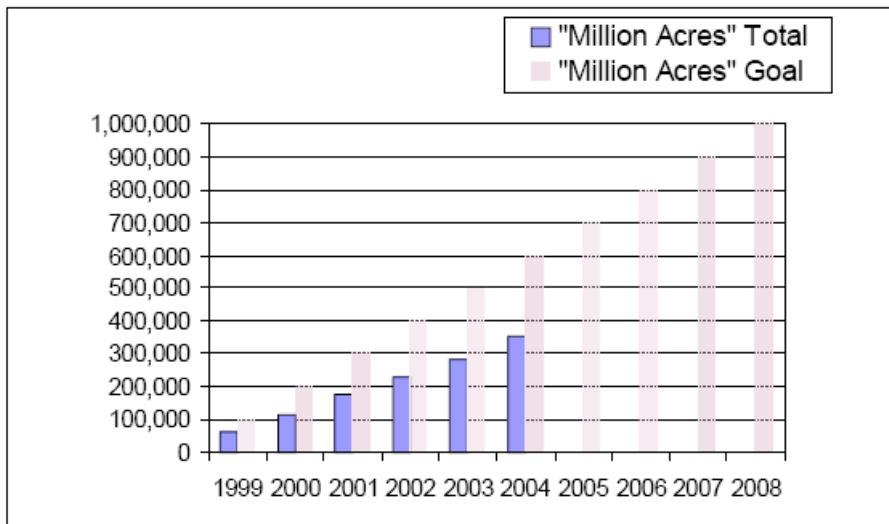
### 3.2 The State of Open Space Conservation in the Triangle

#### 3.2.1 Plans, Programs and Initiatives: Statewide Efforts

##### Million Acre Initiative

In 1999, Governor Jim Hunt’s Interagency Task Force on Smart Growth held a series of public meetings across North Carolina. Finding that open space preservation was a primary citizen concern, he issued a challenge to the state: preserve an additional one million acres of land by the end of 2009 (G.S. 113A-240 and 241). The NC Million Acre Initiative is a collaborative, state-led endeavor to accelerate the rate that land is protected in North Carolina. This initiative will focus on lands permanently protected through voluntary acquisition of fee

title interest or conservation easements by federal, state, local, or private non-profit land managing organizations. At the end of the sixth full year of the North Carolina Million Acre Initiative (Jan. 1, 1999 – Dec.31, 2004), private and public land protection partners across the state had permanently protected 352,090 acres towards the million sought.<sup>20</sup> Given the current rate of land acquisition, they are not on track to meet their goal (See Figure 3). They cite the lack of public and private funding for new protection projects as the primary barrier.



**Figure 3. Progress Towards NC’s Goal of a Million Acres of Permanently Protected Open Space by 2009.**

(Source: Million Acre Initiative Annual Report 2005)

### Land for Tomorrow

Land for Tomorrow is a diverse partnership of businesses, conservationists, farmers, environmental groups, health professionals and community groups committed to securing support from the public and General Assembly for protecting land, water and historic places. Land for Tomorrow is asking the General Assembly to enable a bond issue for \$200 million a year for five years to preserve and protect its special places, helping the state reach its goal of

<sup>20</sup> NCDENR Office of Conservation and Community Affairs, *NC Million Acre Initiative Annual Report*

conserving a million acres (House Bill 1687 or Senate Bill 1046).<sup>21</sup> Their primary focus is coordinating efforts towards conservation funding.

### NC Conservation Network

The North Carolina Conservation Network is a statewide network of over 120 environmental, community and environmental justice organizations focused on protecting North Carolina's environment and public health. The NC Conservation Network supports, trains and coordinates diverse groups and directly advocates to achieve equitable and sustainable solutions for our environment. Launched in 1998, their primary role is conservation advocacy,<sup>22</sup> and they pay special attention to open space conservation.

### One North Carolina Naturally

One North Carolina Naturally is a comprehensive statewide conservation plan that involves the public, governmental agencies, private organizations, and landowners in an effort to maintain functional ecosystems, biological diversity, and working landscapes through the stewardship of land and water resources. One North Carolina Naturally is part of a larger effort by the State to implement a plan that will conserve and restore the State's natural heritage. This online resource hosts an online GIS mapping tool, decision support, and a comprehensive list of statewide conservation planning resources. Their primary focus is supporting a collaborative planning effort that reflects a statewide coordinated green infrastructure.

---

(Raleigh, NC: NCDENR,[2005]).

<sup>21</sup> Land for Tomorrow, *Saving the Goodliest Land* (Durham, NC: ,[2005]).

## Conservation Trust for North Carolina

The Conservation Trust for North Carolina is a non-profit statewide conservation organization. Their mission is to protect the state's land and water through statewide conservation and cooperative work with land trusts to preserve our natural resources as a legacy for future generations. The Conservation Trust works directly with landowners, local land trusts, and government agencies to protect land and water resources most important to local communities throughout the state. The Conservation Trust is an umbrella organization that provides a wide array of technical and financial services to the state's network of 23 local and regional land trusts. Services include grants and loans; legislative advocacy; public relations; management of contracts; and information exchange.

### 3.2.2 Plans, Programs and Initiatives: Regional and Local Efforts

#### Triangle GreenPrint

Triangle J council of Government's GreenPrint project is an attempt at regional open space planning and has met the same resistance as other regional planning efforts. The GreenPrint project began in 2000 with a snapshot of current open space conditions<sup>23</sup>, followed in 2002 by a comprehensive regional open space assessment<sup>24</sup>. The following year, they conducted

---

<sup>22</sup> North Carolina Conservation Network, "History and Goals," <http://ncconservationnetwork.org/>

<sup>23</sup> Hess, Dixon and Woltz, *The State of Open Space 2000*

<sup>24</sup> Triangle J Council of Governments, *Triangle GreenPrint Open Space Assessment*



an extensive outreach, presenting their findings in their 2003 report<sup>25</sup>. In 2005, they issued an update, highlighting scaled down goals and calling for increased funding<sup>26</sup>.

The Triangle GreenPrint project also hosts the GreenPrint Tracker – a web based GIS utility for tracking current and planned investments in green space protection and trails development in the Triangle.<sup>27</sup> The Tracker's Achilles Heel is its dependence on local conservation program personnel to upload their newly protected open space to the regional map. Typical of most municipal planning offices, the regional perspective is a low priority. The GreenPrint Tracker has largely gone unused.

#### County Open Space Conservation Programs

Orange County's Lands Legacy Program is the oldest municipal open space conservation program of the six-county Triangle area. The Lands Legacy Program was adopted by Orange County in April 2000. Administered by the Environment and Resource Conservation Department, the program's mission is to help protect the county's most important natural and cultural resource lands before they are damaged or lost to incompatible development activities. Utilizing a low profile approach and with very limited county funding, Lands Legacy brought over 1000 acres of open space under permanent protection in its first four years.<sup>28</sup> Orange County also has a Master Plan for Parks, Recreation and Open Space. Additionally, they are collaborating with Durham County on the New Hope Corridor Open Space Plan.

---

<sup>25</sup> The Triangle J Council of Governments, *The Triangle GreenPrint Outreach Report* (Raleigh, NC: [2003]).

<sup>26</sup> Triangle J Council of Governments, *Triangle GreenPrint Progress Report*

<sup>27</sup> Triangle Green Space Tracker, <http://66.193.216.195/>

<sup>28</sup> Lands Legacy Program 2004-2006, "Action Plan," <http://www.co.orange.nc.us/ercd/landslegacy/aap0406.htm>

Of the remaining Triangle area counties, only Wake has a dedicated, unified open space strategy – The Wake County Consolidated Open Space Plan. Durham County has a Trails and Greenways Master Plan, and manages all other open space needs through its priority area plans [New Hope Corridor (1991), Little River Corridor (2001), and East Durham Open Space (2006)]. Chatham County derives open space protection through its Comprehensive Parks and Recreation Master Plan. Lee County’s first open space plan will be completed in 2006 and Johnston County has no open space plan.<sup>29</sup>

### Local Non-profits

The Triangle area also has a number of non-profit organizations working to protect open space. The best known is the Triangle Land Conservancy - a land trust for the six-county region which protects important open space—stream corridors, forests, wildlife habitat, farmland and natural areas—to help keep our region a healthy and vibrant place to live and work. Working since 1983, TLC has protected more than 7,000 acres of the most sensitive lands in the Triangle.<sup>30</sup>

The Eno River Association has worked actively since 1966 to protect the lands and waters along the Eno River and its tributaries, conserving almost 5000 acres in the process. The Eno River Association also engages in environmental education and advocacy.<sup>31</sup>

Since 1982, the Haw River Assembly has endeavored to “speak as a voice for the river in the public arena”.<sup>32</sup> Primarily concerned with water quality, they are also working with state and

---

<sup>29</sup> Triangle J Council of Governments, *Triangle GreenPrint Progress Report*

<sup>30</sup> Triangle Land Conservancy, <http://www.tlc-nc.org/>

<sup>31</sup> Eno River Association, <http://www.enoriver.org/>

<sup>32</sup> Haw River Assembly, <http://www.hawriver.org/>

federal agencies and land conservation groups (i.e., Haw River Land and Trails) to identify and preserve fragile ecosystems and larger intact pieces of land along the Haw.

Friends of Bolin Creek are primarily interested in conserving land in the Bolin Creek corridor. Only active since 2004, this group has already gained the approval of the Carrboro Board of Aldermen to adopt their concept plan for a future Bolin Creek Park.<sup>33</sup>

### 3.2.3 Barriers to Successful Open Space Conservation Efforts

The local political climate plays a significant part in the success or failure of local open space conservation efforts. The support of local elected officials is critical in both the planning process (plan creation and adoption) and implementation (funding, staffing, and facilitating the coordination with other plans and departments). Effective leadership can also pave the way for cooperation between adjacent municipalities when priority lands cross metropolitan boundaries. In almost every case, successful open space programs in the Triangle have enjoyed the leadership of their elected officials.

Just as essential to success is the involvement of a wide representation of stakeholders, in both the creation, implementation and monitoring of the open space conservation program. Commonly, this aspect is only paid lip service. Most open space plans produced in the past few years include a review of citizen participation in the planning process. However, upon closer inspection of the open space plans across the Triangle, stakeholder participation has typically been low in numbers and lacks diversity. This usually results in difficulties at the implementation stage.

---

<sup>33</sup> Friends of Bolin Creek, <http://www.bolincreek.org/index.shtml>

The lack of either political leadership or stakeholder participation not only has the potential to undermine funding efforts (i.e., bond referendums), it can de-rail landowner involvement. Rural landowners in the Triangle have historically been reluctant to discuss divesting the ownership of their land for any reason with government officials. Open space acquisition rests squarely on landowner willingness, a fact that is often overlooked by public staff. Trust is paramount. Non-profits can gain landowner confidence by presenting a neutral face to the public, creating positive relationships, which they can leverage into conservation easements. The most successful open space conservation efforts are often created in partnerships. The newly created Little River State Park, whose boundary crosses the Durham and Orange county lines, is an excellent example of a successful partnership between the staff of both county offices and two local non-profit groups (Triangle Land Conservancy, Eno River Association).<sup>34</sup>

The forces affecting land use in this fast growing area of North Carolina present the usual challenges to development management strategies and conservation goals found in urbanizing regions. The Triangle area both benefits from a variety of open space conservation efforts at multiple levels and suffers from the typical barriers to successful implementation.

---

<sup>34</sup> Durham City-County Planning Department, *Little River Corridor Open Space Plan*,[2001]).

## Chapter 4. Identifying Priority Lands

Identifying open space priority lands seems like an interesting mix of art and science. However, it is arguably the most important aspect of the open space preservation process. It is certainly the most contentious. A review of how this crucial decision-making process is handled across the country and at various scales is warranted.

### 4.1 Priority Lands for Conservation across the Nation

Decisions about what lands to conserve can result from political favoritism as easily as complex, landscape ecology metrics. It is a discipline still in its infancy, with a wide variety of experiments in conservation prioritization and implementation happening around the country. Without an overarching national framework, these well-intentioned plans and regulatory approaches amount to a regional and local patchwork and by themselves are not sufficient to slow the decline of natural resources, ecosystem functions, and green “quality of life” amenities. When conservation efforts are reactive, site-specific, narrowly focused or not well integrated with other plans, they become haphazard conservation, which is no better than haphazard development. If the current antidote to haphazard development is smart growth, then the solution to haphazard conservation might be "smart conservation" - strategically directing our nation's conservation.<sup>35</sup>

Benedict and McMahon make the case for a green infrastructure to guide the way. “When we think of infrastructure, we think of built infrastructure such as roads, electric power lines and

---

<sup>35</sup> Mark A. Benedict and Edward T. McMahon, *Green Infrastructure: Linking Landscapes and Communities* (Washington, DC: Island Press, 2006).

water systems as well as social infrastructure such as schools, hospitals and libraries. However, the concept of Green Infrastructure elevates air, land, and water to an equal footing with built infrastructure and transforms open space from "nice to have" to "must have". At the same time, green infrastructure helps frame the most efficient location for development and growth - and related gray infrastructure - ensuring that developers, citizens, and communities capture the cost advantages of location and create and protect household and community."<sup>36</sup>

## 4.2 Priority Lands for Conservation in the Triangle Area

Historically, the conventions used to identify open space priority lands for conservation in the Triangle area has followed the national trend, and has resulted in a collage of disconnected green spaces that do not function very well on a regional scale. Thus, opportunities to establish broader planning goals and preserve critical ecological functions and processes at the landscape scale have been lost.

### 4.2.1 Triangle Green Infrastructure

To be most effective for conservation purposes, potential priority lands need to be identified within the context of the regional green infrastructure as a whole. Launched by the Triangle J Council of Governments in 2002, the Triangle GreenPrint Project provided the first assessment of the Triangle's current green spaces, and identified via local consensus the essential green infrastructure that ought to be protected as the Triangle grows. They compiled a database to show how it all fits together on a regional scale. They also currently host the "Triangle

---

<sup>36</sup> *ibid*

Tracker” GIS map, and will upload new open space acquisitions that are submitted to the Tracker. In this way, it is intended that the Triangle area will have a regularly updated map of local green infrastructure with which to make land use decisions.

#### 4.2.2 Rank and Priority Protocols

According to The Triangle GreenPrint Project, effective conservation planning is a two steps process: 1) determining the significance of potential sites, and 2) prioritizing the sites based on their significance and each organization’s conservation goals. The relative significance of a site (rank) is determined by its open space value – how important the site is in terms of its open space functions. The decision to protect a particular property (priority) involves an examination of other factors such as the threat of development, political considerations, and available funding. Because most agencies involved in land protection have their own established criteria and system of evaluating land protection projects, the GreenPrint focused on determining the relative significance of the sites identified, leaving the task of prioritization to implementing organizations.<sup>37</sup>

##### 4.2.2.1 Triangle GreenPrint Ranking Process

The assessment phase of the Triangle GreenPrint involved over 140 professional and citizen experts on open space in the region, who were divided into three workshops: Parks, Greenways and Historic Areas; Natural Areas and Water Quality; Agricultural and Forest Land. Each workshop created its own unique ranking criteria to reflect the differences in the type of

open space under consideration. The ranking was set to determine how well sites met certain commonly held goals. For Workshop 1 (Parks, Greenways and Historic Areas), the goals were:

- Ability of the site to meet multiple goals and objectives
- Connectivity
- Value as a destination
- Uniqueness<sup>38</sup>

Each site was given a score of 1-5 for each of the above criteria. These scores were then added to create a single score for the site. Natural breakpoints allowed committee members to define and map high, medium and low categories. To avoid overemphasizing natural area and water quality functions, these characteristics were not included in the Parks, Greenways and Historic Areas scoring.<sup>39</sup>

In Workshop 2 (Natural Areas and Water Quality), the goals were:

- Presence of rare or endangered species\*
- High biodiversity\*
- Water supply watersheds
- Connectivity between protected areas
- Wildlife corridors
- High quality waters
- Pristine areas / free from exotic invasive species
- Unique or outstanding geologic sites
- Forest cover

---

<sup>37</sup> Triangle J Council of Governments, *Triangle GreenPrint Open Space Assessment*

<sup>38</sup> *ibid*

<sup>39</sup> *ibid*



- Multiple objectives<sup>40</sup>

\*data from NC Natural Heritage Program

Given the extent and complexity of the overall criteria needed to prioritize the sites, only the top two criteria from Workshop 2 were used in the ranking scores given in the report. This was done as an example to demonstrate how a more comprehensive ranking using all the criteria might be obtained. A raw score was obtained using:

- The number of rare species populations
- Number of rare and outstanding natural communities

This raw score was weighted by:

- The health of the population or community
- The status of the species on federal or state endangered species lists
- The rarity of the species globally or in the state<sup>41</sup>

Note: The raw rankings did not consider water quality or connectivity.

