

# Green Infrastructure

## Protecting Resources for Future Generations



**CHESTERFIELD COUNTY**  
Committee on the Future

**November 2005**

PROVIDING A FIRST CHOICE COMMUNITY THROUGH EXCELLENCE IN PUBLIC SERVICE

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# CHESTERFIELD COUNTY

## Committee on the Future

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November 22, 2005

The Honorable Members of the Board of Supervisors  
Chesterfield County  
Chesterfield, Virginia 23832

Dear Members of the Board:

It is my pleasure to present to the Board of Supervisors the latest report of the Committee on the Future, *Green Infrastructure: Protecting Resources for Future Generations*. In this report, the committee shares its growing concern for the loss of open space, natural resources and historical sites over the next 30 years and beyond. Collectively, they contribute to a loss in residents' sense of place. It provides recommendations and related strategies for addressing them through the use of a green-infrastructure plan.

Chesterfield County has a number of "green" initiatives in county government, private industry and non-profit organizations. While the committee applauds these efforts, our research found that the lack of a strategically-planned and managed network for these initiatives could prove significantly detrimental in the long run. This report focuses on how to begin the process of developing a plan to benefit the economy, environment, health and welfare of current and future generations.

On behalf of the entire committee, thank you for the opportunity to serve the county.

Sincerely,

Edward L. DeGennaro  
Chairman  
Committee on the Future



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# CHESTERFIELD COUNTY

## Committee on the Future

### Bermuda District

Dr. Walter R. Beam  
Ms. Sarah Eastwood

### Clover Hill District

Mr. Victor W. Liu  
Ms. Tracy Williamson

### Dale District

Mr. Edward DeGennaro, chairman  
Ms. Nancy S. Hudson

### Matoaca District

Dr. Grace Norbrey  
Ms. Diane Horner Haring, vice-chairman

### Midlothian District

Ms. Bet Ludden  
Mr. Reuben J. Waller Jr.

# PREFACE:

## Origins, Purpose and Mission of the Committee on the Future

Chesterfield County uses a unique tool to help meet future challenges. The Committee on the Future is a permanent body authorized with adoption of the 1987 Chesterfield County Charter. It is composed of 10 county residents, two from each of the five magisterial districts. The committee members serve at the pleasure of the Board of Supervisors. Thirty-four different residents have been appointed over the course of 18 years; some have served later as planning commissioners, school board members and county supervisors.

As authorized in the charter, “the committee shall prepare reports and make recommendations concerning changes in governmental structure, revisions to fiscal and land-use planning, and any other matters concerning approaches to meeting the governmental needs of the people of Chesterfield in the future.” The purpose of the committee, as stated in its bylaws, is: “to forecast comprehensive, long-range conditions in the county; to make recommendations for resolution of issues in the long range; to provide information designed to guide elected officials toward a realistic long-range plan for Chesterfield County in the 21<sup>st</sup> century; and to expand thinking beyond present-day limitations, presenting a view not necessarily bound by what will be, but embracing what can be.”

To accomplish these directives, the committee researches issues and prepares reports. The Committee selects topics that will likely impact the county’s quality of life 20, 30 or more years ahead. There is public representation and input throughout the report process. Past reports have focused on human services and development issues.

The reports follow a seven-step study process beginning with selecting a topic and developing a work plan. The topic is thoroughly researched, and the scope of the report is defined. Issues pertinent to the topic are studied further before recommending strategies to address future challenges. The committee presents the preliminary work to county departments, to residents (through constituency meetings in each of the magisterial districts) and to various special interest groups. The final draft of the report is reviewed by county departments and then edited by the committee. After being presented to the Board of Supervisors, the report is distributed throughout the county and state. All recommendations are reviewed annually to determine the degree of implementation.







# INTRODUCTION

It is the charge of the Chesterfield County Committee on the Future to identify challenges that the county will face over the next 30 years and beyond. With this charge clearly in focus, the committee spent two years studying the concept of green infrastructure and the feasibility of a green-infrastructure plan for the county and the region. As seen in this visionary report, the committee strongly recommends the development of a green-infrastructure plan.

The committee recommends developing a plan for several reasons. Our research discovered a growing concern for the loss of open space, natural resources and historical sites. This concern has generated a large number of “green” initiatives from individual residents and landowners, county departments, local and regional organizations, private businesses and industry. While these market-driven and conscience-driven initiatives are well meaning, they lack a cohesive plan to ensure their sustainable future. Without a clear plan, well meaning individual initiatives invariably leave important green issues unaddressed. The committee learned through case studies across the nation that strategically-planned and managed green initiatives provide significant benefits to the economy, environment, health and welfare of a community.

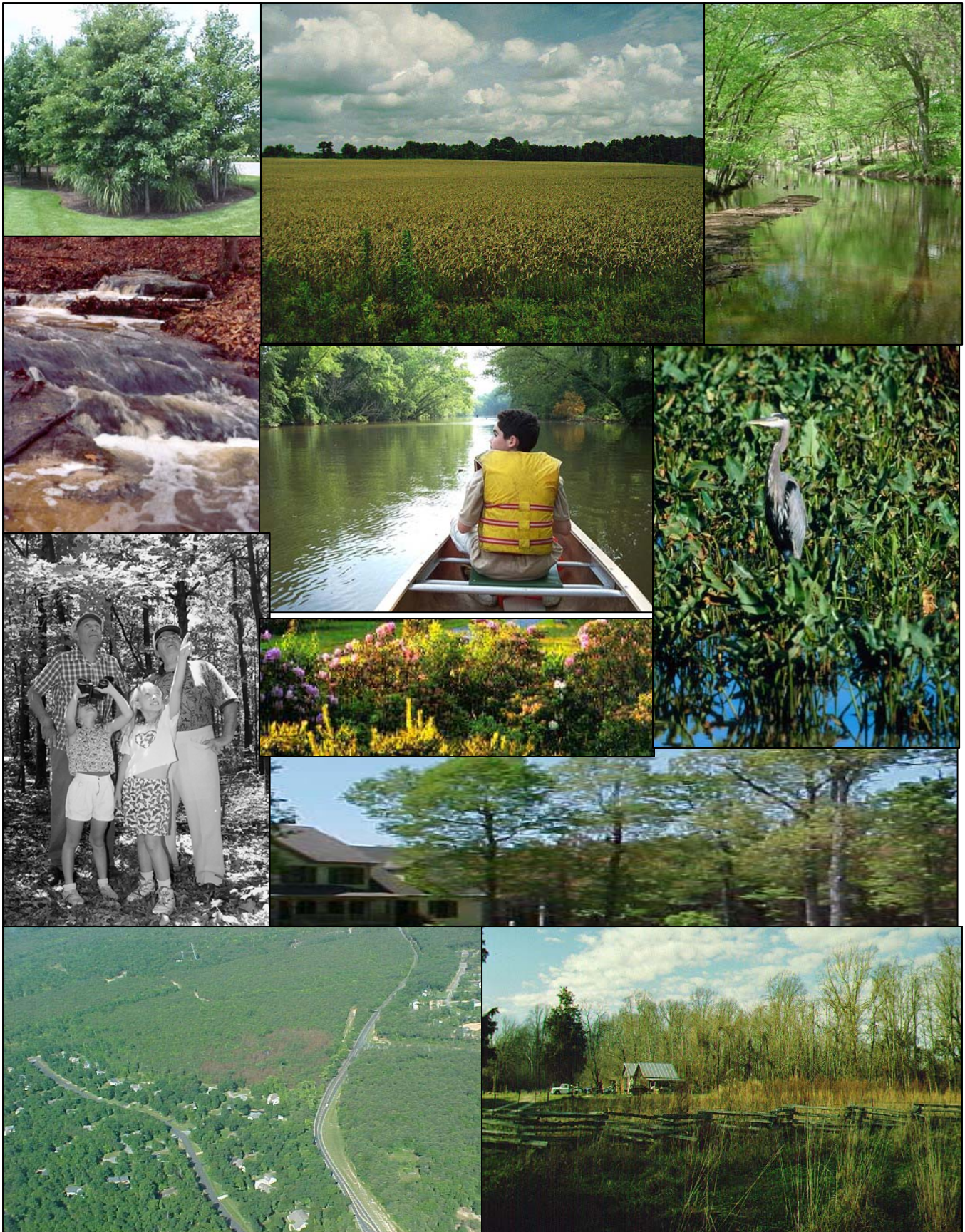
Committee research also realized that developing a green-infrastructure plan would not be easy. It is a new concept and it requires change. One obstacle is a clear understanding of the concept. While most citizens quickly recognize some green element from their own perspective— wilderness, parks, greenways, conservation, natural-resource management, environmental regulations, financing – few grasp the broader concept of an infrastructure that incorporates all elements and perspectives toward a common goal to benefit both citizens and nature. An education and awareness campaign would be needed before beginning the process of developing a plan. Without strong, centralized leadership, this campaign could become just another initiative rather than the basis for developing a green-infrastructure plan.