The results from Workshop 3 (Farm and Forest Land) involved land characteristics and a sustainability score. Characteristics of a successful rural resource community include:

- Natural resource factors
- Market factors
- Family economic factors
- Support service factors
- Development factors
- Heritage factors

---

<sup>40</sup> *ibid*

<sup>41</sup> *ibid.*

- Other factors

Relative “sustainability” of site (still intact in 10 years):

- Probably
- Maybe
- Probably not<sup>42</sup>

#### 4.2.2.2 Other Ranking and Prioritizing Protocols

Open space plans across the focal area all handle ranking differently. Ranking protocols are based on assessments, and these vary widely. For instance, the Town of Cary Open Space and Historic Resources Plan (2001)<sup>43</sup> featured a thorough resource evaluation that was the result of two external reports and a Threat of Loss Analysis. The Town contracted with an ecological assessment firm to develop an inventory and database of significant natural and historic resources. A NC State University research team was hired to conduct view shed mapping of rural landscapes associated with two National Register historic districts, and to create visual simulations of conservation design scenarios. The latter will be an important tool for informing landowners on development techniques that can preserve open space resources. Town of Cary staff conducted a threat analysis to determine the most vulnerable open space parcels in the study area. This analysis will help determine Cary’s preservation priorities.

---

<sup>42</sup> *ibid*

<sup>43</sup> Town of Cary Planning Department, *Open Space and Historic Resources Plan*, [2001].

Seven miles down the road in Apex, the Parks, Recreation, Greenways and Open Space Master Plan (2001)<sup>44</sup> cited no resource evaluation and identified priority areas based on input from citizen surveys. This was a plan strongly focused on the recreational use of green space.

Setting clear priorities about what open space to preserve, in what order, and at what cost is a daunting task for a municipal agency. The opportunity to draw on critical information like a regional database of natural heritage resources and a regional green infrastructure map are indispensable. Just as essential is public participation at all stages: planning, implementation, and monitoring.

---

<sup>44</sup> Town of Apex Planning Department, *Parks, Recreation, Greenways and Open Space Master Plan*, [2001]).

## **Chapter 5. Conservation Subdivision Development**

A thorough understanding of conservation subdivision development that includes its benefits and drawbacks is essential to an appreciation of what it can offer as a multi-purpose land use tool. Important distinctions need to be drawn between the type of conservation subdivision design that is capable of multiple functions, and those that are more limited in their utility.

### **5.1 An Introduction to Conservation Subdivision Development**

When subdivision developments are designed around the central organizing principle of protecting open space, it is considered a conservation subdivision. Conservation subdivisions are characterized by common open space (typically 50% or more of the total acreage) and clustered compact lots. Compared to traditional subdivision design, conservation subdivision development offers the full development potential of a parcel (allowing for the maximum number of residences under current local zoning and subdivision regulations) while minimizing environmental impacts and protecting desirable open spaces. In some cases, a greater density (density bonus) may be offered in the local ordinance to encourage this approach to residential development planning. The developed portion of the parcel is concentrated on those areas most suitable for development, such as upland areas or areas with well-drained soils. The undeveloped portion of a conservation subdivision can include such ecologically or culturally-rich areas as wetlands, forest land, agricultural land/buildings, historical or archeological resources, riparian zones (vegetated waterway buffers), wildlife habitat, and scenic view sheds. In this way, homes are built in a less land-consumptive fashion allowing the balance of the property to be

permanently protected and potentially added to an interconnected system of green spaces and greenway corridors.<sup>45</sup>

Typically, the open space is permanently preserved via easement or dedication and managed through a homeowners association, land trust (or other conservation organization), or local government agency. In some conservation subdivisions, preserved areas have been leased to farmers for small-scale agricultural production, used for community gardens, and even used as community-owned horse farms.

#### 5.1.1 The Benefits of Conservation Subdivision Development

The most obvious benefit is environmental. The community-at-large can benefit from conservation subdivision development. It can be a useful tool to help address local concerns regarding the loss of environmental resources, farmland and community character. Local governments can also use conservation subdivision development as a vehicle for creating community-wide open-space networks, reducing the need to purchase and maintain new tracts of public land. Establishing open-space networks and reducing impervious surface cover can benefit the community by providing new recreation opportunities, protecting wildlife habitat, maintaining the ecological and water filtration functions of wetlands and riparian areas, and reducing stormwater runoff and flooding.<sup>46</sup> Environmental benefits include:

- Protection for unique or fragile habitats
- Reduction of the pollution impacts of stormwater runoff
- Aquifer recharge

---

<sup>45</sup> Randall Arendt, *Conservation Design for Subdivisions* (Washington, DC: Island Press, 1996).

<sup>46</sup> *ibid*

- Opportunities to link wildlife habitats
- Conservation values that are part of the planning process
- Meeting the goals of open space and community development plans

Randall Arendt, widely regarded as the leading authority on conservation subdivision design, feels that conservation subdivisions are “twice green” because they succeed both environmentally and economically.<sup>47</sup> Benefits for the municipality include:

- Reduction in infrastructure and maintenance costs
- Reduced demand to acquire new public parkland
- Preservation of local character
- Enhancing the municipality’s quality of life, one of its chief assets in attracting quality businesses and in encouraging economic growth

Conservation subdivisions also target the growing consumer market for homes in natural settings with less property to maintain. Even with smaller lots, housing prices and resale values in conservation subdivisions compare favorably to those in traditional subdivisions. In fact, consumers have shown a willingness to pay a premium for the environmental amenities and quality of life that conservation subdivisions offer. Many people would gladly trade lot size for proximity to natural scenery.<sup>48</sup> A recent study by Rachel and Stephen Kaplan at the University of Michigan supports this contention.<sup>49</sup> Social and Recreational benefits to the consumer include:

- Reduces isolation and sprawl

---

<sup>47</sup> Randall Arendt, "Enhancing Subdivision Value through Conservation Design," *On Common Ground* (Summer, 2001).

<sup>48</sup> Leonard Gilroy, *Conservation Subdivision Design: A Market Friendly Approach to Local Environmental Protection* (Los Angeles, CA: The Reason Foundation, 2002).

- Enhances community character
- Promotes community involvement
- Provides the opportunity to network neighborhood trails and open space with the community at large

From the developer's perspective, conservation subdivision development offers lower development-related expenses with a high-quality, highly-marketable product as the end result. Having homes clustered on smaller lots reduces development costs since there are fewer trees to clear, less land to grade, and less road, water, and sewer infrastructure needed to serve the development.<sup>50</sup> Benefits for the developer and realtor include:

- Streamlines plan review process; reduces time and costs
- Adds valuable amenities that can enhance marketing and sale prices
- Increases resale value; homes in conservation subdivisions have shown to appreciate faster than those in conventional subdivisions
- Provides flexibility to encourage developers to create "Green Neighborhoods"
- Decreases site development costs by designing with the terrain

## 5.2 The Conservation Subdivision Development Design Process

In conventional subdivision planning, the site development process typically begins with a brief suitability analysis that addresses three basic aspects of the site: slope, soil and hydrology. An assessment of these three site characteristics is usually mandated to ensure that basic state or

---

<sup>49</sup> Laura Bailey, "New Market for Developers," *University of Michigan News Service* June, 2004.

<sup>50</sup> *ibid*

municipal environmental codes are met. The goal here is to give the eventual homeowner some security regarding potential problems with flooding and the integrity of the foundation. Next comes determining the lot sizes and drawing the lot lines. This is widely considered the most important aspect of the design process, as it represents that way that developers see their land value realized. Commonly, developers have the land value tied to how large the individual lot size is, and therefore bigger is better. As a result, every square inch of “developable” land is carved up into lots, with the aim being not to “waste” any sellable square footage by keeping it open. Conservation subdivisions offer an alternative, by using a four step planning process that reverses the typical subdivision planning process. First, the open space is designated; second, the houses are sited; third, the roads and trails are planned; and fourth, the lot lines are drawn (For a complete description of the process, see Appendix 3).<sup>51</sup> This re-ordering of the process makes it immediately apparent that the land value is tied to conservation. It illustrates what green building guru William McDonough means in his statement “Design is the first signal of intent”.<sup>52</sup>

### 5.3 Distinctions between Cluster and Conservation Subdivision Development

Rayman Mohamed summed up the distinctions between conservation subdivision design and cluster development thusly: "Conservation subdivisions are distinct from the mere clustering of lots where environmental concerns, aesthetics, history, and culture are given relatively short shrift."<sup>53</sup>

---

<sup>51</sup> Gilroy, *Conservation Subdivision Design: A Market Friendly Approach to Local Environmental Protection*

<sup>52</sup> William McDonough, *Cradle to Cradle* (North Point Press, 2002).

<sup>53</sup> Rayman Mohamed, "Conservation Subdivisions: Price Premiums, Improvement Costs, and Absorption Rates," *Urban Affairs Review* (January, 2006).



Randall Arendt highlighted three important distinctions. "First, it sets much higher standards for the quantity, quality, and configuration of the resulting open space."<sup>54</sup> Typically, cluster ordinances require only 10 to 20 percent open space to be set aside. However, conservation subdivisions designate at least 50 percent (and sometimes as much as 70 percent) of the land as permanent, undivided open space. "Unlike most cluster provisions, this figure is based only on the acreage that is high, dry, flood-free, and not steeply sloped. Following this approach, a significant part of the community's important farmland or woodland resources (including terrestrial habitat) and its historic or cultural features can be protected."<sup>55</sup>

"Second, municipalities can exercise greater influence on the design of new conservation subdivisions."<sup>56</sup> Municipalities can encourage this flexible design approach (or even require it) where the Comprehensive Plan has identified the location of important resources. Establishing a conservation zoning overlay across the established focal area as well as offering density bonuses for land-conserving design could be an effective combination.

"Third, the protected land is also configured so that it will, wherever practicable, contribute to creating an interconnected network of open space throughout the community, linking resource areas in adjoining subdivisions and/or providing buffers between new development and preexisting parklands, state forests, game lands, wildlife refuges, or land trust preserves."<sup>57</sup> This opportunity will be examined more closely in Chapter 5.

#### 5.4 Criticisms of Conservation Subdivision Development

---

<sup>54</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).

<sup>55</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).

<sup>56</sup> *ibid*

<sup>57</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).

Common criticisms of conservation subdivision development include the following:

#### Economic Criticisms

- Poor marketability (too expensive for developer to implement)
- Affordability (consumers will refuse to pay the premium for increased site amenities)
- Confusion about terminology (open space, easement, etc.)
- Tax burden (who pays taxes on preserved lands?)

#### Environmental Criticisms

- Produces haphazard, small green islands (not ecologically sustainable)
- Dubious habitat value (depends on the quality of the environmental assessment)
- Who manages preserved lands (HOA lack the expertise)
- Need a green infrastructure plan (very expensive if not already in place)
- Unrealistic (how will disturbance regimes be handled, i.e., fire??)

#### Social Criticisms

- Exclusionary (when conserved land is privately held in common)
- Increased density will negatively affect traffic, noise, etc. with surrounding community

#### Civil Criticisms

- No recognized benchmark or performance standards in place as a guide
- Hard to Implement (need zoning and subdivision ordinances in place)

With these criticisms in mind, it is understood that conservation subdivision development is no silver bullet – but it does have its place in the open space conservation toolbox. It is a strategy that requires the thoughtful attention of all of the stakeholders in order to maximize its potential.

## **Chapter 6. Where Conservation Subdivision Can Make a Difference**

If conservation subdivision development is to provide multiple benefits to a variety of stakeholders, it must be sited intentionally. The process starts with a series of site selection choices that maximize the environmental and development management objectives separately. These are then correlated, resulting in a range of potential sites that are most appropriate for a successful collaboration.

### **6.1 Selecting a Site to Maximize Benefits**

This chapter will seek to identify those opportunities within the focal area where conservation subdivision can be used as a tool to acquire critical resource lands within a proposed interconnected green system. It will correlate the most significant open space areas that are proposed for protection with parcels that are situated to serve smart growth objectives at the outer ring of metropolitan development. It will further correlate the sites with those that are available for development, along with the applicable zoning and subdivision ordinances that are beneficial to land conservation. Parcels that meet these parameters will be identified and placed into a conservation subdivision overlay district. Characteristics to correlate for site selections:

1. Sites within highly significant open space areas that are proposed for protection
2. Sites within a target area located at the leading edge of urban development
3. Sites with applicable zoning and subdivision ordinances that are beneficial to land conservation
4. Sites within the target zone that are not currently developed

5. Sites within the target zone that have been recently developed and occupy or are adjacent to highly significant open space areas that are proposed for protection

## 6.2. Following the Triangle GreenPrint

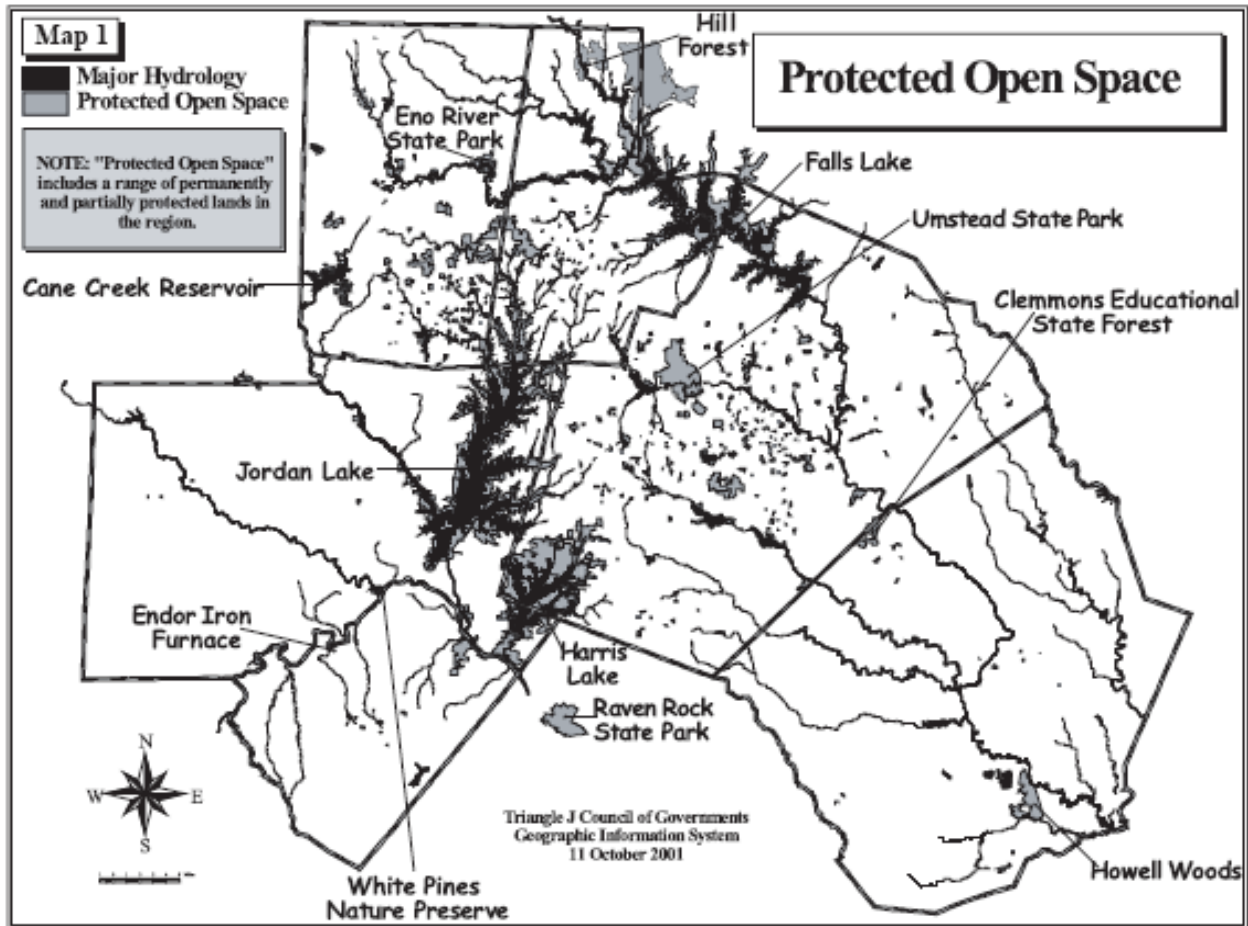
According to Randall Arendt, conservation subdivisions should be sited within the context of the larger, green infrastructure of the area in order to realize the maximum ecological and social benefits and avoid haphazard conservation. If sited in this way, conservation subdivision has the potential to be a powerful tool to augment, buffer or link green spaces within an interconnected green system. In locating optimal sites within the six-county Triangle area where conservation subdivision would make this kind of difference for open space preservation, the green infrastructure of the area would need to be identified and studied.

A review of the existing open space in the Triangle area revealed that the current green infrastructure is incomplete and fragmented. Most of the existing open space follows riparian corridors along larger watersheds, punctuated by lakes, state parks, a recreation area and a natural area (see Map 1).

The Triangle GreenPrint project was intended to serve as the green infrastructure plan for the six county area. As noted in Chapter 2, the project produced a database of a wide variety of significant resources across the focal area as well as a GIS map of the lands and features that were deemed worthy of saving (see Map 2). Please note that in map 2, many of the resource lands overlap each other because they were significant in more than one category. For instance, all of the lands that were important for water quality were also important for parks and for natural areas, so the water quality lands layer is not visible and not included in the map legend.

The feature of the GreenPrint Program known as the GreenPrint Tracker was intended to provide a consolidated repository of current open space GIS data, uploaded to the Tracker as parcels came under protection. While the Tracker data was current at the time of its inception in 2002, it has clearly not been updated comprehensively since then. As a result, its value as an information resource to open space planners is limited.

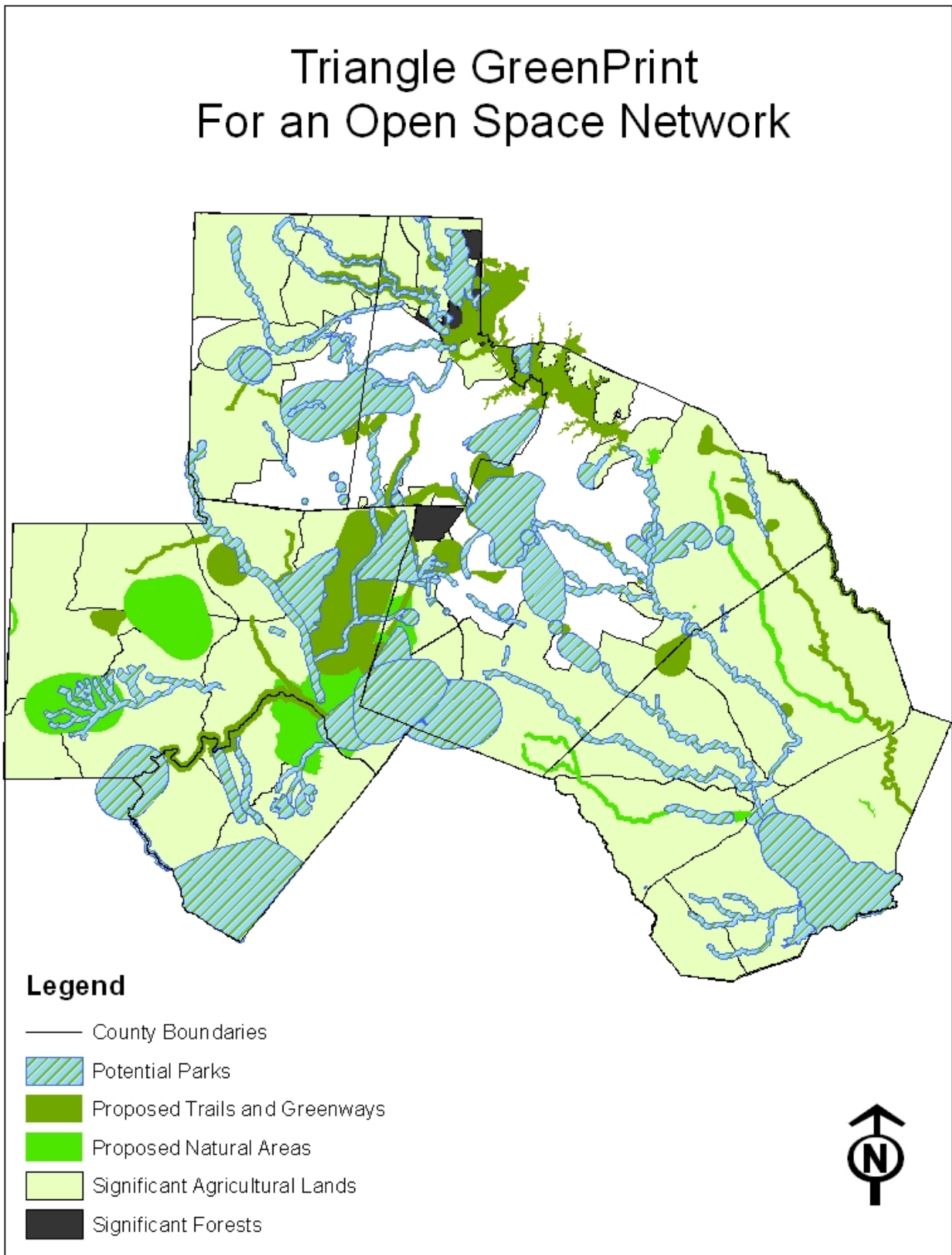
### Map 1: Existing Protected Open Space



*Protected open space in the Triangle region includes everything from neighborhood parks to large preserves.*

Source: Triangle GreenPrint Regional Open Space Assessment 2002

**Map 2: The Triangle GreenPrint**



Source: Triangle GreenPrint database

### 6.2.1 The GreenPrint Ranking Scheme

The Triangle GreenPrint was analyzed in order to narrow the selection of best potential sites for conservation subdivision to significant open space areas that are proposed for protection. A review of the GreenPrint rankings of these significant open space areas produced a range of potential sites for conservation subdivision strategies.

It should be noted that there is no composite, overall ranking of the GreenPrint sites. The selected sites were ranked within the context of the three separate open space workshops that reflected their function (Parks, Greenways and Historic Areas; Natural Areas and Water Quality; Farm and Forest Land). Therefore, there were three separate ranking rubrics.

It should also be understood that the GreenPrint rankings for Natural Areas and Water Quality are incomplete. Using data from the NC Natural Heritage Program, the Natural Areas and Water Quality selections for the GreenPrint were chosen to reflect a wide range of ecological characteristics (presence of rare or endangered species, high biodiversity, water supply watersheds, connectivity between protected areas, wildlife corridors, high quality waters, pristine areas and/or areas free from exotic invasive species, unique or outstanding geologic sites, forest cover, and achievement of multiple objectives).<sup>58</sup> However, due to time and budget constraints, the Natural Areas and Water Quality selections were only ranked for the presence of rare species populations and rare, outstanding natural communities.

The ranking of the Parks, Greenways, and Historic Areas selections for the GreenPrint were complete and the protocol they used can be found above at 3.2.2. The Farm and Forest Land selections for the GreenPrint were ranked using a “relative sustainability” score and the protocol they used can also be found above at 3.2.2.

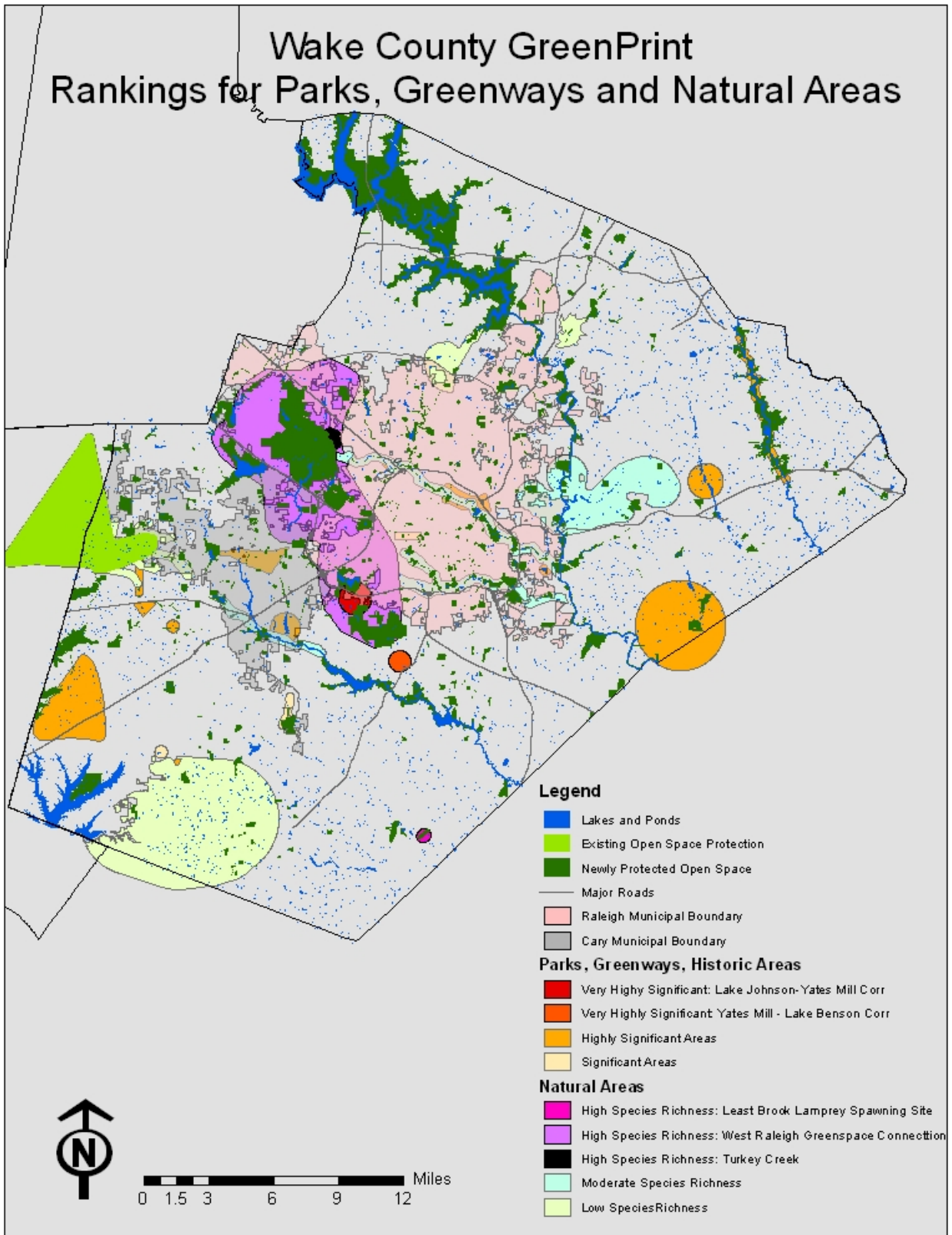
A composite map was created with the results of all of the ranking protocols across the Triangle. Due to the enormous amount of data, the focal area was narrowed to include only Wake County (see Map 3). For the purposes of this study, only the three highest-ranking natural areas were individually broken out, with the remaining natural areas allocated into ranges of “moderate species rarity” and “low species rarity”. Similarly, for the Parks, Greenways, and Historic Areas, only the “very highly significant” selections were individually broken out, with the “highly significant” and “significant” selections remaining grouped. The GreenPrint rankings, although incomplete, provide enough information to determine selection sites reflecting the highest scores for species richness, species rarity, and outstanding natural communities. The GreenPrint rankings also identify sites that have superior value as potential linkage corridors.

---

<sup>58</sup> Triangle J Council of Governments, *Triangle GreenPrint Open Space Assessment*



**Map 3: Wake County GreenPrint Rankings**



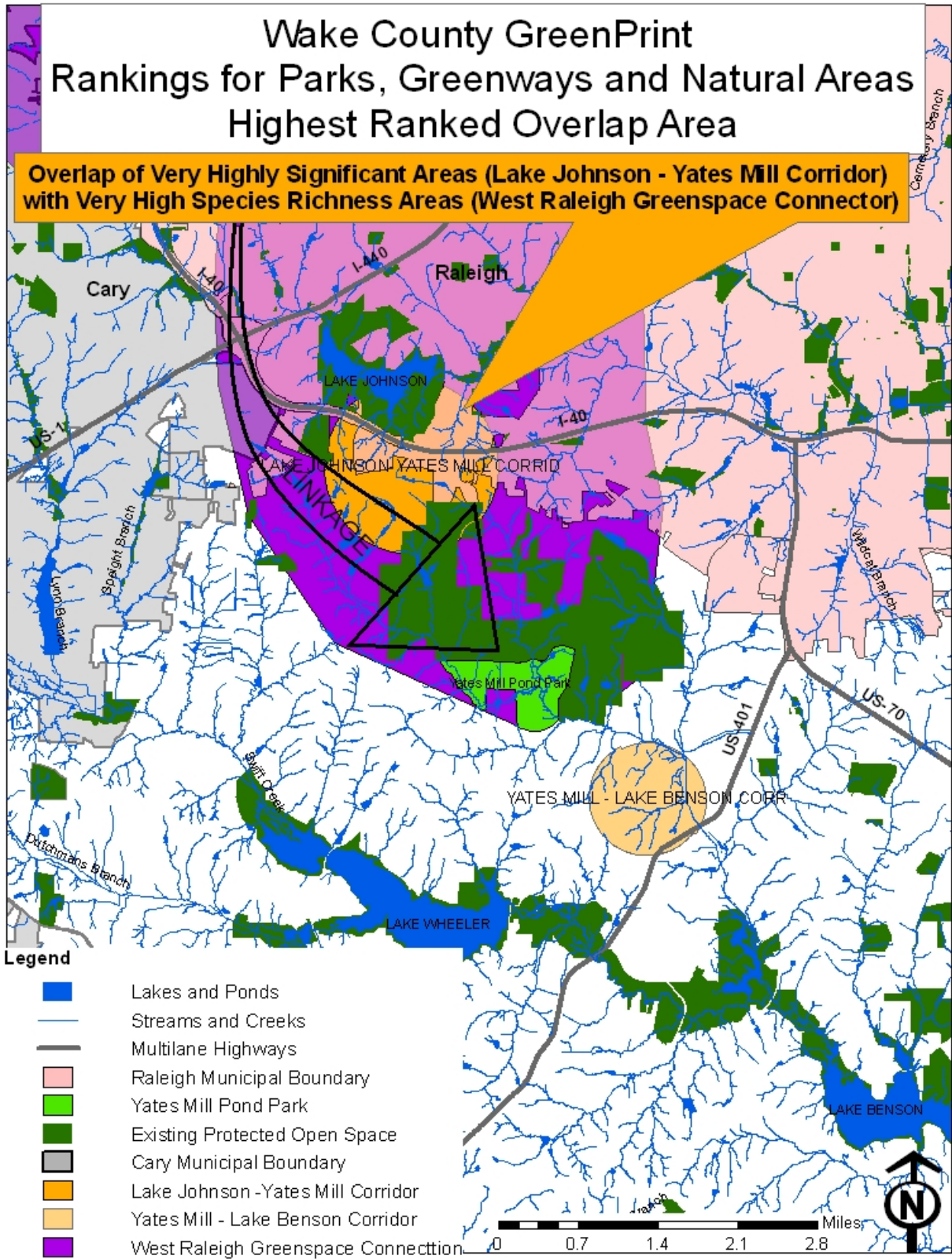
Source: Triangle GreenPrint database

## 6.2.2 Finding the GreenPrint Target Area

A review of the GreenPrint rankings in Map 3 revealed areas where parks and greenway sites overlapped natural areas. It suggested a noteworthy opportunity in the southeast Raleigh area where a “very highly significant” *greenway* patch (Lake Johnson-Yates Mill Corridor) coincides with one of the three highest-ranking *natural areas* (West Raleigh Greenspace Connection). The overlapping of these two types of open space is important because it represents an opportunity to conserve multiple characteristics and functions of open space. This has economic as well as ecological implications. Because this particular instance appears to be the highest ranked and most significant intersection across Wake County, it was chosen as the target area. Having identified the most highly significant open space area within Wake County that is proposed for protection, the first step in the site selection process is complete (see Map 4).