The committee realized the second major obstacle to most green-infrastructure-plan processes is the difficulty in determining responsibility. In Chesterfield County government, no one department or division directs all the elements of a green infrastructure. The magnitude of the task – in scope, in duration and in needed resources – makes accepting responsibility for creating and implementing a plan less attractive. The reality of changing political climates over the decades needed to develop and implement this plan adds to the complexity.

Nevertheless, the committee feels strongly that the residents and government of Chesterfield County should begin the process of developing a green-infrastructure plan. This process would require communication, leadership and commitment. Communication among and between all interested parties and organizations would achieve a community-based plan. Leadership would have to ensure the plan is vision-driven, not market-driven and commit to changing existing plans and policies when necessary. Long-range commitment would be needed to integrate the demands of nature with growth and development needs.

The Committee on the Future is not proposing that the county create green initiatives – it already has them. What the committee is proposing is that the county develop a green-infrastructure plan that researches, addresses and coordinates all aspects of a green infrastructure. In doing so, it will ensure that open space, natural resources and heritage sites will be preserved and maintained after full build-out is attained in the coming decades. This will require a plan and people with vision, leadership and commitment. Without them, Chesterfield County would have to settle for whatever open spaces, natural resources and historic sites are randomly left after build-out occurs.







# GREEN 'THE OTHER' INFRASTRUCTURE

In April 2003, the Committee on the Future decided that one of the greatest challenges Chesterfield County would likely face in the next 20-30 years is the loss of open space, natural resources and historical sites. To address what the committee considers a growing concern, it chose the topic Green Infrastructure.

## What is a green infrastructure?

The term 'green infrastructure' is often misunderstood. According to the Conservation Fund, a national nonprofit land-conservation organization, and for the purposes of this report, green infrastructure is defined as "our Nation's natural life support system – a *strategically planned and managed network* of wilderness, parks, greenways, conservation easements and working lands with conservation value that supports native species, maintains natural ecological processes, sustains water and air resources, and contributes to the health and quality of life for America's communities and people<sup>1</sup>." In addition the committee's research indicates the county's unique historical and cultural assets play a vital role in its green infrastructure.

The essential point in the above definition is *strategically planned and managed network*. For example, gray infrastructure – networks of pipes, poles and pavement – is strategically planned and managed to support utilities, communication and transportation. Who doesn't have electricity, running water and paved roads in their neighborhood? A power outage, broken pipe or fallen tree can cause a real inconvenience. But there is a plan in place to deal with complaints and repairs because *gray infrastructure* is a necessity. Ask anyone who experienced Hurricane Isabel in 2003.

Social infrastructure – schools, libraries and fire stations – is a strategically planned and managed network to support education and public safety. Quality education is a citizen expectation, as is a quick response to an emergency. A well-defined and well-managed *social infrastructure* is also expected and valued. Chesterfield residents showed their support of the county's social infrastructure with a positive response to bond referenda in 1998 and 2004.

Natural, cultural and historic resources are often taken for granted with no assurance of availability for future generations. Green infrastructure is the strategically planned and managed network to support these natural, cultural and historic resources. It requires organization, coordination, integration and connection. Without these four elements, a green infrastructure cannot exist and flourish.

## Interconnection of green, gray and social infrastructures

Green, gray and social infrastructures are mutually dependent. For example, green infrastructure works to decrease some demands on the gray – like naturally filtering pollutants to reduce water treatment; soaking up storm water to reduce the size of sewer lines; and lowering cooling bills by decreasing heat while absorbing carbon dioxide through urban forestry. Green areas provide better settings for corporate locations and opportunities for eco-tourism. Green infrastructure can reduce expenditures and increase revenues to local government.

Green infrastructure also supports the social infrastructure. Natural areas and working lands provide outdoor classrooms for the schools. Parks and conservation areas provide opportunities for active and

passive recreation, as well as opportunities for social interaction to strengthen communities. Access to historic sites provides residents with a “sense of place.”

The key to having a sustainable green infrastructure is to approach it like gray and social infrastructures – plan it, finance it and maintain it. Everyone should be involved in these three activities. Together, these infrastructures are a three-legged system supporting development, the community and nature.

Building on a rich history of natural-resources stewardship, the incorporation of a green infrastructure into the county fabric will secure a continuing high quality of life for future generations.

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<sup>1</sup> GreenInfrastructure.Net. The Conservation Fund. <http://www.greeninfrastructure.net/pagespinner.asp?article=2007>



**FIGURE 1.** Green, gray and social infrastructures are mutually dependent. Together, they are a complete system supporting development, the community and nature.

# A GROWING CONCERN

*This report is based on a vision of the residents of Chesterfield County enjoying a high quality of life in attractive urban, suburban and rural neighborhoods interspersed with public and private natural areas. All development is designed with nature, protecting cultural and natural resources for the benefit of the economy, the environment and the community. Interconnected greenways and waterways enable Chesterfield residents to enjoy the beauties of the land, the air and the waters during all daily activities.*