Overall, the West Raleigh Greenspace Connection appears to be an attempt to link existing protected open space containing very significant natural communities from Umstead Park (west of Raleigh) to Lake Benson (south of Raleigh). The Target area shown in Map 4 highlights the portion of this connection between Lake Johnson and Yates Mill. It reflects the GreenPrint determination that there are very outstanding natural communities within these two protected patches that deserve linking. It also recommends that linkages between Lake Johnson and Yates Mill serve as very significant locations for greenways. Future opportunities are also suggested south of Raleigh to complete the linkage between Yates Mill and Lake Benson.

Map 4: Wake County GreenPrint – West Raleigh Greenspace Connector



Source: Triangle GreenPrint database

### 6.2.3 Linking Gaps in the GreenPrint

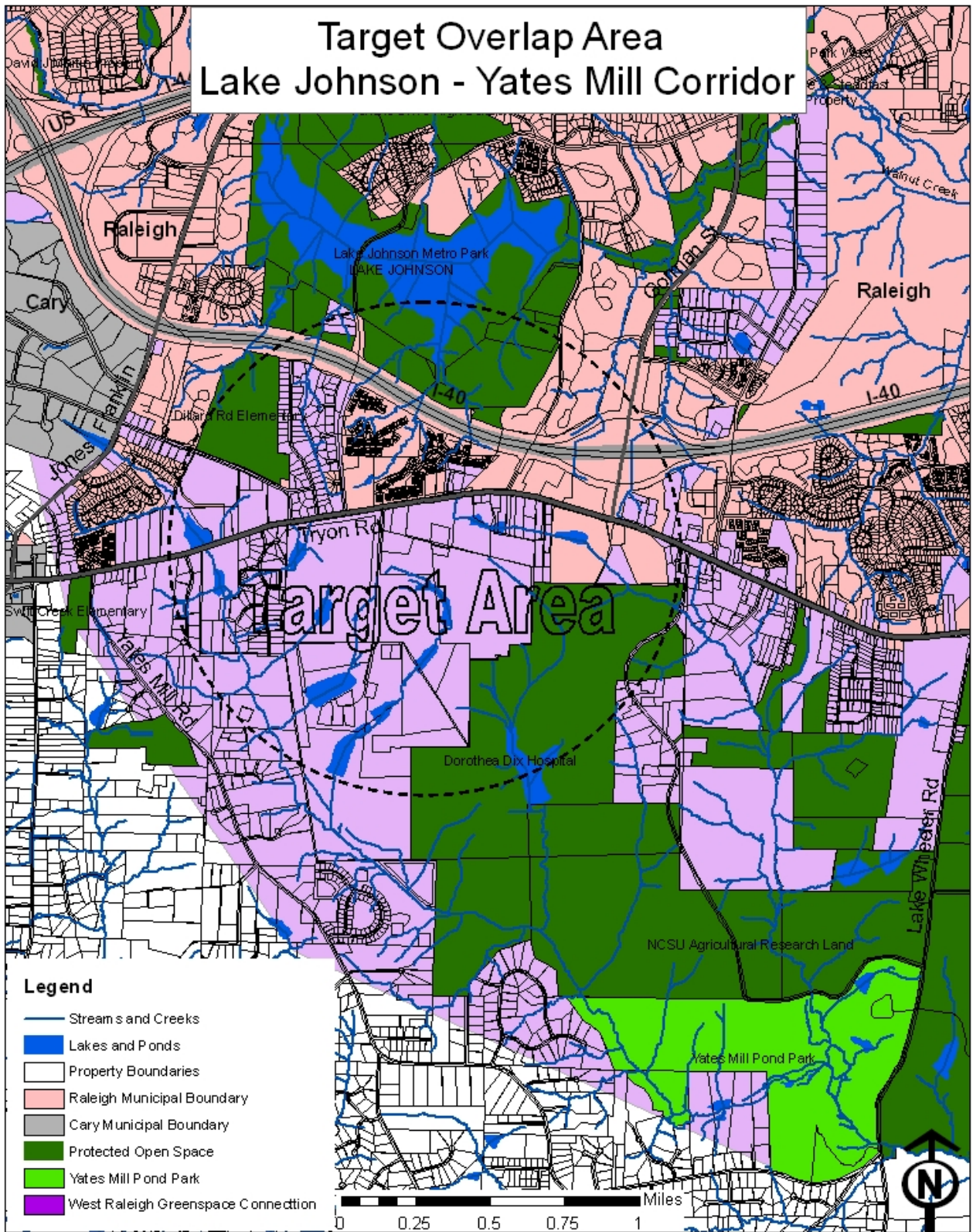
Green corridors are most easily created by following the path of least resistance in tracking along the route of streams and creeks. This works well for a variety of reasons. Many urban and suburban areas already have some form of mandated water quality buffer. Combined with the usual prohibitions against developing on steep slopes or in floodplains, this sets the table for designating these riparian avenues as green space.

However, in some cases the riparian lands stop short of the areas we want to connect. This forces municipalities to try to acquire the upland in between, which is typically already developed. Map 5 focuses close attention on the gap in the Lake Johnson-Yates Mill Corridor. The area between the Dorothea Dix Hospital Land and Lake Johnson Metro Park is upland (between the Swift Creek Watershed and the Neuse River Watershed), and contains a major interstate highway, a school, several residential subdivisions, and a strip of commercial, industrial and institutional properties along busy Tryon Rd. There are also a number of small farms to the south of Tryon. This will be a challenging area to create a green linkage.

Map 5 also shows that the target area straddles the Raleigh municipal boundary and lies primarily in the Raleigh Extra Territorial Jurisdiction south of Tryon. It illustrates that the target area is at the urban/suburban divide at the growing edge of the city. The use of conservation subdivision strategies in these dynamic growth areas can compliment smart growth efforts. They can be integrated into the land use and development plan to assist in directing growth away from critical resources and preserve necessary ecological functions. Having identified a target area within the West Raleigh Greenspace Connection that is located at the leading edge of urban development, the second step in the site selection process is complete (see Map 5).



**Map 5: Lake Johnson – Yates Mill Corridor**



Source: Triangle GreenPrint database and Wake County GIS files

### 6.2.3.1 The Movement of Natural Communities across Gaps

The movement of species between large patches of natural habitat is certainly facilitated by a continuous green space corridor. However, unbroken natural areas are not an absolute necessity of survival for numerous plants and animals. In fact, many creatures commonly move between habitat patches, crossing dangerous and inhospitable areas in the process of moving between resource sources and sinks. Distance between the patches, the length of patch edge and inner patch size are important factors. The quality of the corridor habitat is significant (the size and density of the cover) and a redundancy of routes is essential.

Barriers to movement along corridors can be a mixed blessing; some species will be favored and some will be hindered. Sometimes barriers can prevent a predator from pursuing their prey, and sometimes it produces a gradual weakening of the genotype of a species via genetic drifting. A wide variety of responses can be expected.

## 6.3 Zoning and Subdivision Ordinances

### 6.3.1 Zoning and Subdivision Ordinances for Conservation Subdivision

Communities wanting to utilize conservation subdivision as a tool for open space acquisition need to implement effective zoning and subdivision ordinances. There are a number of ways that this can be accomplished. At the very minimum, subdivision regulations need to accommodate the smaller lots sizes that make conservation subdivision clustering possible. Conservation subdivision development may be voluntary throughout the municipality or

mandatory in specific places. Designating conservation subdivision overlay zones is more effective in directing growth and preservation efforts, but more controversial.

It must be understood that conservation subdivision development is not a benchmarked technique and there are no performance standards associated with it. The distinction between conservation subdivision design and clustering design is routinely collapsed. The process needs to be flexible enough to be tailored to the needs of each particular community, but structured sufficiently to achieve significant conservation goals. Therefore, careful guidance through the planning process is critical for success. According to Randall Arendt, the progression begins with a review of the community's three principal land-use documents: its comprehensive plan, its zoning ordinance and its subdivision regulations. Conservation subdivision and land development ordinances should contain:

- Procedures that strongly encourage dialogue between the applicant and the municipality before detailed plans are engineered
- A requirement for a context map showing all natural and manmade features surrounding the site
- A requirement for a site inventory of existing features upon which to base decisions regarding the development
- A required site visit by the planning commission members accompanied by the developer, with the site inventory in hand
- A four-step design process in which the conservation areas are determined first, before houses, streets, and lot lines are established
- Standards for the configuration and location on the conserved lands<sup>59</sup>

Zoning ordinances should contain:

- The ability for an applicant to obtain full density through a by-right (versus conditional use) approval process, but only when a conservation option is selected
- A requirement that protected lands in conservation subdivisions are comprised of at least 50% of the buildable ground, whenever the underlying density is one unit per acre or lower
- Strong disincentives to discourage “conventional” development, usually by reducing the density by half
- Restrictive covenants that ensure that the conservation lands are perpetually restricted from further development<sup>60</sup>

Arendt further recommends a thorough review of existing land use regulations, updating the comprehensive plan and/or open space plan to contain conservation goals. Municipalities should also consider adopting a map of prioritized sites for conservation along with ordinance revisions.<sup>61</sup>

---

<sup>59</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).

<sup>60</sup> *ibid*

<sup>61</sup> *ibid*



### 6.3.2 Current Zoning and Subdivision Ordinances in the Target Area

Map 6 illustrates the applicable zoning and overlay districts in the target area. The Dillard Road Elementary School is a newly designated open space, although its current landscape design precludes it from being included as viable open space for this project. The Lake Johnson Metro Park is protected open space within the Conservation Management District (CM). The Dorothea Dix Hospital Lands are protected open space within the Agricultural Productive District (AP) (see Map 6).

Currently, the zoning below Tryon Rd is rural residential (RR) within a Watershed Protection Overlay District (WPOD). The RR zone is designated for a minimum lot size of 40,000sf (about 1 acre). The WPOD brings the minimum lot size up to 80,000sf, or almost 2-acre lots. Between I-40 and Tryon Rd, there is a patchwork of zones (commercial, residential, industrial, institutional, office), characteristic of a fast-growing, outer ring of development.

#### 6.3.2.1 The Conservation Management District

Several of the creek buffers between I-40 and Tryon Rd have been included in the Conservation Management District (CM). “The CM District may carry residential density, which can be transferred to contiguous residentially zoned property under the same ownership when a site plan is approved. The maximum residential density per net acre is equal to the per net acre residential density of the contiguous residentially zoned property that is under the same ownership. If developed as a cluster unit development, the property which receives the density is exempted from the minimum site sizes of twenty (20) and ten (10) acres. All residential units

must be located outside the CM District and the (density transfer) requirements of §10-2074(d) must be met.”<sup>62</sup> The application of the CM District also regulates impervious surface, tree removal, light pollution and land-disturbing activities.<sup>63</sup> It also requires “natural resource buffer yards” along all watercourses within the CM District having a concentrated flow from a drainage area of at least five acres.<sup>64</sup> “These natural resource buffer yards provide an area where stormwater flows in a diffuse manner so that the stormwater runoff does not become channeled and infiltration of the stormwater and filtering of pollutants can take place.”<sup>65</sup> While these waterway buffers do not extend into the surrounding upland, addressing other ecological functions of the site, they represent a solid first step beyond typical cluster development. The CM District appears to function as a “bare bones” conservation subdivision overlay, in that there are both incentives and requirements for development to design with nature.

---

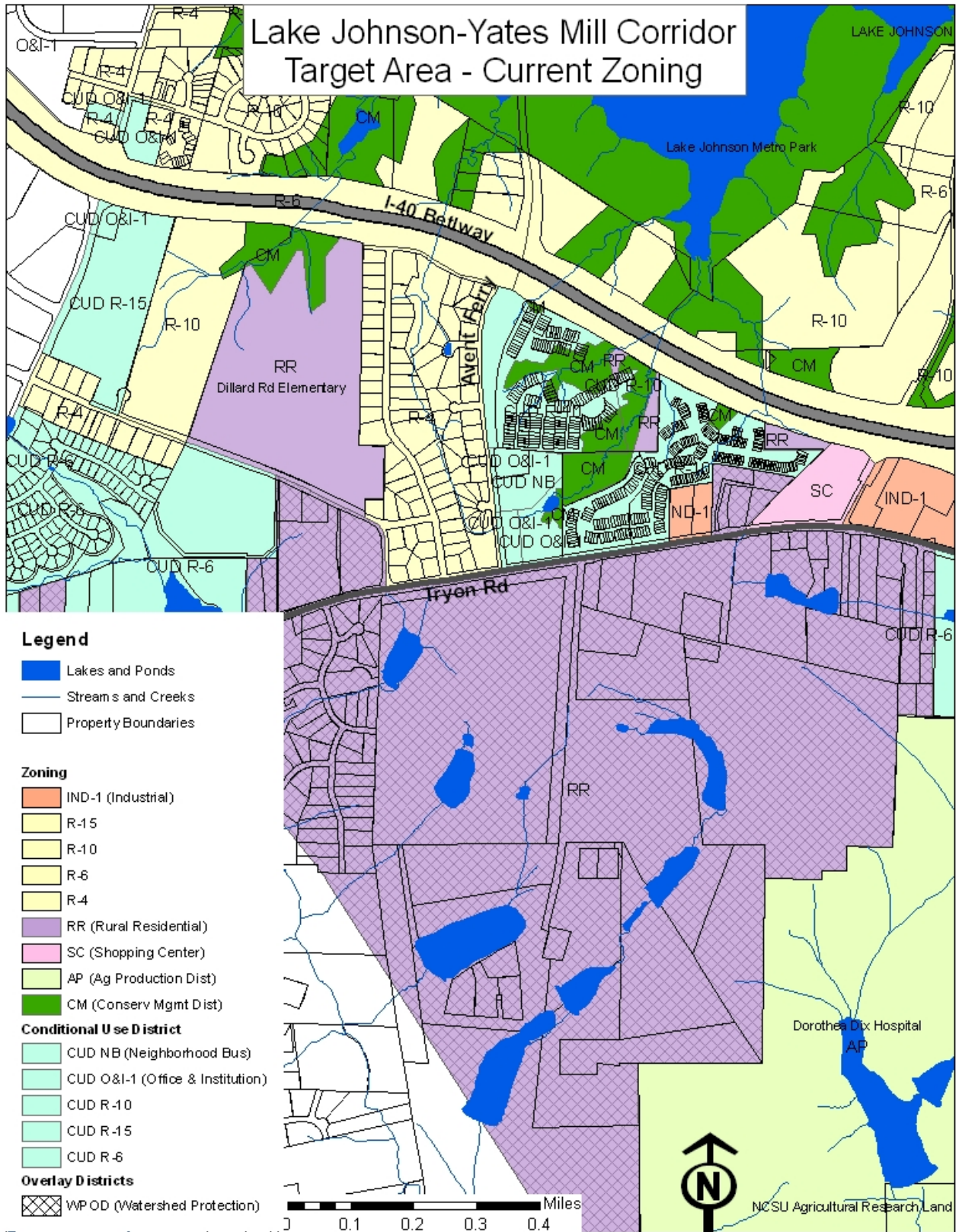
<sup>62</sup> City of Raleigh, Code of Ordinances, §10-2030, (Ord. No. 1992-43-TC-397, §1, TC-10-92, 9-1-92; Ord. No. 1996-851-TC-128, §3, TC-23-95, 4-2-96; Ord. No. 1997-137-TC-153, §§10, 11, TC-18-96, 6-17-97; Ord. No. 2001-991-TC-206, §4, TC-8-00, 5-1-01).