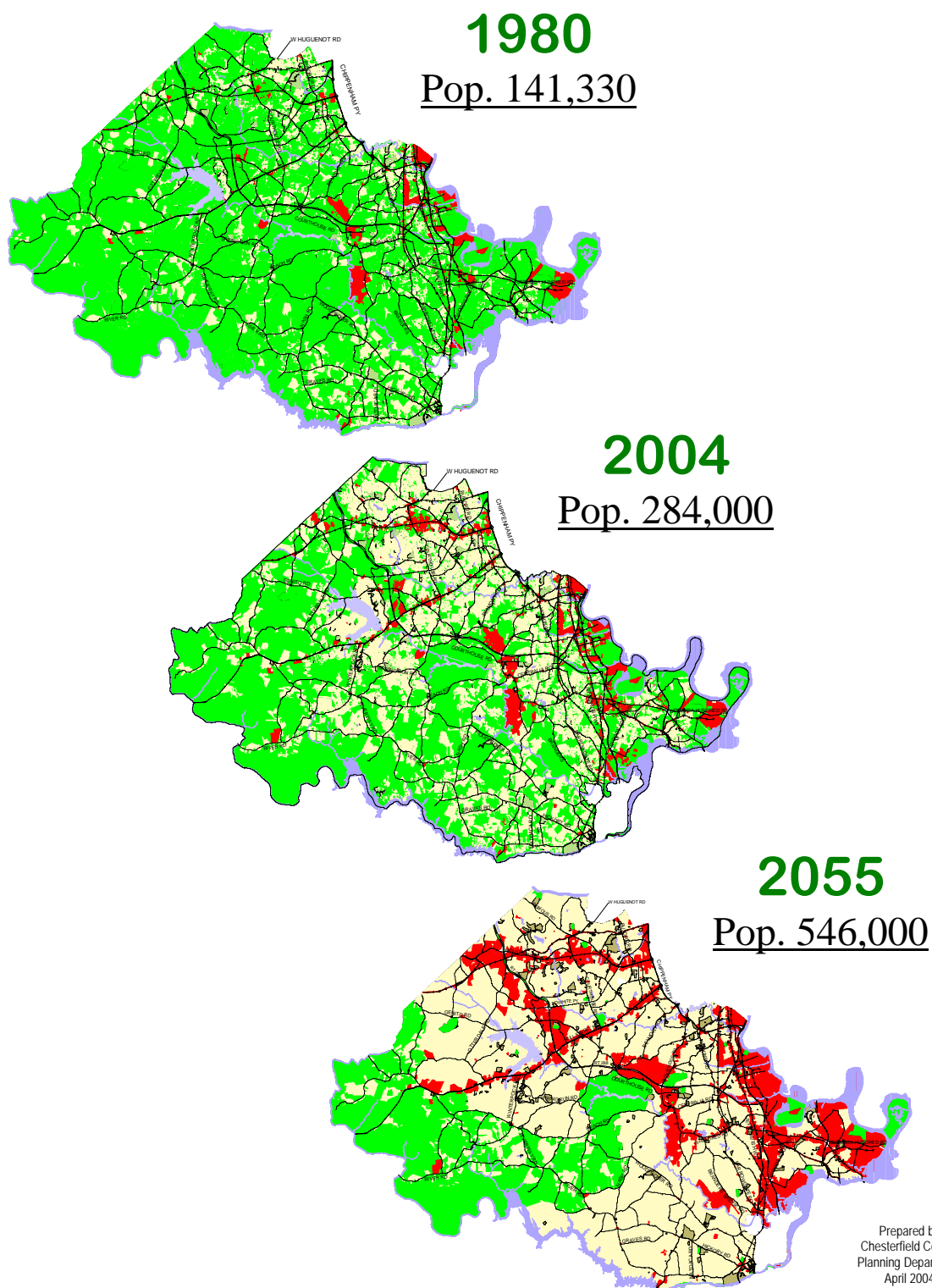
This vision of the future supports Captain John Smith's belief that, "Heaven and Earth never agreed better to form a place for man's habitation<sup>1</sup>." For hundreds of years, the land area known as Chesterfield has been a FIRST CHOICE community because populations have been responsible stewards of its natural resources. The primarily rural environment continued well into the middle of the 20<sup>th</sup> century. Then, a more suburban way of life brought major change in the next few decades, particularly in the demand for land and water resources. As the county moves into the 21<sup>st</sup> century, the population will continue to grow. These factors raised a growing concern for the committee about the future viability of open space, natural resources and historic sites.

## Open Space

While natural resources are used for the benefit of people, those uses should sustain the resources of the 446 square miles (285,440 acres) of Chesterfield County for future generations and continue the example of good stewardship. Accelerated land use in the last 25 years by residential and commercial development, needed to keep pace with a population that has doubled, has reduced forested areas, fragmented animal habitat and compromised water resources (see Figure 2).

Guided by the current Plan for Chesterfield, the county will more than double in dwellings and quadruple in business space by plan build-out.<sup>2</sup> A significant amount of land in the county is already zoned for development. There are no national, state or county benchmarks that mandate where and how much land should be conserved as open space. Each locality is unique in terms of defining those parameters.

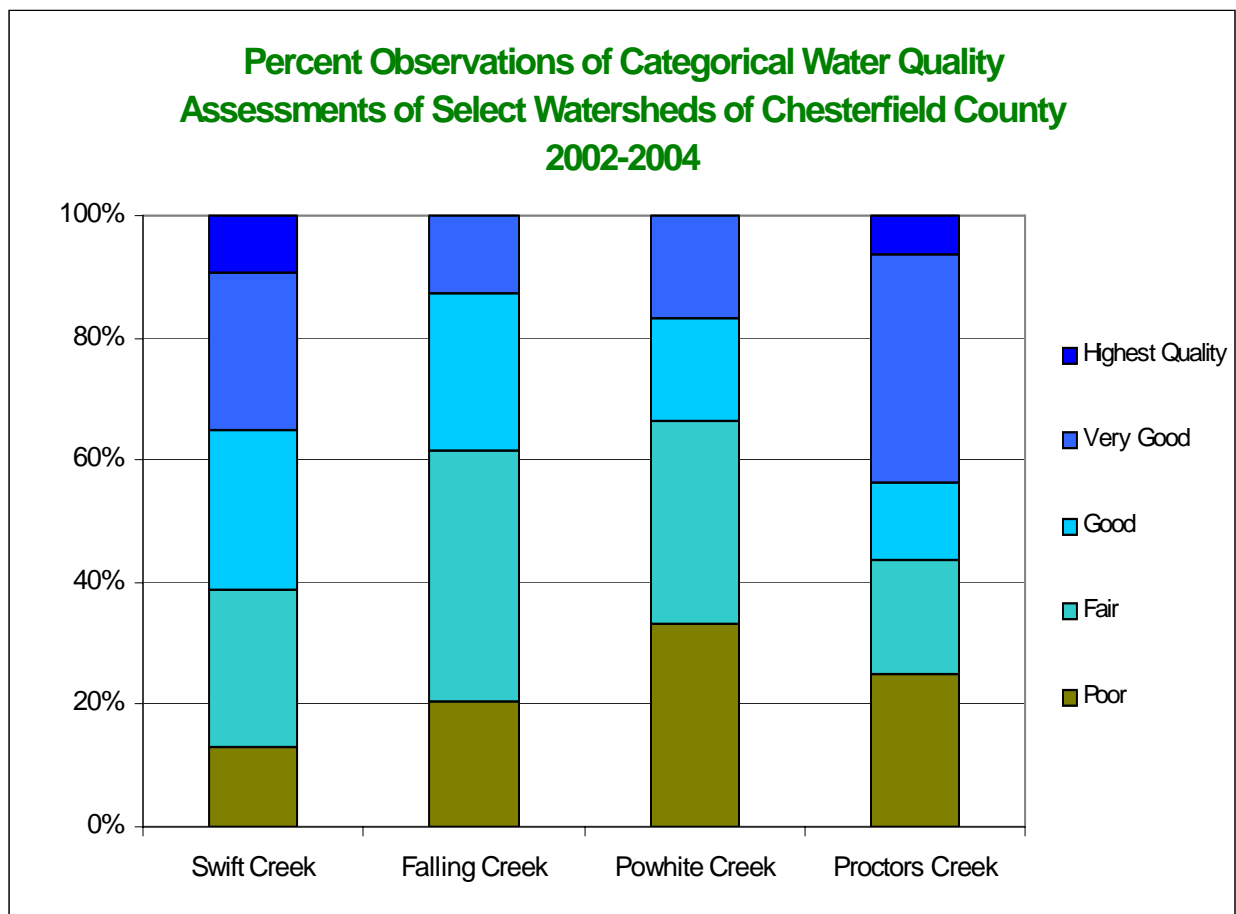
Fortunately, there are models to consider. For example, the Committee on the Future discovered that the Chester County, Pa. plan<sup>3</sup> for a protected open-space network in suburban Philadelphia sets a goal of protecting 50 percent of existing undeveloped land. By 2020, the county forecasts it will be 60 percent developed with 35 percent protected open space and 5 percent unprotected open space. In suburban Denver, the Jefferson County, Co. open space plan celebrated its 30<sup>th</sup> anniversary in 2002 by securing more than 50,000 acres (11 percent of the county) by fee, conservation easement, lease or donation.<sup>4</sup> The comprehensive plan of Loudoun County, Va., fast becoming part of suburban Washington, D.C., establishes the environmental, natural and heritage features of the county's green infrastructure as a single unifying element of the county as a whole.<sup>5</sup>



**FIGURE 2.** With a population of 141,000 people, the undeveloped (gray-shaded) areas of Chesterfield County amounted to over 70 percent of the land area. Accelerated land use over the next 25 years by residential and commercial development, needed to keep pace with a population that doubled, has reduced natural resources. Undeveloped areas in 2004 amounted to approximately 50 percent of the county's landmass. It is forecast that the county will reach full build-out in 2055, with another doubling of the population.

Of Chesterfield County's boundaries, 124 miles are riverfront along the James and Appomattox rivers. Inside the political boundaries of Chesterfield County are 10 primary watersheds, and 70 sub-watersheds holding 1,342 miles of streams. There are also 4,879 acres of surface water in the Swift Creek, Falling Creek and Lake Chesdin reservoirs. These waters serve as important health, recreational and visual resources. Intensive uses of the land for agriculture, timber production, recreation or urban development create off-site effects to the larger ecosystem within a watershed. For example, in some of the more developed parts of the county, storm-water flows from urbanized areas have resulted in the physical degradation of streams. This causes sediment to be deposited to downstream locations. In some extreme cases, stream channels have relocated, causing land loss for property owners along streams. Sediment also can be deposited as runoff from construction sites in the developing parts of the county.

County data<sup>6</sup> support the fact that water quality in some areas has been negatively affected due to the clearing of the lands and buffers immediately adjacent to them. Figure 3 shows the quality of the water tested in four primary watersheds in the county. Water quality is fair or poor at more than 60 percent of the sites tested in the Falling Creek and Powwhite Creek watersheds, and approximately 40 percent of those tested in the Swift Creek and Proctors Creek watersheds. Data from these same tests also demonstrate the healthiest streams are protected by densely vegetated buffers. Other activities of an increasing population that impact the health of county waters include illegal dumping of pollutants, over fertilization of residential and commercial lawns, and polluted runoff from roadways and parking lots.

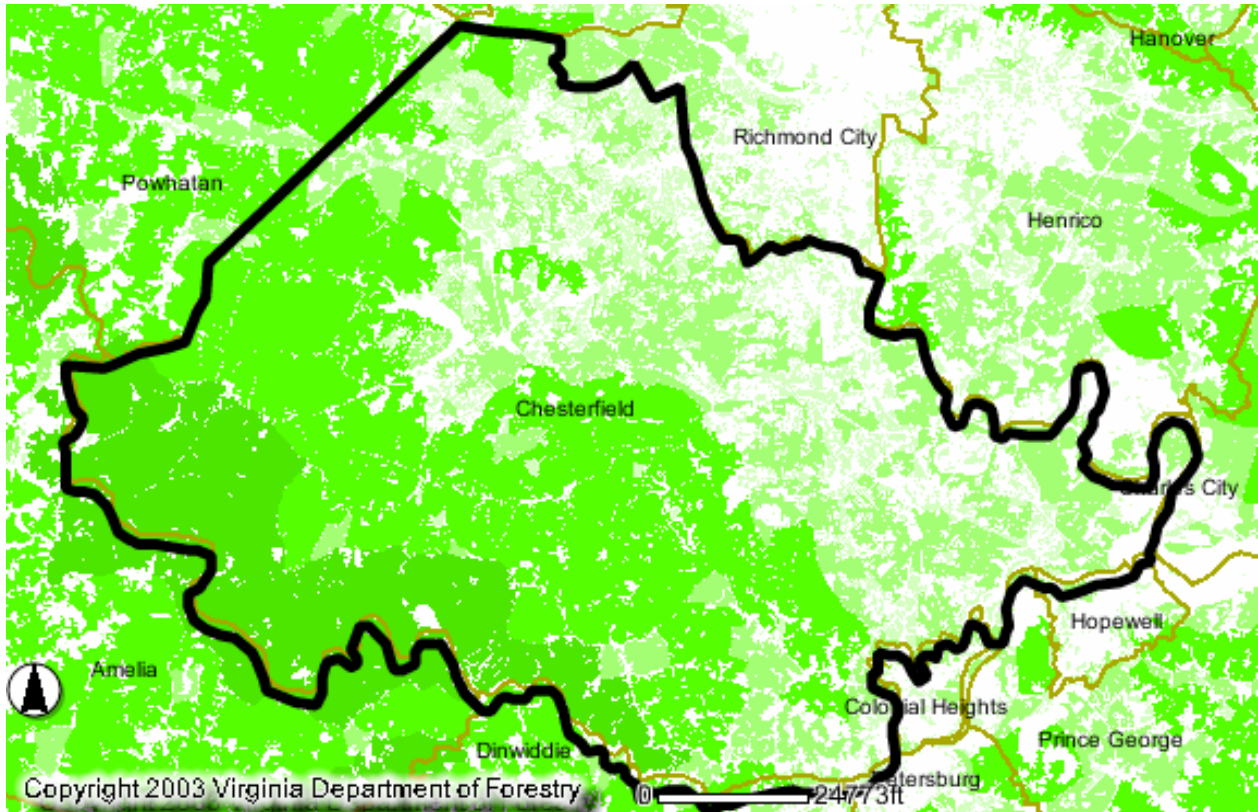


*Chesterfield County Office of Water Quality*

**FIGURE 3.** Water quality is fair or poor at more than 60 percent of the sites tested in the Falling Creek and Powwhite Creek watersheds and approximately 40 percent of those tested in the Swift Creek and Proctors Creek watersheds.



Forested areas in Chesterfield County have declined over the last 50 years with the development of more residential and commercial areas. This can reduce the ability of forests to absorb and control floodwaters and sediment, e.g. the rising level of Swift Creek Reservoir after storm events. Trees produce oxygen, clean pollution from the air and cool the environment. For example, driving along Courthouse Road and then Qualla Road on a summer day with the windows open, vehicle occupants notice a marked temperature drop when passing through Pocahontas State Park. The forest cover within Chesterfield County, as illustrated in Figure 4, provides an estimated \$4.9 billion per year in benefits and services.<sup>7</sup>