<sup>63</sup> *ibid*

<sup>64</sup> City of Raleigh, Code of Ordinances, §10-9040, (Ord. No. 2001-991-TC-206, §1, TC-8-00, 5-1-01; Ord. No. 2005-817-TC-267, §22, TC-7-05, 4-19-05)

<sup>65</sup> *ibid*

**Map 6: Target Area Zoning**



Source: Triangle GreenPrint database and Wake County and Raleigh GIS files

### 6.3.2.2 Conservation Subdivision Ordinances in the Target Area

Of the six counties in the Triangle area, only Wake County specifically recommended that its municipalities adopt conservation subdivision ordinances and / or a conservation subdivision overlay zone.<sup>66</sup> Of the nine municipalities in Wake County, only Cary and Zebulon actually adopted conservation subdivision regulations, although the two municipalities took entirely different approaches. Cary's conservation subdivision ordinance is voluntary and is only one of a large number of attractive options available to developers. As a result, there have been few takers. Zebulon's conservation subdivision ordinance is also voluntary, but is the only alternative to the underlying zoning density and lot sizes. As a result, it has proven more popular.

In the target area of Southeast Raleigh, there is no conservation subdivision ordinance and / or a conservation subdivision overlay zone. The clustering ordinance requires between 10-25% dedications. As expected, the dedicated lands are usually the unbuildable portions of the tracts. As mentioned above, the Conservation Management District is the closest analogy to a conservation subdivision ordinance and overlay zone in the target area. Having identified the applicable zoning and subdivision ordinances that are beneficial to land conservation in the target area, the third step in the site selection process is complete (see Map 6).

## 6.4 Current Land Use in the Target Area

Map 6 depicts the variety of land uses in the target area (commercial, residential, industrial, institutional, office, agricultural, parks and recreational) characteristic of a fast-

---

<sup>66</sup> Greenways Incorporated, *Wake County Consolidated Open Space Plan*, 1-3

growing, outer ring of development. Land values within these vicinities are usually rising precipitously, and sites that are available for development are usually expensive, yet sell quickly.

Map 7 illustrates the availability of undeveloped land in the target corridor (see Map 7). There are still a few working farms in the area south of Tryon Road, and farms that have been broken up into scattered, single-family residences. These large parcels are ripe for development and will not remain long in their current configuration.

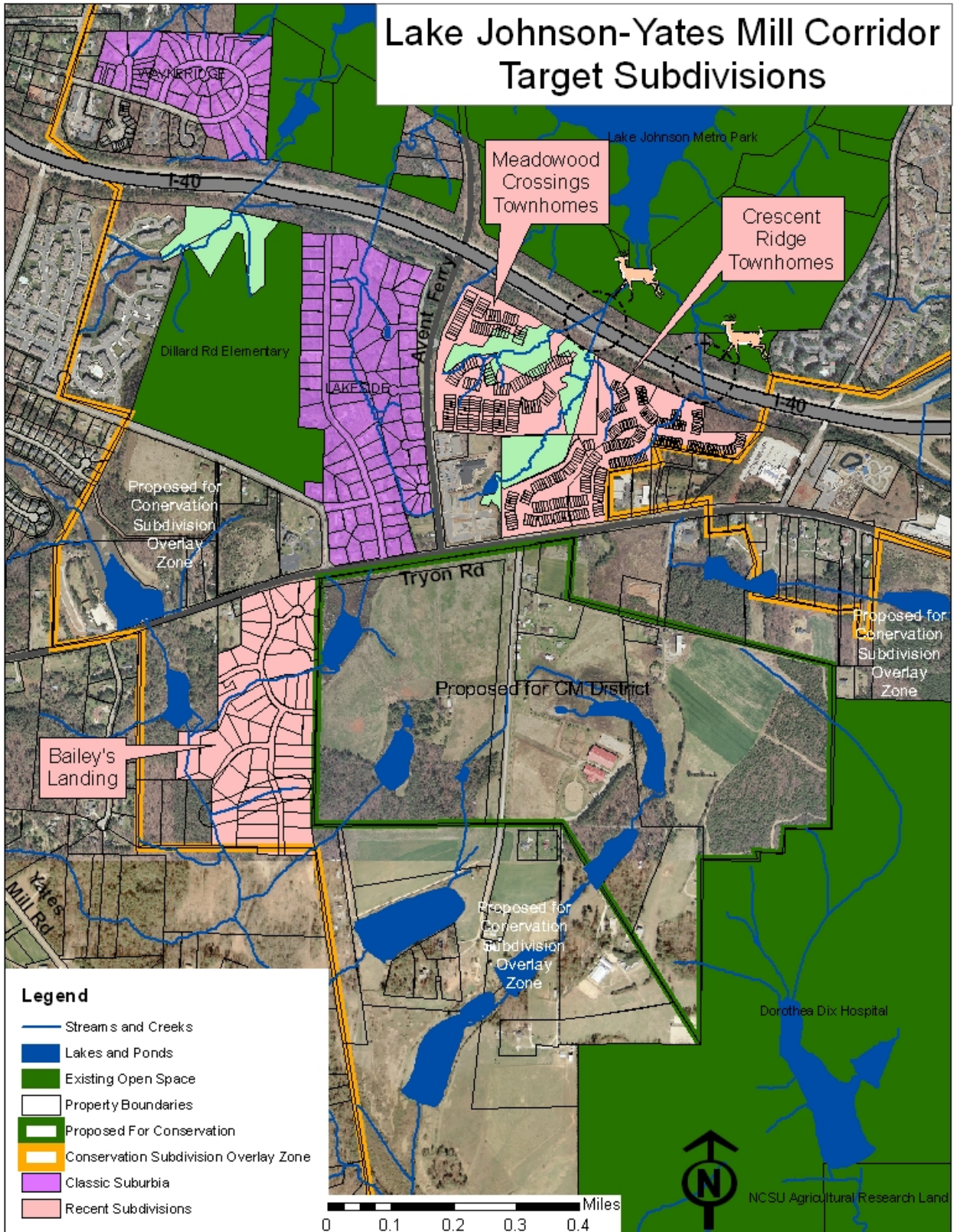
#### 6.4.1 Current Subdivision Development in the Target Area

There are varieties of subdivisions in the target area: some are older while some are quite recent (see Map 7). Built in the late 1960's, the Lakeside subdivision was probably one of the first along Tryon Rd. It was followed in the early 1980's by Wayneridge. Both of these subdivisions have the classic suburban lot layout that we associate with sprawl, with lot sizes ranging from .5 to 1 acre. There is no attempt to buffer the creeks that enter these properties, or to buffer, link or augment open space of the adjacent Lake Johnson Metro Park. In all fairness, however, the Lakeside subdivision was there long before the Lake Johnson Metro Park was established (1976), but the Wayneridge subdivision was not.

Map 7 also highlights recent subdivision development in the target area. Bailey's Landing (2001), Meadowood (2002) and Crescent Ridge (2003) are the Tryon Road subdivisions that could have made a difference in completing the proposed West Raleigh Greenspace Connection linking Lake Johnson Metro Park to Yates Mill Pond Park. Chapter 7 will address these missed opportunities in detailing an alternative conservation subdivision design for Bailey's Landing, and suggesting a more broadly considered ecological solution for Meadowood and Crescent Ridge Townhomes.



**Map 7: Target Subdivisions**



Source: Triangle GreenPrint database and Wake County and Raleigh GIS files

## **Chapter 7. Alternative Scenarios in the Target Area**

What would a conservation subdivision would look like if sited appropriately within the target area? Illustrating an example will make clear the benefits of taking advantage of the same opportunities that were previously missed.

### **7.1 Creating Conditions Favorable to Open Space Linkage**

In order to facilitate the creation of an open space linkage corridor in the target area, I have designated additional acreage into the Conservation Management District to serve as the backbone of the linkage, and designated a Conservation Subdivision Overlay Zone for the tracts immediately adjacent to it (see Map 7). I will then show how a conservation subdivision located in the Conservation Subdivision Overlay Zone can augment and buffer the adjacent Conservation Management District linkage corridor.

#### **7.1.1 Designating a Conservation Management District**

I have selected the largest and least developed of the farm parcels and grouped them into a one-half mile wide green corridor proposed for addition to the Conservation Management District (Green outline on map 7). This approximately 200ac parcel will serve as the backbone of the linkage corridor, taking the conserved land right up to Tryon Rd, and reducing the gap between the larger, open space patches (Lake Johnson Metro Park and Dorothea Dix Hospital Lands). Assembling an open space corridor of this size in this location is extremely challenging.

This tract represents 10 separate landowners, with whom the City of Raleigh and possibly the Triangle Land Conservancy will need to negotiate either a fee simple purchase, the donation of an easement, or some other creative arrangement. However, it is far easier and cheaper to purchase the largest, most contiguous and unbroken tracts than to pursue dozens of smaller, scattered parcels. Once the Conservation Management District boundaries are set within the linkage corridor, a determination of where conservation subdivision may augment and/or buffer these lands can begin. This decision is facilitated by designating a conservation subdivision overlay zone in the areas around the new Conservation Management District lands.

#### 7.1.2 Designating a Conservation Subdivision Overlay Zone

The lands immediately adjacent to this future Conservation Management District have been designated as a Conservation Subdivision Overlay Zone (Yellow outline on map 7). This is to buffer the future protected open space and provide a transition zone between natural areas and the impervious built environment. Coupled with a Conservation Subdivision Development Ordinance, the zone also assures that the ecological benefits of the conservation lands will extend out into the community, establishing an ongoing interconnection between the citizens and their natural lands. As described in above in 6.3.1, a conservation subdivision overlay zone can accommodate the smaller lots sizes that make conservation subdivision clustering possible, yet allow the full density of the underlying zoning.

The Conservation Subdivision Overlay Zone in the area between I-40 and Tryon Rd plays an important role in the linkage corridor. The few parcels here that are not completely developed are especially critical in supporting conservation subdivisions set-asides that can



provide the green corridors needed to complete the linkage through this very densely developed belt.

Having identified the sites within the target zone that are not currently developed, and designating a portion of them for the linkage corridor and a portion for the Conservation Subdivision Overlay Zone, the forth step in the site selection process is complete (see Map 7).

## 7.2 Bailey's Landing as a Conservation Subdivision Development

It should be understood that an actual conservation subdivision development design relies on a thorough on-site environmental assessment as well as a viewshed analysis, a review of the significant natural heritage resources and research into the cultural and social history of the land. For the purposes of this project, the available GIS data and orthographic images will form the basis of this alternate scenario design.

### 7.2.1 The Original Bailey's Landing Tract

With that caveat in mind, I will begin with an Orthographic photo of the site conditions at the Bailey's Landing tract in 1999, prior to development (See map 8). This is to afford the viewer a baseline for comparison between the original landscape and the results of the current subdivision of the Bailey's Landing tract. It also serves as a comparison to the results of the proposed conservation subdivision design.

Map 8: Baileys Landing Tract- 1999 Orthographic Photo



Source: Wake County and Raleigh GIS files

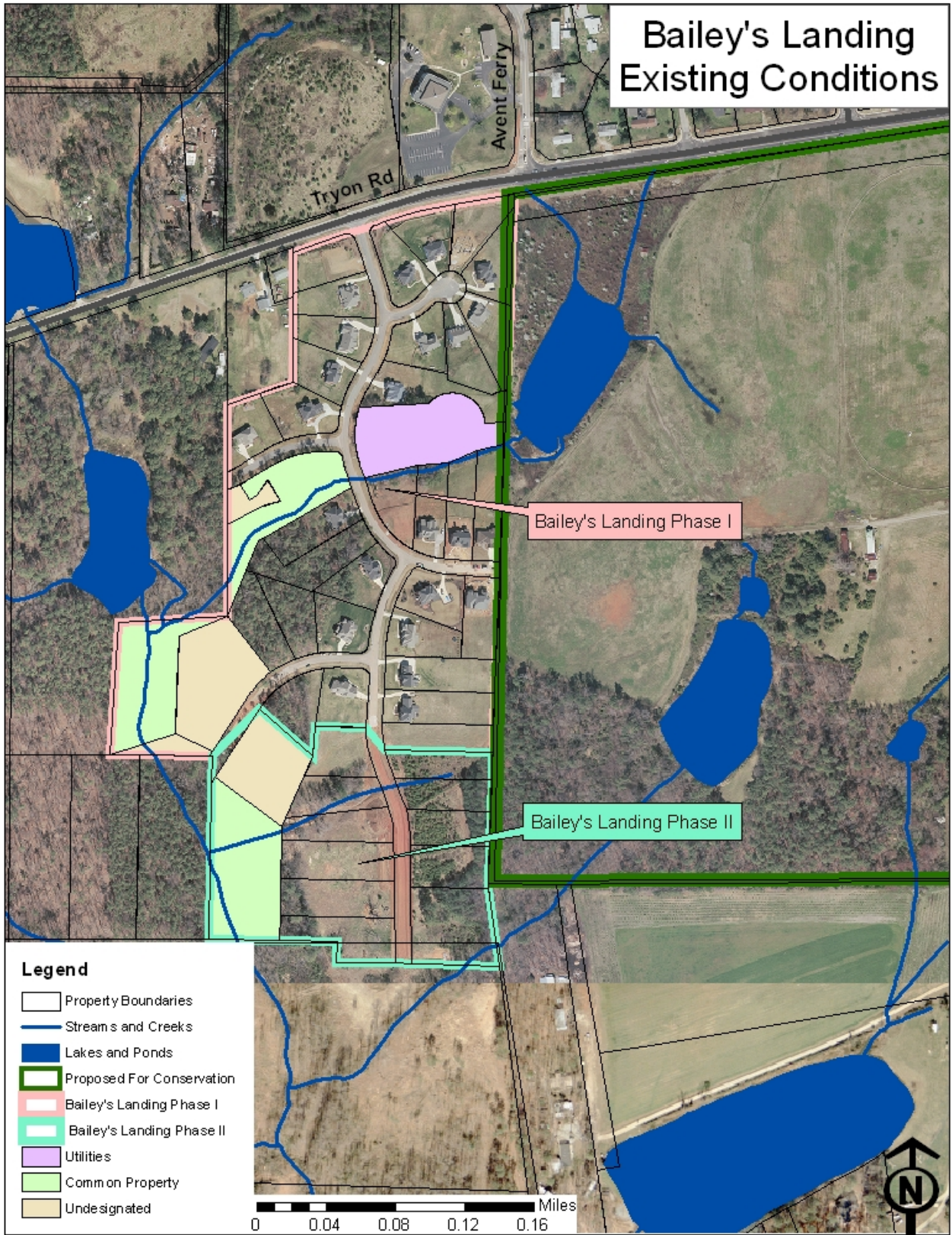
### 7.2.2 Current Subdivision at Bailey's Landing

In reviewing the current development conditions at Bailey's Landing, it appears that unlike Crescent Ridge and Meadowood, it has no Conservation Management District designation (See map 9). The two streams passing through Phase I of the Bailey's Landing property are either on commonly owned lots or on lot boundaries. This subdivision is within the Watershed Protection Overlay District (WPOD) (see Map 6), but it is not in a Primary Watershed. Therefore, the minimum lot size is 40,000sf or about one acre. Bailey's Landing Phases I and II have a total of 52 acres. Although it is not obvious, it is considered a cluster development. The developer was able to reduce lot size to 0.6 acres and retain all 52 of his lots. Of the 52 total acres in the tract, approximately 10% (5 acres) is commonly owned property, with 2 acres in utilities and 3.5 acres undesignated (and probably unbuildable). The remainder has been developed into 52 nearly uniform 0.6-acre lots.