**FIGURE 4.** 2000 Forest Cover from the Virginia Department of Forest Resource Information Mapper (ForestRIM).

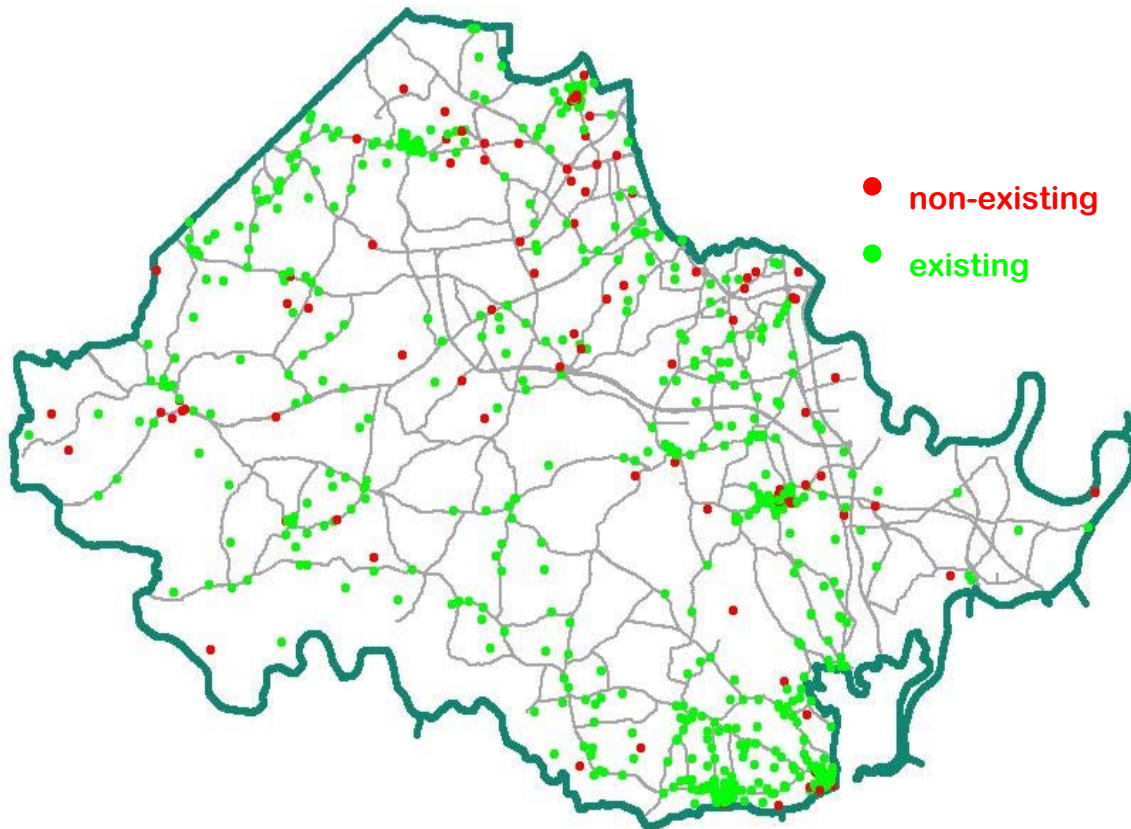
Vegetation in Chesterfield County is abundant. Although the disappearance of natural plant and animal species has not been a significant problem to date, it should be noted that the Virginia Department of Conservation and Recreation is monitoring several rare plant and animal species in Chesterfield County and bordering rivers.<sup>8</sup> Fragmentation of forests and natural habitats can result in insufficient space for native plants and animals to flourish. Their disappearance and the appearance of invasive exotic species, like the gypsy moth along Route 360 and the Scotch broom at Eppington,<sup>9</sup> affect the entire ecosystem of the watersheds.

## Heritage Sites

A rich cultural history offers a tangible link to the past and an intangible sense of place for residents. Portions of the historic fabric of Chesterfield County culture often are lost because there is no comprehensive policy to identify, study, record and, when appropriate, preserve these resources. It is not

just a loss of sites or failure to preserve existing sites that should be concerning, it is also insufficient awareness of this issue. Without action, much of the information about early settlement, Revolutionary War and Civil War cultures of Chesterfield County may be unavailable to future generations. While the Chesterfield County planning department is building a database to record all structures built in the county, 16 percent of those recorded have already been destroyed. Figure 5 illustrates the locations and notes whether they currently exist. So far, the listing contains more than 1,100 sites and structures dating from the mid-1600s to the mid-1900s. Completion of this information can be used to ensure the identification of more sites such as the historic Cheatham House, which was razed for the building of a new high school. Its value is preserved with a display in the county museum, including detailed architectural information pertinent to studies of the Huguenot era.

## Chesterfield County Historical Sites



**FIGURE 5.** While the Chesterfield County Planning Department is building a database to record all structures built in the county, 16 percent of those recorded no longer exist.

An intangible sense of place is found not only in historic sites, but also in familiar natural landmarks unique to a locality. For example, quiet scenic back roads and heavily trafficked, arbored parkways both provide an identity. “Human communities are part of the natural environment”<sup>10</sup> and are, in some ways, defined by it. Chesterfield County’s early years as a mining community, then an agricultural community, and now a suburban community, give its residents a sense of place. The first goal in the Matoaca Village Plan, for example, is to ensure that development within the village core promotes and enhances the visual appeal.<sup>11</sup> The update of the Midlothian Area Community Plan states “the public raised a series of

important development issues ... which focused on aesthetics, neighborhood vitality, community involvement, ... resource protection ...”<sup>12</sup> As noted in *Community Culture and the Environment*<sup>13</sup> “some of today’s most pressing environmental problems, such as non-point-source pollution, urban sprawl, habitat destruction, and vehicle emissions are rooted in the cultural fabric of the country.”

## Complementary Public Health Issues

The leading public health agency in the nation, Centers for Disease Control and Prevention,<sup>14</sup> recognizes several significant health issues related to green-infrastructure management. It states: “Of the 21st century’s many challenges, the major one for planners and designers will be designing well for population density. The health challenges of the 21st century include an aging population; mental health protection; environmental threats; chronic diseases such as diabetes and obesity; and eliminating disparities such as much poorer health status in low-income populations. For most of these challenges, we will need to be much smarter about how we use the land and design our housing and landscapes.”<sup>15</sup>

A 2003 Committee on the Future report addressed Chesterfield County issues for its older population (over 65 years old) projected to reach almost 20 percent of the total populace by 2030. It primarily spoke to the challenges of keeping older residents informed and involved. Although the report did not specifically address the public health challenges of the growing elder population, a number of the recommendations dealing with housing, transportation and pedestrian mobility would be addressed in a green-infrastructure plan.

Studies<sup>16</sup> by the Human-Environment Research Laboratory at the University of Illinois showed that the presence of vegetation contributes to the mental health of a population. Attention Deficit Disorder (ADD) symptoms in children are relieved after spending time in nature. Additional conclusions<sup>17</sup> of Frances Kuo and William Sullivan were that the presence of greenery had a calming effect on residents and brought them outside where their presence increased surveillance and reduced crime. Green spaces bring neighbors outside on a regular basis where they build friendships and strengthen the community.

The air quality index, or AQI, calculated by the Environmental Protection Agency, is an indicator of the daily overall air quality in various localities. It tells how clean or polluted the air is and what associated health effects might be of concern to the population. It is based on ambient concentrations of the five critical air pollutants regulated under the Clean Air Act. The values range from 0-500, with 50 representing good air quality, below 100 being the standard for satisfactory air quality, and above 100 indicating unhealthy levels of air pollutants. The AQI for Chesterfield County in 2004 was between 51 and 100,<sup>18</sup> in the moderate range meaning air quality is acceptable. It was the first year since the index began that the county value was not above 100, indicating some days of unhealthy levels of air pollutants – at first a concern for certain sensitive groups of people and then for everyone. The number of residents in the “sensitive” group is rising. The number of Chesterfield County residents with pediatric asthma rose 52 percent between the 1999-2001 and 2000-02 report cycles, and those with adult asthma rose 19 percent.<sup>19</sup> If this trend continues, significant numbers of county residents may be affected. Vegetation reduces at least one critical air pollutant, ground-level ozone.<sup>20</sup>

The percentage of the adult population that is obese (body mass index, or BMI, of greater than or equal to 30) has steadily grown in Virginia from more than 10 percent in 1991<sup>21</sup> to more than 15 percent in 1995 and 1999,<sup>22</sup> to more than 20 percent in 2003.<sup>23</sup> Part of the reason for increased obesity and its resulting chronic illnesses is lack of exercise. Even more alarming are the results of studies by the Chesterfield County Health Department during health screenings in the public schools. Thirty percent of Chesterfield County school-aged children are either overweight or at risk of becoming overweight.<sup>24</sup> This is partly due to a non-pedestrian lifestyle. Changes in land-use patterns have placed homes farther from needed

services and amenities. Families are forced to use automobiles to access goods, services or recreational activities, instead of walking or bicycling. A systematic review<sup>25</sup> of published studies conducted by the Task Force on Community Preventive Services reports a 25 percent increase in physical activity once access to places for physical activity is improved.

## A Green-Infrastructure Plan

Can the county maintain and improve air and water quality at current levels of management, planning and funding? Can it protect plant and animal habitat? Can it provide storm-water storage? Can it impede erosion, reduce sediment load and offer a record of county history for future generations? County plans such as the area plans, thoroughfare plan, utilities plan, and county growth policies continue to guide residential and commercial development, roads, public facilities, etc. Without a strategic set of county goals, objectives, policies and procedures that address green infrastructure, there will be no direction to guide stewardship of open space, natural resources and heritage sites.

The county should ensure that the concerns above be addressed and managed in a comprehensive, expeditious and cost effective manner. The committee believes county adoption and implementation of a green infrastructure plan can best accomplish this.

Currently, the Plan for Chesterfield guides the use of land for physical growth and redevelopment. Transportation plans, the Utilities Plan, the Public Facilities Plan, and the Comprehensive Parks and Recreation Master Plan assist in this process. The strategies of the Riverfront Plan, the proposed Greenways and Trails Plan, the Water Quality Plan, and the Chesterfield County Historical Society of Virginia address the stewardship of resources. State and federal environmental regulations and the Chesapeake Bay Preservation Act protect many resources or specify how they can be used. The county has accepted lands under conservation easements. The county has begun to inventory its historical sites. Any of these efforts taken separately, though noteworthy, are not enough to ensure a sustainable green infrastructure.

Planning, designing and implementing a green-infrastructure plan represents the next generation of county responsibility. By accepting this responsibility, the committee believes that open space, natural resources and heritage sites will be protected and available for future populations.

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<sup>1</sup> Lutz, Francis Earle. "Chesterfield, An Old Virginia County: Volume I 1607-1954." Waynesville, NC: Don Mills, Inc. 1954. p. vii

<sup>2</sup> Chesterfield County Growth Analysis definition of build-out is a maximum development scenario for Chesterfield County based on current zoning and the recommendations of the county land-use plan. Under the current rate of development, build-out could take at least 50 or more years. February 2004.

<sup>3</sup> Linking Landscapes, A Plan for the Protected Open Space Network in Chester County, Pa. Adopted February 2002. <http://dsf.chesco.org/planning/cwp/view.asp?a=3&Q=608142&planningNav=1>

<sup>4</sup> 2003 edition of the Jefferson County, Colorado Open Space 5-Year Master Plan  
[http://www.co.jefferson.co.us/ext/dpt/comm\\_res/openspac/index.htm](http://www.co.jefferson.co.us/ext/dpt/comm_res/openspac/index.htm)

<sup>5</sup> Loudoun County, Virginia Revised General Plan. Amended January 2003.  
<http://www.loudoun.gov/compplan/index.htm>

<sup>6</sup> Water and Stream Assessments Program, Water Quality Office, Chesterfield County Department of Environmental Engineering. 2005

<sup>7</sup> Analysis done by American Forest at the National Urban Forest Conference. San Antonio, Texas. Sept. 17-20, 2003. [www.americanforests.org](http://www.americanforests.org)

<sup>8</sup> Virginia Natural Heritage Program. Virginia Department of Conservation and Recreation.  
<http://www.dcr.virginia.gov/dnh/nhrinfo.htm>

<sup>9</sup> PowerPoint presentation by Richard Reuse, Department of Forestry. April 2003



- <sup>10</sup> *Community Culture and the Environment: A Guide to Understanding a Sense of Place*, 2002, U.S. EPA (EPA, 842-B-01-003), Office of Water, Washington, D.C. p 2
- <sup>11</sup> Matoaca Village Plan, Chesterfield County Plan for Chesterfield, adopted November 2003. 2/2004: MV1.
- <sup>12</sup> Midlothian Area Community Plan, Chesterfield County Plan for Chesterfield, adopted April 1989. M5.
- <sup>13</sup> *Community Culture and the Environment: A Guide to Understanding a Sense of Place*, 2002, U.S. EPA (EPA, 842-B-01-003), Office of Water, Washington, D.C. p2
- <sup>14</sup> Division of the U.S. Department of Health and Human Services [www.cdc.gov/healthplaces/](http://www.cdc.gov/healthplaces/)
- <sup>15</sup> Richard Joseph Jackson, MD, MPH, director, National Center for Environmental Health, Centers for Disease Control and Prevention. "What Olmstead Knew." *Western Magazine*, March 2001.  
[http://www.checnet.org/healthhouse/education/articles-detail-print.asp?Main\\_ID=565](http://www.checnet.org/healthhouse/education/articles-detail-print.asp?Main_ID=565)
- <sup>16</sup> F.E. Kuo, W.C. Sullivan. "Canopy & Crime" "Kids & Concentration" "Neighbors & Nature" "Plants & Poverty" "Vegetation & Violence" Human-Environment Research Laboratory. University of Illinois.  
<http://www.herl.uiuc.edu/>
- <sup>17</sup> F.E. Kuo, W.C. Sullivan. "Vegetation & Violence" Human-Environment Research Laboratory. University of Illinois. August 2002 [http://www.herl.uiuc.edu/trees/GreenRelief/Blurb\\_GreenRelief.pdf](http://www.herl.uiuc.edu/trees/GreenRelief/Blurb_GreenRelief.pdf)
- <sup>18</sup> Environmental Protection Agency Web site. <http://www.epa.gov/air/data/msummary.html?st~VA~Virginia>
- <sup>19</sup> State of the Air: 2003 and 2004. American Lung Association. May 2003 and April 2004. <http://lungaction.org>
- <sup>20</sup> Ozone NY. [http://63.161.215.216/about\\_ozone/how\\_plants\\_reduce\\_it.asp](http://63.161.215.216/about_ozone/how_plants_reduce_it.asp)
- <sup>21</sup> A.H.Mokdad, et al. *Journal of the American Medical Association*. 1999, 282:16.
- <sup>22</sup> Ibid. 2000, 284:13
- <sup>23</sup> Behavioral Risk Factor Surveillance System. Centers for Disease Control and Prevention. 2003
- <sup>24</sup> Coalition for Active Children. Chesterfield County Health Department November 2004  
<http://www.chesterfield.gov/COACH/default.asp>
- <sup>25</sup> Community Preventive Services. "Creating or Improving Access to Places for Physical Activity Is Strongly Recommended to Increase Physical Activity." *American Journal of Preventive Medicine* 2002; 22(4S); 73-107  
<http://www.thecommunityguide.org/pa/default.htm>

# PLANNING FOR A GREEN INFRASTRUCTURE

*The mission of the committee's report is to enhance the quality of life in Chesterfield County by incorporating a green-infrastructure plan into the planning process as a critical public commitment to ensure social, economic and environmental benefits for present and future generations.*

To accomplish this mission, the committee has developed recommendations and strategies for consideration and implementation of a green-infrastructure plan. These strategies, when implemented, will preserve the natural, cultural and historical resources of significant value during growth and development. Although based on broad public input, the design of a green-infrastructure plan requires buy-in and direction from the very top of the organization.