On a positive note, the unbuildable areas will likely remain as undeveloped, bringing the total open space up to 8.5 acres and perhaps added to the Homeowners Association. Additionally, streets have been sited for connectivity to future communities. However, there is scant buffering for the watercourses, lots of impervious surface and monoculture lawn, and no greenway link.



**Map 9: Baileys Landing-Current Conditions**



Source: Triangle GreenPrint database and Wake County and Raleigh GIS files

### 7.2.3 Conservation Subdivision Development at Bailey's Landing

As noted above in 6.3.1, conservation subdivision development is a four-step design process in which the conservation areas are determined first, *before* houses, streets, and lot lines are established. In the following section, I have applied this four-step process, as described by Randall Arendt, to Bailey's Landing (see Drawings 1-4).

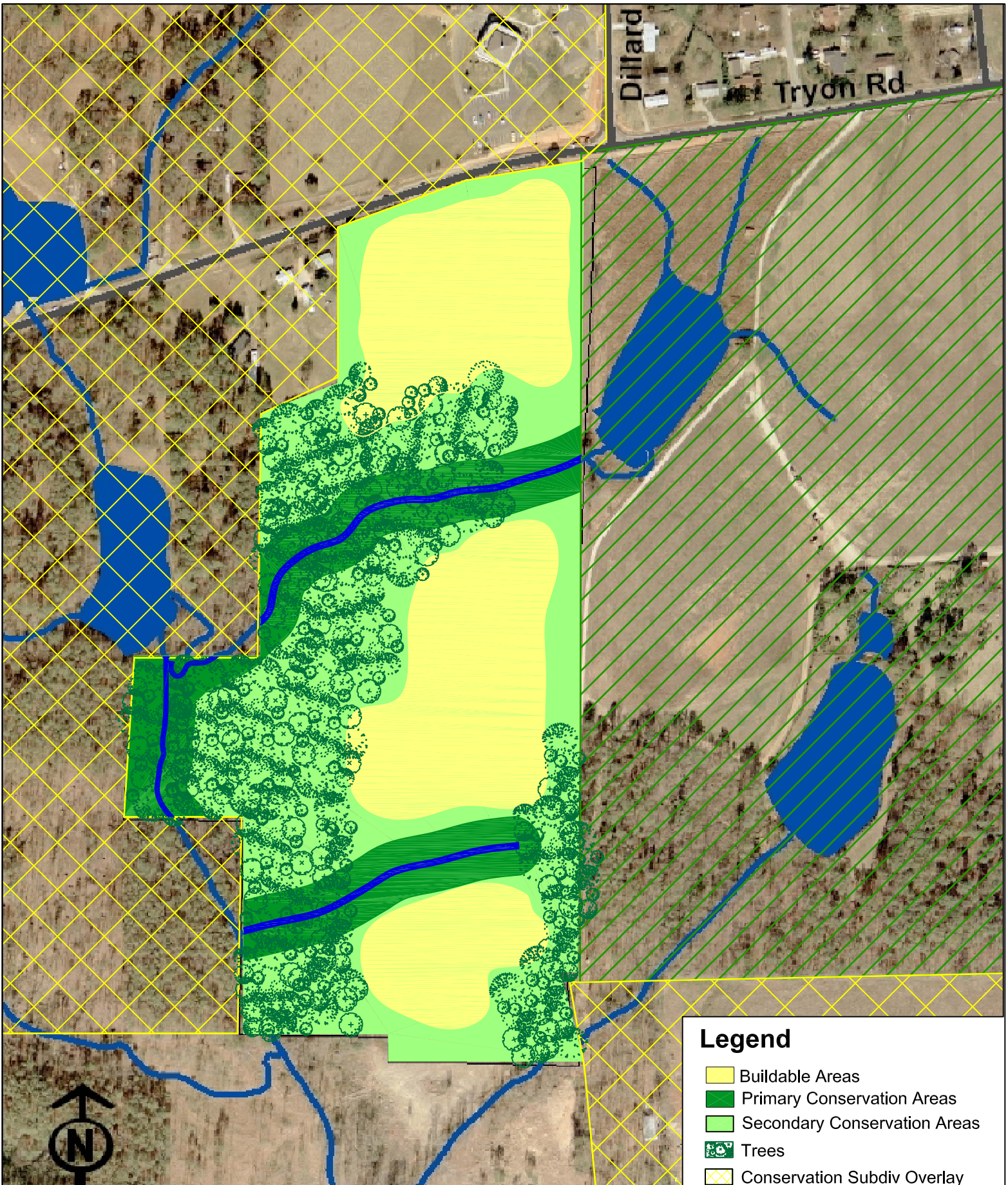
#### 7.2.3.1 Step One - Identifying Conservation Areas

“The first step, which involves the identification of green space worthy of preservation, is divided into two parts: Primary Conservation Areas comprising regulatory wetlands, floodplains and steep slopes; and Secondary Conservation Areas including those unprotected elements of the natural and cultural landscape that deserve to be spared from clearing, grading and advancement. Once both kinds of Conservation Areas have been ‘greenlined’, the remaining land becomes the buildable area.”<sup>67</sup> In Drawing 1, I have added sixty-foot watercourse buffers into the Primary Conservation area at Bailey's Landing, bringing it up to a standard similar to the Conservation Management District buffer regulations (see Drawing 1). There were only a couple of steep slopes to include, and no floodplains. To benefit a greater diversity of ecological communities, portions of upland as well as lowland have been reserved in the Secondary Conservation Area. The buildable areas have organically emerged as discrete neighborhoods. Overall, the buildable areas make up a modest footprint (30%) with the remaining portion in open space (70 %).

---

<sup>67</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).





**Legend**

- Buildable Areas
- Primary Conservation Areas
- Secondary Conservation Areas
- Trees
- Conservation Subdiv Overlay
- Conservation Management

**Bailey's Landing**

**Step One - Identifying Conservation Areas**

### 7.2.3.2 Step Two – Locating House Sites

“The second step involves locating the approximate sites of individual houses which for marketing and quality-of-life reasons should be placed at a respectful proximity to the conservation areas, with homes backing up to woodlands for privacy, fronting onto a central common or wildflower meadow, or enjoying long views across open fields or boggy areas. In this process, an important goal is to lay out the actual development areas so that they can take maximum advantage of the property’s conservation elements, thereby capturing the added value those elements convey”.<sup>68</sup> In the second step, I have arranged the houses around a central open space, with those on the western side backing up to woodlands and those on the eastern side backing onto preserved open meadows (see Drawing 2). Additionally, the houses were arranged as much as possible to screen them from the public road, to provide them with access and views to the meadows, and to conserve for them much of the undisturbed woodland buffer.

“In a full-density plan such as this, the number of house sites will be the same as that shown on a typical yield plan”.<sup>69</sup> The allowable density at Bailey’s Landing reflects the underlying zoning for the rural residential minimum lots size (40,000sf) on 52 acres for a yield of 52 lots.

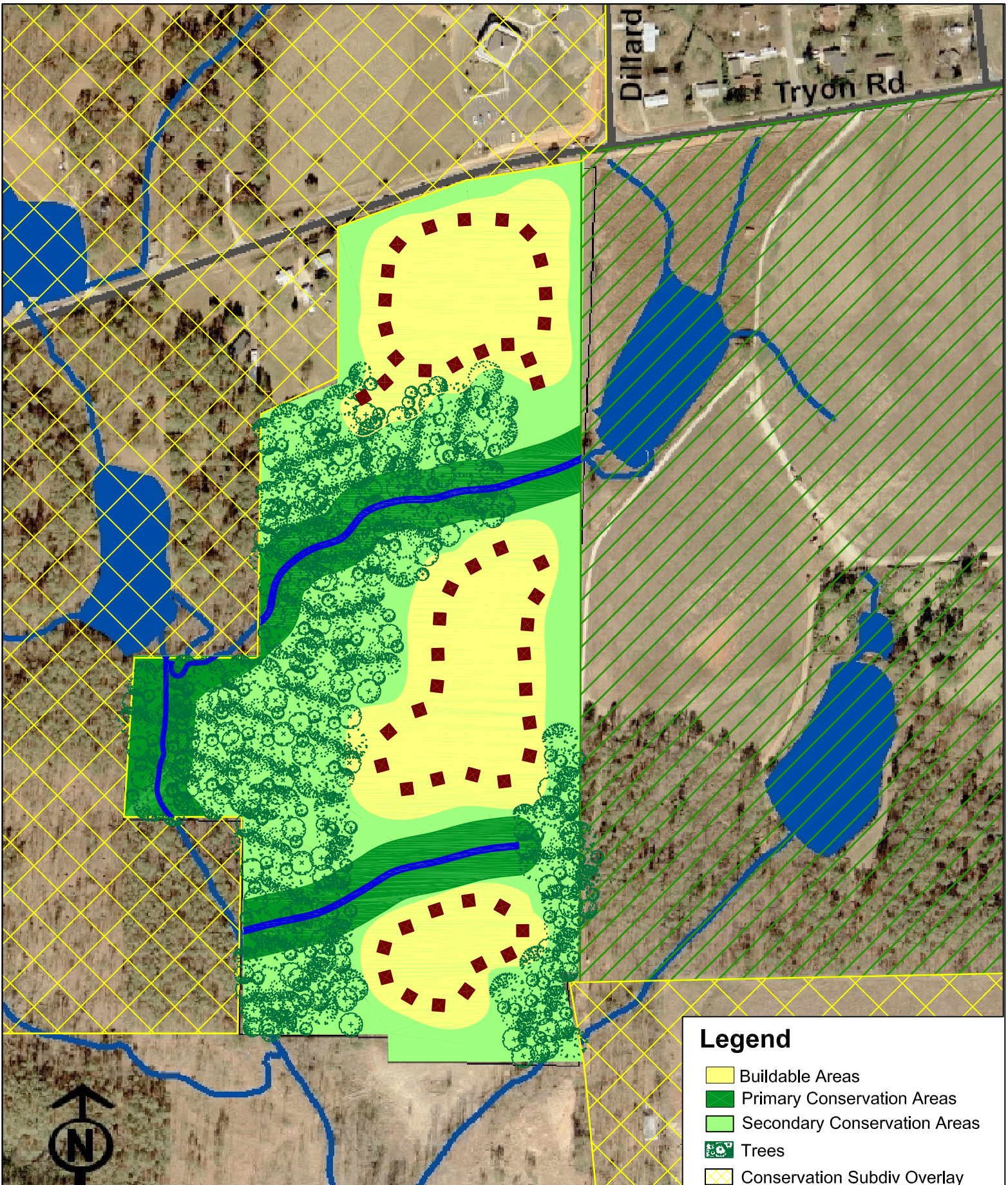
With regard to the property’s woodlands and fields, “the conservation/development choice is sometimes an ‘either/or’ proposition, depending on whether the forested areas or the farmland is deemed to possess greater significance.”<sup>70</sup> In this case, a compromise has been judged most appropriate, preserving the most critical contiguous areas of woodlands and streamside habitat, while also conserving most of the meadows and fields.

---

<sup>68</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).

<sup>69</sup> *ibid*





Dillard  
Tryon Rd

**Legend**

- Buildable Areas
- Primary Conservation Areas
- Secondary Conservation Areas
- Trees
- Conservation Subdiv Overlay
- Conservation Management
- Houses

**Bailey's Landing**  
Step Two - Locating House Sites



### 7.2.3.3 Step Three – Aligning Streets and Trails

“The third step consists of tracing a logical alignment for local streets to access the 52 homes and for informal footpaths to connect the neighborhoods, making it easier for residents to enjoy walking through the green space, observing seasonal changes in the landscape and possibly meeting other folks who live at the other end of the subdivision.”<sup>71</sup>

In step 3, the intent is that the impervious surfaces (roadways, parking, sidewalks) are limited (see Drawing 3). Walking is encouraged by the close proximity of neighbors and recreation areas. The option to commute is enhanced by the fact that it is less than a quarter of a mile from the most southern neighborhood up to the bus stop on Tryon Rd.

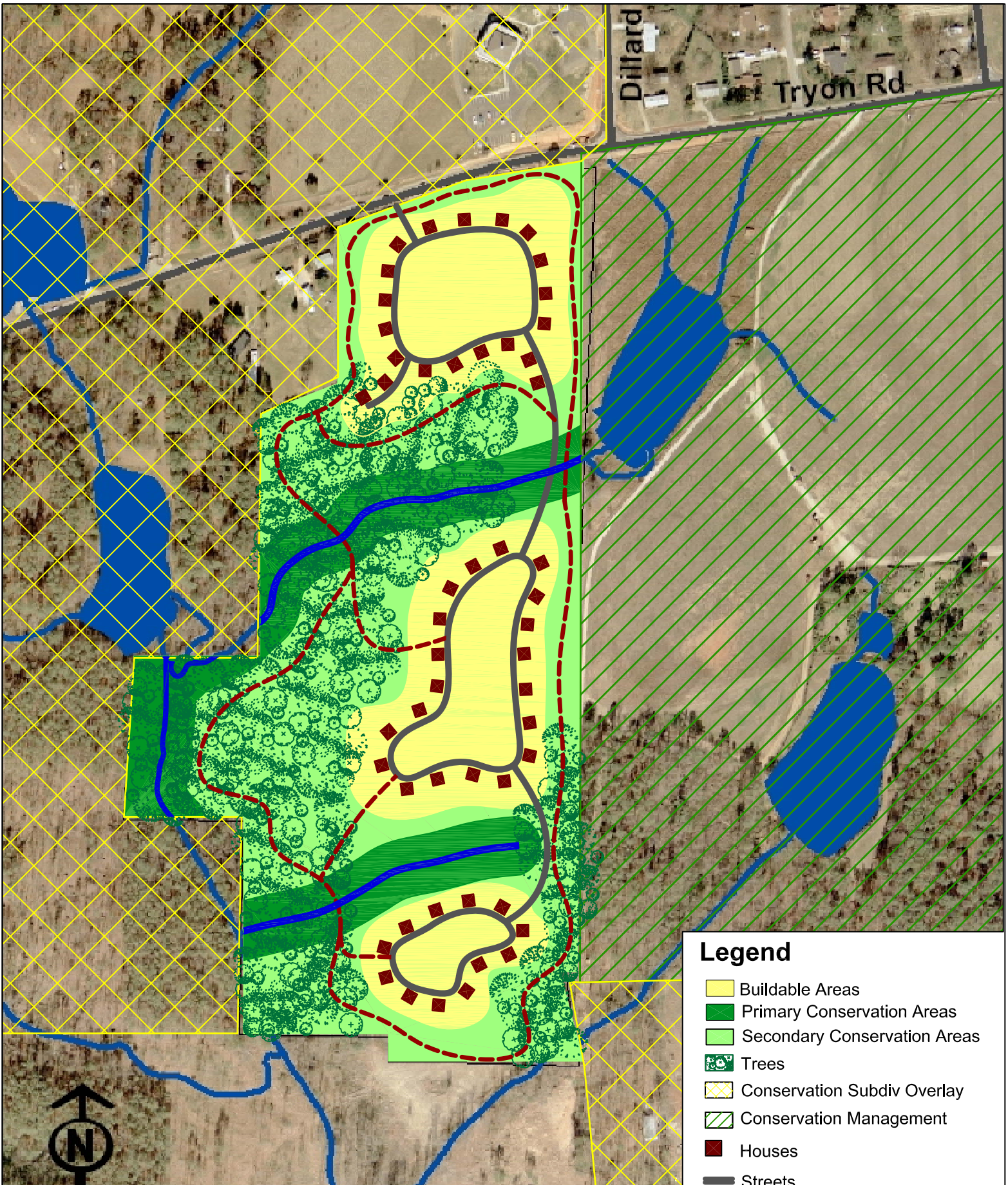
### 7.2.3.4 Step Four - Drawing the Lot Lines

The final step is simply a matter of drawing in the lot lines, perhaps the least important part of the process. “Successful developers of conservation subdivisions know that most buyers prefer homes in attractive park-like settings and that views of protected green space enable them to sell lots or homes faster and at premium prices. Such homes also tend to appreciate more in value, compared with those on larger lots in standard “cookie-cutter” developments offering no views or nearby green space.”<sup>72</sup> In Drawing 4, the lots are approximately .33 acre. While this is currently below the WPOD and cluster development lot size minimums, the proposed conservation subdivision overlay zone would waive these minimum lot size requirements.