Residents need to understand green infrastructure from all perspectives, not just their own or in terms of specific initiatives, even though individual “green” elements are more easily understood than the broad concept of a green-infrastructure plan. For this reason, the initial task should be to raise the general public’s awareness of the concept of green infrastructure in its entirety. The synergy between the various elements of a green infrastructure must be understood. This will set the stage for future involvement and commitment in developing a green-infrastructure plan. The committee recommends using the public media and a series of forums to raise awareness.

## RECOMMENDATION 1

**Raise the awareness of green infrastructure through public media and forums.**

### **STRATEGY 1.1**

**Develop educational materials on green infrastructure and offer workshops to the public.**

The county should develop educational materials on green infrastructure and offer workshops to the public. Several members of the committee participated in the nine-month-long Planning Education Workshop Series offered by the Chesterfield County Department of Planning. A similar format could be used in workshops offered at various venues throughout the county. Fluvanna County, Va., held a series of

annual citizen forums<sup>1</sup> to discuss protection of open spaces. Prince William Conservation Alliance in Prince William County, Va., began a series of monthly roundtables<sup>2</sup> in August, 2005 to discuss local issues relating to green infrastructure.

### **STRATEGY 1.2**

**Assign the county administrator the leadership role of development, oversight, implementation and accountability of outcomes for a green-infrastructure plan.**

Results of a 2003 study comparing Atlanta, Ga., to nine other similar cities showed that those localities with the strongest open-space programs have histories of strong governmental leadership and constituent support.<sup>3</sup> The Committee on the Future encourages the Board of Supervisors to acknowledge the importance of a green-infrastructure plan and support its implementation through strong leadership and allocation of resources. Once the public has been engaged and commitment to

the project has been achieved through an education and awareness campaign, the Committee on the Future suggests that the county administrator assume the leadership role for the development, oversight, implementation and accountability of outcomes for this green-infrastructure plan. The development of an infrastructure plan requires strong leadership. The wide scope of the planning process ultimately merits overall direction by the county administrator though not necessarily the day-to-day activities.

## **RECOMMENDATION 2**

### **Develop a green-infrastructure plan.**

The committee's most important recommendation is that county government develop a green-infrastructure plan to understand, leverage and value natural systems for efficient and sustainable land use and protection of ecosystems. Green infrastructure functions across different jurisdictions, interconnecting all county plans. The interests of many diverse stakeholders are involved because green infrastructure benefits everyone.

#### **STRATEGY 2.1**

##### **Form an advisory commission and appoint an executive committee.**

It is suggested that the county administrator form an advisory commission representing all communities of interest and appoint an executive committee chosen from the advisory commission membership. The commission's role would be to study, design and recommend a green-infrastructure plan suited to Chesterfield County. The objectives of the recommended plan should act as a guide to the composition of the advisory

commission. In other words, the needs of the plan would dictate the expertise needed by members of the advisory commission. The private citizen is the most important member of this commission and the key to achieving a successful green-infrastructure plan.

The county administrator should appoint an executive committee that is essentially the leadership of the overall advisory commission. Although a large number of qualified people would comprise the advisory commission and would assist with development of the plan, the executive committee would have the interest and influence to carry the plan forward. In other words, the executive committee would provide the direction for a much broader participation of the public, private and nonprofit sectors as well as the academic community and local citizens. State, regional and local involvement would also be desirable. From experience, the committee realizes that strong staff support will be required to assist the commission in reaching its goals and objectives.

The executive committee would likely be chosen for their commitment, their interest in all facets of green infrastructure, and the expertise they can bring to the project. The skills members would bring to this committee should include qualified expertise in relevant areas, e.g., conservation sciences, land transactions, geographic information systems (GIS), planning and funding. Consideration also might be given to people with knowledge of the county's ecology and history. Other important skills should be community leadership and budgeting authority.

Possible members of the larger advisory commission that represent government might include elected officials, appointees or employees. Although this is to be a county plan, government employees from state and regional agencies could also participate with knowledge from their respective fields within the departments of Agriculture, Conservation and Recreation, Environmental Quality, Forestry, Game and Inland Fisheries, Historic Resources and Transportation, the Environmental Protection Agency, regional planning district commissions, James River Soil and Water Conservation District Commission, and the Virginia Cooperative Extension Services.



Nonprofit organizations that focus on conservation, outdoor recreation, agriculture or historic preservation could provide input from their staffs, board members or volunteers. Members of civic organizations or citizen groups might be on the panel. Chesterfield County is fortunate to have active involvement in Friends of Chesterfield's Riverfront, Hands Across the Lake, the Falling Creek Reservoir Preservation Society, Friends of the Lower Appomattox River, Chesapeake Bay Foundation, James River Advisory Council, the villages of Midlothian, Chester, Bon Air, Matoaca and Ettrick, the organizations of the Chesterfield Historical Alliance, Meadowbrook Area Community Council, Green Infrastructure Group, Friends of Pocahontas State Park, Coalition for Active Children, The Task Force for Responsible Growth, The Sierra Club, James River Association, The Trust for Public Land, The Nature Conservancy, BikeWalk/Virginia Trails, sports leagues and community associations.

From the private sector, it would be important to include corporate landowners, real-estate developers, industry representatives, business councils, the chamber of commerce and other landowner interest groups. Involvement could come from representatives of E. I. Dupont, Dominion Power, Honeywell, CJW Medical Center, UPS, Bon Secours, The Arboretum, Gateway Center, the Boulders, Moorefield Park, Waterford, River's Bend Center, Appomattox Industrial Center, Ruffin Mill Industrial Park, Oaklake Business Center, and Southport Industrial Center. Representatives of the Virginia Sustainable Housing Network, the Home Building Association of Richmond, Richmond Association of Realtors, Chesterfield Business Council, and Chesterfield Chamber of Commerce should be considered for the advisory commission.

Academic advisors could be teachers from area schools, professors and graduate students in relevant university departments, and research scientists such as conservation biologists, landscape architects and urban planners. Science teachers in the Chesterfield County Public Schools, professors and students from Virginia State University, Virginia Commonwealth University, Virginia Tech, the University of Virginia and area community colleges would provide information grounded in scientific and land-use planning theories. Additional assistance could be gained from the Virginia Natural Resources Leadership Institute.

Additional representation could come from private landowners, local residents and tourism groups. Local residents, especially those whose families have lived in Chesterfield County for generations, could provide valuable cultural and historical perspective. The Virginia Tourism Corp. could offer insight into some of the potential economic benefits of protecting natural, cultural and historic resources.

**STRATEGY 2.2**  
**Train county leadership and the executive committee on green-infrastructure strategic planning.**

To provide a comprehensive understanding of the task ahead, it is suggested that the county administrator, deputy administrators, department directors and the executive committee attend a short course on green-infrastructure strategic planning similar to The Conservation Fund's course titled A Strategic Approach to Natural Resource Planning and Conservation. This training would provide the fundamental

understanding and tools the attendees would need as they incorporate the unique characteristics and values of Chesterfield County into a customized county green-infrastructure plan.

**STRATEGY 2.3**  
**Perform a gap analysis.**

Chesterfield County has numerous plans and initiatives related to the environment. The committee suggests that a gap analysis be performed to compare these plans with current regulations and standards. This information will help set the parameters for a green-infrastructure plan.