---

<sup>71</sup> Randall Arendt, *Growing Greener* (Washington, DC: Island Press, 1999).

<sup>72</sup> *ibid*

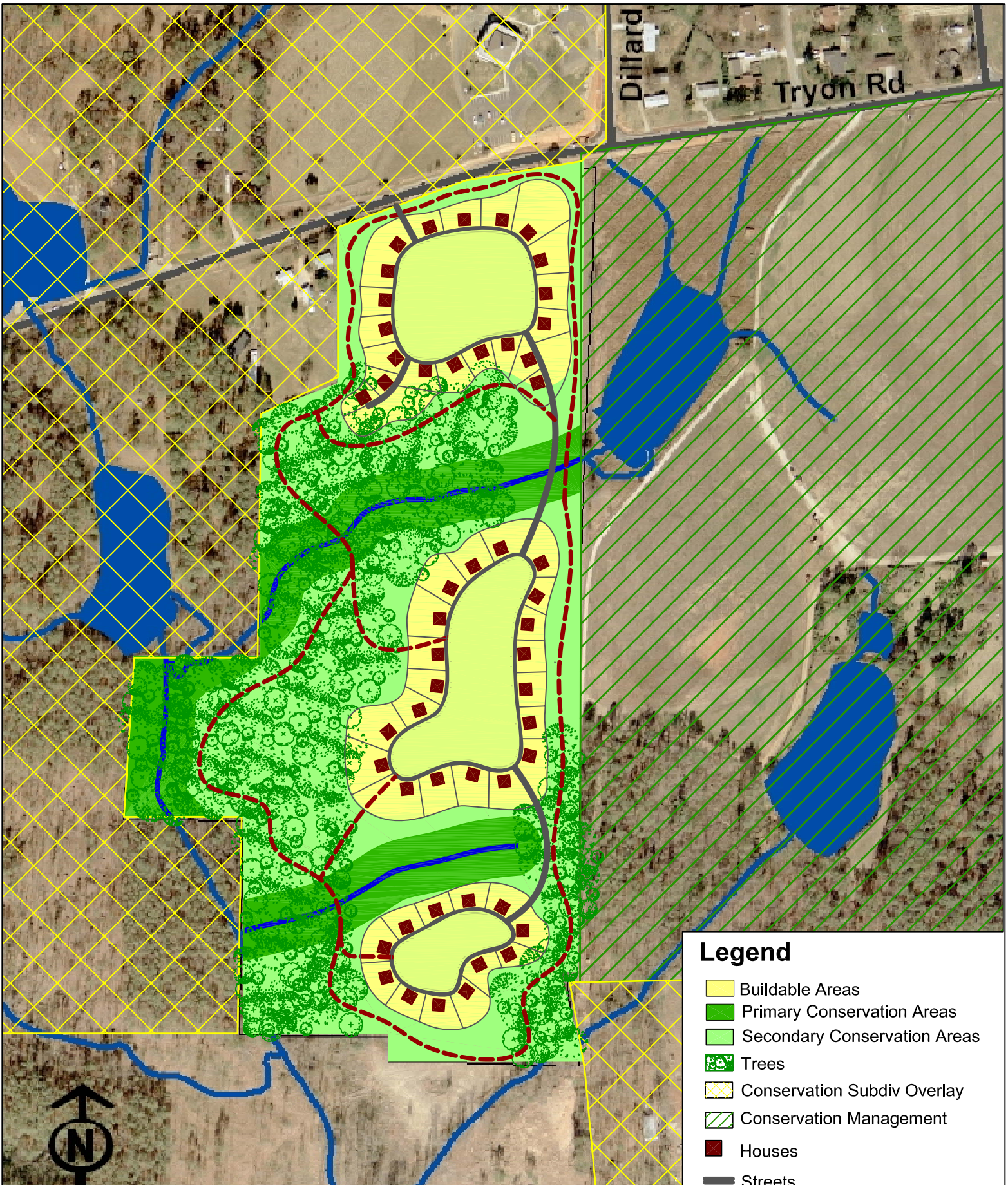


**Legend**

- Buildable Areas
- Primary Conservation Areas
- Secondary Conservation Areas
- Trees
- Conservation Subdiv Overlay
- Conservation Management
- Houses
- Streets
- Trails

Bailey's Landing  
Step Three - Aligning Streets and Trails





**Legend**

- Buildable Areas
- Primary Conservation Areas
- Secondary Conservation Areas
- Trees
- Conservation Subdiv Overlay
- Conservation Management
- Houses
- Streets
- Trails

Bailey's Landing  
Step Four - Adding Lot Lines

### 7.3 Increased Open Space Linkage at Meadowood and Crescent Ridge Townhomes

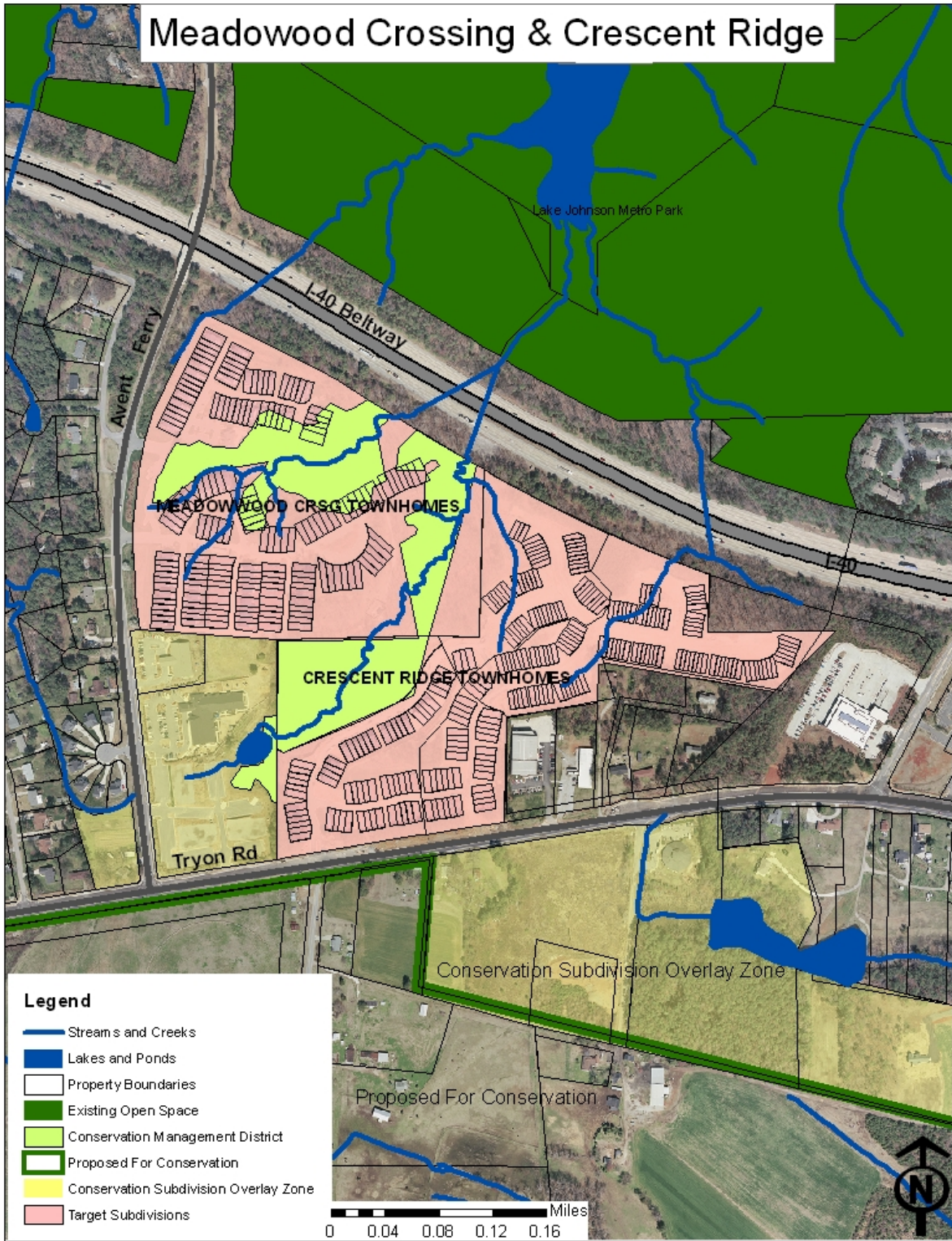
#### 7.3.1 Current Conditions

Map 10 details Meadowood and Crescent Ridge Townhomes, a partially missed opportunity to provide linkage and a wildlife corridor in the target area (See Map 8). Meadowood (2002) and Crescent Ridge (2003) are positive attempts at making the Conservation Management District on both of these properties work as a catalyst for conservation subdivision design. Meadowood and Crescent Ridge Townhomes currently have 60ft buffers on each side of the watercourses, compliments of the CM District.

Meadowood Townhomes is a 31 acres tract with CUD R-10 zoning and a basic minimum lot size of 5000sf. Approximately half of the 170 units that are planned have been completed. Crescent Ridge is also a 31 acres tract with CUD R-10 zoning and a basic minimum lot size of 5000sf. Approximately half of the 250 units that are planned have been completed. These are very dense residential developments for the Tryon Road area, and confirm how much things are changing in SW Raleigh. As noted earlier, the Conservation Management District carries a density that can be transferred to the adjacent on-conserved portion of the parcel. This, combined with the underlying CUD R-10 zoning, is what is responsible for the very small lot size.



Map 10: Meadowood Crossing and Crescent Ridge



Source: Triangle GreenPrint database and Wake County and Raleigh GIS files

### 7.3.2 Augmenting the Open Space Linkage

Meadowood and Crescent Ridge Townhomes could have been sited to provide substantially more linkage in the Lake Johnson – Yates Mill corridor. This is especially critical, as open space links through this densely developed belt are very rare. Simply increasing the length and width of the watercourse buffers across these subdivisions, as illustrated in Map 11, would have significantly enhanced the utility of these small fingers of the Lake Johnson Metro Park so that they extend to the proposed conservation management lands across Tryon Road (see Map 11).

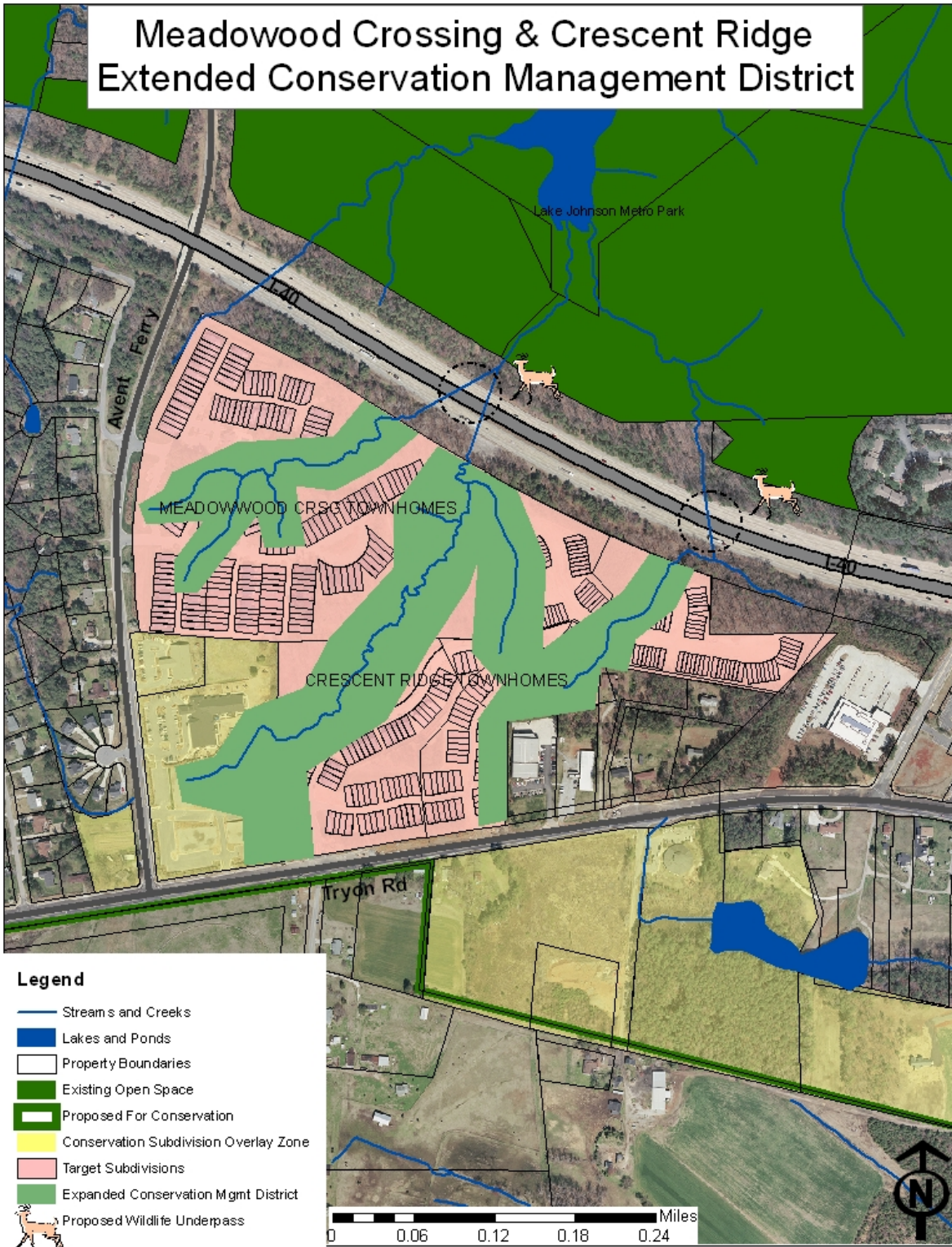
### 7.3.3 The Potential for Wildlife Underpasses

One of the benefits of completing the linkage between Lake Johnson and Yates Mill Pond Park is the potential for wildlife to travel safely all along the West Raleigh Greenspace Connection. Map 11 shows two possible sites for wildlife underpasses, which would serve to offer safer passage across I-40 for a number of species. By designing redundancy into wildlife corridors and offering several alternative routes to traveling wildlife, vulnerable prey species are not confined to a singular, dangerous bottleneck.

While it may seem completely unrealistic to even consider a wildlife underpass under a major highway in the Triangle, there is a precedent. The NCDOT is planning to include a wildlife underpass when it replaces the 15-501 bridge over New Hope Creek in Durham several years from now. This resulted from passionate lobbying by a coalition of supporters of the New Hope Creek Corridor Plan and the dedicated members of the New Hope Creek Commission.



Map 11: Meadowood Crossing and Crescent Ridge-Alternate Design



Source: Triangle GreenPrint database and Wake County and Raleigh GIS files

By illustrating an example of “what could have been” in the target area, a powerful demonstration of the potential of conservation subdivision development has been created. This type of full value land use product relies on the committed collaboration of multiple stakeholders. Without them, the conditions favorable for achieving these maximum benefits could not have been created.



## Chapter 8. Implementation Issues

### 8.1 Design Issues and Recommendations

As noted earlier, there is no one benchmark or exclusive set of design standards for conservation subdivision development. In the previous chapter, I used Randall Arendt's 4-step process for conservation subdivision design, but there are many other rubrics. Most of these are folded in with other aspects of the design and development process (i.e., green building guidelines, LEED, high performance building, cluster design, ecological design, design with nature, low impact development, conservation by design, etc.). However, there are instances where site development decisions need to be considered separately, irrespective of whether the site is being developed for production housing development or for custom green building.

A third party certification specifically for conservation subdivision, similar to what is available for green building, would be useful. Ideally, merit would be earned based on performance standards. Performance would need to be measured across an array of characteristics: environmental service (ecological functions), consumer satisfaction (amenities and price), and costs for developer (efficiency), landowner satisfaction (personal legacy). Bonus points could be earned for its use as a tool to direct development (assumes smart growth principles) and for connection to the regional green infrastructure (assumes a level of regional cooperation). Performance would need to be monitored prior to and at intervals after development. In generating a positive feedback loop, performance standards mimic nature's way of measuring success (biomimicry).<sup>73</sup>

## 8.2 Market Issues and Recommendations

Conservation subdivision development is taking off in other parts of the country. Recent examples include Prairie Crossing, IL; Sugar Creek Preserve, WI; and Farmcolony, VA (see Appendix 3 for a list of examples). What is working is the appeal of green amenities and the consumer's willingness to pay for them. Developers are beginning to recognize this connection. What is not working is that lending institutions are still reticent to finance this relatively new concept in the housing market. It makes them nervous to deviate from the traditional model of real estate development that has had a proven record of success.

Lending institutions need to be educated about the conservation subdivision option. There seems to be enough successful examples now to make a strong case possible. The public needs information as well. A combined effort on the part of the development, homebuilders, and real estate associations need to market this option to consumers.

There are also special incentives for landowners that need emphasis. Landowners may be more inclined to sell their land for a conservation subdivision development if they realize that those "special places" on their land will be preserved. In some cases, those legacy landscape features become the centerpiece of the new conservation subdivision development. LandChoices, a non-profit land trust, is one of a very few national organizations providing landowners with these kinds of flexible land protection options.

Building and real estate professionals need information too. The National Homebuilders Association supports a conservation and smart growth section on their website. More collaboration between conservation and built environment professionals will be needed to continue the education effort.

---

<sup>73</sup> Benyus, Janine, *Biomimicry*, First ed. (New York, NY; HarperCollins, 1998).

### 8.3 Smart Growth Issues and Recommendations

Many of the new conservation subdivision developments are situated on greenfield sites in rural and/or agricultural areas or bedroom suburbs. Relatively few conservation subdivision developments have been specifically designed to function as a growth management tool in an urban/semi-urban environment. Even fewer have been intentionally linked to a regional open space network.

This Masters Project asserts that there is a role that conservation subdivision development can play in both regional conservation and smart growth. To accomplish this, the commitment of public agencies is needed. Municipal agencies can support conservation subdivision development by strategically locating their conservation lands in relation to the regional open space network. Coordination of data across jurisdictional boundaries is very challenging, but a necessary step in any regional planning process. Municipalities can also create conservation subdivision development overlay zones to augment, buffer and link their larger open space holdings. This regulatory approach can only work if it is preceded by efforts to educate and involve landowners and the development community. Elected officials should be a part of the planning effort. They can contribute support within their leadership role to think regionally and act locally.

## 8.4 Environmental Issues and Recommendations

As noted earlier, there is a growing need for a regional, if not statewide, open space infrastructure plan. The initial onerous work is in data collection and database creation. We already have some of this in place. The North Carolina Natural Heritage Program has completed natural area inventories on 4/5ths of the North Carolina counties. We have the beginnings of a regional infrastructure plan in the Triangle GreenPrint. One North Carolina Naturally is attempting to coordinate a statewide green infrastructure plan, and hosts a web-based database and GIS tool to inform land use decisions. These efforts need the continued support of all of the stakeholders in the land use and development community.

On a national scale, with the new “National Forest Land Conveyance for Rural Communities Act”,<sup>74</sup> it appears that we are actually going to sell off portions of our national forest to development. For those tracts targeted for residential development, I recommend that it be done under a conservation subdivision overlay zone. Because it is “interspersed with or adjacent to non-Federal land”, it seems ideally situated to take advantage of the benefits of conservation subdivision development.

## 8.5 Conclusion

This project intended to demonstrate how intentionally targeting a location where conservation subdivision can balance multiple interests could result in ecologically sound, cost-effective and civically responsible open space preservation. Towards this end, the state of open

---

<sup>74</sup> National Forest Land Conveyance for Rural Communities Act, <http://www.fs.fed.us/land/staff/rural/FINAL%20SRS%20Leg.pdf>

space across the nation, state, region, and target municipality was reviewed. The difficulties of linking open space in metropolitan regions were explored as well as recent trends across the nation in support of a regional green infrastructure. A brief tour of the art and science of open space rank and priority protocols was given. The conservation subdivision development strategy was described, the design process detailed, and the distinctions clarified. A systematic method involving GIS analysis of landscape ecology along with land use information, regulations, and guidelines was employed. This approach facilitated a series of decisions on where to site conservation subdivision development so that it addressed the majority of factors influencing the open space site selection process (green infrastructure, ranking and priority, economic concerns, relevant policies, smart growth issues). A conservation subdivision design was offered for a tract in the target area that was developed more conventionally to illustrate the difference between “what is” and “what could have been”. In another example, the power of even modest greenways to provide critical linkage through extremely dense urban neighborhoods was illustrated. Finally, implementation issues and recommendations regarding conservation subdivision were given for design management, market factors, land use decisions and environmental concerns.

Conservation subdivision development is only one strategy in a growing toolbox of conservation methods. However, through an improved understanding of its significance, this relatively under utilized tool can demonstrate its strength. It has the potential to extend the value of ecological services rendered by the open space network while also providing economic benefits to developers and municipalities, and addressing consumer preferences. It is the kind of win-win-win that should make cooperation between the various stakeholders easier, thereby facilitating the overall success of the development.

## **Appendix One: Principles for Green Infrastructure**<sup>75</sup>

Principle 1: Identify and protect green infrastructure before development.

Green infrastructure needs to be identified and protected in advance of land development due to the high cost of restoration and the difficulty of creating human-made systems that function as well as natural systems. Identifying where green infrastructure is needed and desired will aid in public and private protection of critical resources.

Principle 2: Engage diverse people and organizations in your green infrastructure initiative, obtaining input from representatives of different professions and sectors.

To be successful, Green Infrastructure initiatives must excite and engage many people. Just like built infrastructure systems are planned and implemented through an open participation process, Green Infrastructure systems must be planned and implemented involving public input and incorporating the comments and issues of citizens, community organizations, and private landowners.

Principle 3: Recognize that linkage is key, for connecting natural areas and features and for connecting people and programs.

---

<sup>75</sup> The Conservation Fund and USDA Forest Service, "Principles for Green Infrastructure," <http://www.greeninfrastructure.net/2006>).

The desired outcome for all Green Infrastructure initiatives is the creation of a network of green spaces that maintains vital ecological processes, wildlife populations, and human health. Just as the nation's interstate, state, local and private roads are designed holistically to create a functional transportation system, we need to design Green Infrastructure holistically, creating physically connected green space systems through the protection and restoration of vital ecological areas and linkages.

Principle 4: Design green infrastructure systems that function at different scales, across political boundaries, and through diverse landscapes.

Our nation's transportation, power, communication and other gray infrastructure systems are designed to connect across multiple jurisdictions and incorporate facilities that function at different scales. Likewise, we need to design Green Infrastructure systems strategically to connect across urban, suburban, rural and wilderness landscapes and incorporate green space elements and functions at the state, regional, community and parcel scales.

Principle 5: Ground green infrastructure activities in sound science and land-use planning theories and practices.

Just as our transportation, water, electric and telecommunication systems are grounded in the theories and practices of diverse professional disciplines (for example, traffic engineering), we need to design and plan Green Infrastructure systems according to the theories and practices

of scientific and land planning professions such as conservation biology, landscape ecology, urban and regional planning, landscape architecture and geography.

Principle 6: Fund green infrastructure up-front as a primary public investment, using the full range of available financing options.

Our nation's gray infrastructure - our transportation, water, electric, telecommunication and other essential community support systems - are financed as primary budgetary line items. State and local governments use dedicated gas taxes and other public funding mechanisms to pay for the planning, rights-of-way acquisition, construction, maintenance and improvement of our highway systems. Likewise, we need to finance Green Infrastructure planning, protection, management and/or restoration as a priority public investment.

Principle 7: Emphasize that green infrastructure benefits are afforded to all, to nature and to people.

Green Infrastructure provides a diversity of public and private functions and values that address both natural and human needs and benefit the environment and communities. These benefits need to be documented, in terms of both their ecological values for people and the environment and their economic values to society.



Principle 8: Make green infrastructure the framework for conservation and development.

The gray infrastructure upon which America's communities depend - which provides the framework for future growth and development - is planned in advance as a system of interconnected parts. We need to embrace Green Infrastructure as the framework for conservation.

## **Appendix Two: Conservation Organizations**

### List of National Land Conservation Organizations

The Nature Conservancy

Environmental Defense

The Trust for Public Land

The Federal Land and Water Conservation Fund (LWCF)

US Fish and Wildlife Service

### List of Regional Land Conservation Organizations

Million Acre Initiative

NC Wetlands Restoration Program

North Carolina State Trails Program

Parks and Recreation Trust Fund

NC Natural and Scenic Rivers System

North Carolina Conservation Tax Credit Program

Ecosystem Enhancement Program

NC Councils of Governments

Conservation Trust for North Carolina

The Nature Conservancy

Environmental Defense

The Trust for Public Land

NC Department of Environment and Natural Resources (NC DENR)

North Carolina Clean Water Management Trust Fund (CWMTF)

Natural Heritage Trust Fund

North Carolina Division of Parks and Recreation

North Carolina Wildlife Resources Commission

North Carolina Department of Transportation

The Federal Land and Water Conservation Fund (LWCF)

US Fish and Wildlife Service

#### Local Land Trusts

Triangle Land Trust

#### List of Green Infrastructure Projects - Southeast Region\*

Florida Statewide Greenways System Planning Project

Linking Natural and Historic Assets: Green Infrastructure As Economic Development in Lenoir County, NC.

The Southeastern Ecological Framework Project

Triangle GreenPrint

The Parramore Greenprint Plan

Chattooga Watershed Green Infrastructure Plan

Albemarle-Pamlico Bioregional Greenway Plan

Loxahatchee Greenways Project

\*For more information on these examples of green infrastructure plans and for examples from other regions of the country go to <http://www.greeninfrastructure.net>

### **Appendix Three: Examples of Conservation Subdivision Development**

Prairie Crossing, IL	<a href="http://www.prairiecrossing.com/pc/site/index.html">http://www.prairiecrossing.com/pc/site/index.html</a>
Sugar Creek Preserve, WI	<a href="http://www.sugarcreekpreserve.com/index.html">http://www.sugarcreekpreserve.com/index.html</a>
Tryon Farm, IN	<a href="http://www.tryon-farm.com/">http://www.tryon-farm.com/</a>
Farmcolony, VA	<a href="http://www.farmcolony.net/">http://www.farmcolony.net/</a>

More examples are available at the following websites:

National Assoc. of Homebuilders	<a href="http://www.nahb.org/page.aspx/category/sectionID=216">http://www.nahb.org/page.aspx/category/sectionID=216</a>
Land Choices	<a href="http://www.landchoices.org">http://www.landchoices.org</a>
Greener Prospects	<a href="http://www.greenerprospects.com/">http://www.greenerprospects.com/</a>
Green Neighborhood Alliance	<a href="http://www.greenneighborhoods.org">http://www.greenneighborhoods.org</a>

## Bibliography

- Arendt, Randall. "Enhancing Subdivision Value through Conservation Design." *On Common Ground* (Summer, 2001).
- . *Growing Greener*. Washington, DC: Island Press, 1999.
- . *Conservation Design for Subdivisions*. Washington, DC: Island Press, 1996a.
- . *Open Space Design Guidebook for the Albemarle-Pamlico Estuarine Region* NC Association of County Commissioners, 1996b.
- Bailey, Laura. "New Market for Developers." *University of Michigan News Service*, June, 2004.
- Benedict, Mark A., and Edward T. McMahon. *Green Infrastructure: Linking Landscapes and Communities*. Washington, DC: Island Press, 2006.
- Benyus, Janine, *Biomimicry*, New York, NY: HarperCollins, 1998.
- Campanella, Thomas, ed. *The Republic of Shade*. First ed. New Haven, CT: Yale University, 2003.
- Durham City-County Planning Department. *Little River Corridor Open Space Plan* 2001.
- Eno River Association. <http://www.enoriver.org/>.
- Friends of Bolin Creek. <http://www.bolincreek.org/index.shtml>.
- Gilroy, Leonard. *Conservation Subdivision Design: A Market Friendly Approach to Local Environmental Protection*. Los Angeles, CA: The Reason Foundation, 2002.
- Greenways Incorporated. *Wake County Consolidated Open Space Plan*. Raleigh, NC: 2003.
- Haw River Assembly. <http://www.hawriver.org/>.
- Hess, George, Kate Dixon, and Mary Woltz. *The State of Open Space 2000*. Raleigh, NC: 2000.
- Land for Tomorrow. *Saving the Goodliest Land*. Durham, NC: 2005.
- Lands Legacy Program 2004-2006. "Action Plan."  
<http://www.co.orange.nc.us/ercd/landslegacy/aap0406.htm>.
- McDonald, L., W. Allen, M. Benedict, and K. O'Connor. "Green Infrastructure Plan Evaluation Frameworks." *Journal of Conservation Planning* 1, no. 1 (March, 2005),  
<http://www.journalconsplanning.org>.
- McDonough, William. *Cradle to Cradle* North Point Press, 2002.

- Mohamed, Rayman. "Conservation Subdivisions: Price Premiums, Improvement Costs, and Absorbtion Rates." *Urban Affairs Review* (January, 2006).
- Natural Connections. "Green Infrastructure in Wisconsin." <http://www.greenmapping.org/>.
- Natural Resources Conservation Service. *National Resources Inventory 2001: Urbanization and Development of Rural Land*. Washington, DC: NRCS, 2003.
- NCDENR Office of Conservation and Community Affairs. *NC Million Acre Initiative Annual Report*. Raleigh, NC: NCDENR, 2005.
- North Carolina Conservation Network. "History and Goals." <http://ncconservationnetwork.org/>.
- One North Carolina Naturally. "Statewide GIS Mapping Tool." <http://www.cep.unc.edu/oncn/index.html>(2006).
- Ontario Ministry of Public Infrastructure Renewal. "Places to Grow." [http://www.pir.gov.on.ca/userfiles/HTML/cma\\_4\\_40902\\_1.html](http://www.pir.gov.on.ca/userfiles/HTML/cma_4_40902_1.html) (accessed March, 2006).
- State Demographics Unit. "North Carolina Demographics." <http://demog.state.nc.us/> (accessed March, 2006).
- The Conservation Fund, and Ed McMahon. *Greenways. A Guide to Planning, Design, and Development*. Washington, DC: Island Press, 1993.
- The Conservation Fund, and USDA Forest Service. "Principles for Green Infrastructure." <http://www.greeninfrastructure.net/2006>).
- The Triangle J Council of Governments. *The Triangle GreenPrint Outreach Report*. Raleigh, NC: 2003.
- Town of Apex Planning Department. *Parks, Recreation, Greenways and Open Space Master Plan2001*.
- Town of Cary Planning Department. *Open Space and Historic Resources Plan2001*.
- Triangle Green Space Tracker. <http://66.193.216.195/>.
- Triangle J Council of Governments. *Triangle GreenPrint Progress Report*. Raleigh, NC: 2005.
- . *Triangle GreenPrint Open Space Assessment*. Raleigh, NC: 2002.
- Triangle Land Conservancy. <http://www.tlc-nc.org/>.