## Open Space

*The Plan for Chesterfield* guides land-use issues and follows a set of philosophical and conceptual “guiding elements.” Because a green-infrastructure plan encompasses land use, as well as a number of non-land-use issues, it is suggested that a green-infrastructure plan might follow these same elements: reasonable growth management, quality economic development, shaping character of development, preserving important environmental, cultural and historic resources and maintaining healthy neighborhoods. This would help align it with the conceptual and operational parameters the Plan for Chesterfield uses thereby making them as compatible as possible.

**STRATEGY 2.4**  
**Consider design parameters that follow the Plan for Chesterfield’s guiding elements.**

The Committee on the Future proposes that a green-infrastructure plan would support the goals of the 2002 Parks and Recreation Master Plan<sup>4</sup>. The sixth goal speaks to “planning for the use and the conservation of the entire Chesterfield outdoors for future generations.”<sup>5</sup> County acquisition of open space for public use began with the 1974 Parks and Recreation Open Space Plan. Active recreation areas were the primary focus 30 years ago. The public has shown a desire for more passive-use areas, nature centers, trails and access to historic sites. Four main concerns emerged from research to develop the current master plan: maintain existing park lands and programs, increase diversity within the parks-and-recreation system, protect natural systems and historic resources, and utilize public-private partnerships. These same concerns could be applied to a green-infrastructure plan.

**STRATEGY 2.5**  
**Support the goals of the 2002 Parks and Recreation Master Plan that pertain to green infrastructure.**

**STRATEGY 2.6**  
**Support the goals of the proposed Greenways and Trails Strategic Plan.**

The seventh goal in the county’s current Parks and Recreation Master Plan is to incorporate the public interest in greenways, blueways and trails into the plan.<sup>6</sup> “As our communities become more urbanized and traffic congestion increases, citizens want parks and trail systems close to residences and offices.”<sup>7</sup> In response to this, and with a grant from the Virginia Department of Forestry’s Urban and Community Forestry Program, the county drafted a Greenways and Trails Strategic Plan presented in June 2003. This document provides awareness of current and potential linear corridors of open space within the county. From a regional aspect, additional information can be garnered from the Virginia Department of Transportation Bicycle and Pedestrian Plan. The committee suggests that the goals, action steps and measurements in the proposed Greenways and Trails Strategic Plan should be considered in the development a green-infrastructure plan.

## Natural Resources

**STRATEGY 2.7**  
**Support the goals, policies and implementation strategies of the Water Quality Protection Plan.**

The county actively implements a variety of programs to preserve, protect and improve water quality. The Chesterfield County Water Quality Protection Plan, adopted by the Board of Supervisors in November 2002, promotes water quality protection and helps meet the planning requirements of the Chesapeake Bay Preservation Act,<sup>8</sup> including amendments adopted by the Board of Supervisors in November 2004. As a part of the comprehensive plan, these strategies are used in land-

use decision-making that guides future growth and reduces the amount of pollutants generated by new development. More importantly, they also control pollution from existing land uses. The Department of Environmental Engineering uses the Erosion and Sediment Control Ordinance to reduce sediment-laden runoff from entering county waters. The committee suggests that strategies within the green-infrastructure plan support the efforts of the Water Quality Protection Plan.

**STRATEGY 2.8**  
**Consider utilizing the strategic concepts of the Riverfront Plan.**

Adopted by the Board of Supervisors in 1997, the Chesterfield County Riverfront Plan was developed “to protect, enhance and balance the natural, cultural, and visual resources, economic opportunities, and overall quality of life along the Chesterfield Riverfront through the creation and implementation of a community-based voluntary and collaborative plan.”<sup>9</sup> The committee suggests these concepts be considered in a green-infrastructure plan.

## Heritage Sites

The mission of The Chesterfield Historical Society of Virginia is to collect, preserve, interpret and promote the county’s unique past for the education and enjoyment of present and future generations.<sup>10</sup> The goals and objectives of their strategic plan provide specific initiatives that could be incorporated into a green-infrastructure plan.

**STRATEGY 2.9**  
**Complete the inventory of structures built in Chesterfield County.**

The Committee on the Future found that the first step to complete the above mission would be to identify all historic sites on a map layer. Although an inventory is not yet complete, land-use plans revised in the last five years have included a more complete section detailing the historic sites within the plan’s boundaries and providing guidelines for their future use. The county planning department’s database of historic sites should be completed and the Geographic Information System (GIS) layer updated for use by other departments.

## Non-County Programs

**STRATEGY 2.10**  
**Coordinate and partner with adjacent jurisdictions and regional planning agencies.**

Development of a green-infrastructure plan should not confine its review to existing county programs. Many state, regional and federal agencies have compiled information about the open space, natural resources and heritage sites of Chesterfield County. Chesterfield County is a member of both the Richmond Regional Planning District Commission (PDC) and the Crater Planning District Commission. These regional planning agencies place major emphasis on the areas of transportation, water resources and solid-waste planning, local technical assistance and information services. Through PDCs, local governments solve mutual problems that cross boundary lines. Because a green-infrastructure plan is based on the ecology of the area, its effects reach beyond geopolitical boundaries. The committee suggests that working with PDCs would provide consistent environmental goals for Chesterfield and surrounding jurisdictions. Cooperation should be sought with all jurisdictions sharing borders with us or sharing natural resources.

**STRATEGY 2.11**

**Connect green-infrastructure plan components with those of adjacent jurisdictions.**

Adjacent jurisdictions often have facets of a green-infrastructure plan already in place, just as Chesterfield County does. The committee suggests coordinating with neighboring jurisdictions so that a network is continuous through boundary lines whenever possible. An example would be the existing trail system through James River Park in the city of Richmond connecting with a corridor of a green-infrastructure plan in the northern part of the county.

**STRATEGY 2.12**

**Incorporate state and federal sites into the green-infrastructure network.**

The Virginia Department of Conservation and Recreation (DCR) has several programs that could assist in the development of a green-infrastructure plan. The department enhances natural and recreational resources through land management, funding education and regulation. Pocahontas State Park, located in the heart of Chesterfield County, is one of the largest and most popular sites in the state park system. Swift

Creek forms the nucleus of the park. With value as a heritage site, recreational park and wildlife management area, Pocahontas State Park could serve as one hub in a green-infrastructure plan.

Presquile National Wildlife Refuge is an important component in the network of refuges on and around the Chesapeake Bay, our nation's largest estuary. Presquile provides important habitat for wintering Canada geese and is also home to nesting and roosting bald eagles. The refuge could serve as another hub in a green-infrastructure plan.

**STRATEGY 2.13**

**Utilize relevant data, programs and services pertaining to green infrastructure from state and federal agencies.**

The mission of DCR's Natural Heritage Program is "conserving Virginia biodiversity through inventory, protection and stewardship."<sup>11</sup> It represents a comprehensive effort to record and preserve the animal, plant and natural community resources of the commonwealth. Part of this program is the Virginia Conservation Land Needs Assessment (VCLNA)<sup>12</sup> that prioritizes cores and corridors of the natural landscape. The committee suggests using this data to define the values and

vulnerabilities of Chesterfield's ecosystems. VCLNA is a tool for integrating and coordinating the needs and strategies of different conservation interests.

DCR coordinates and directs soil and water conservation programs and services that prevent degradation of the quality and quantity of water resources. The local James River Soil and Water Conservation District (JRSWCD) provides educational and technical assistance to urban and rural land users, civic and school groups and government. The committee suggests that the JRSWCD could provide valuable conservation assistance and knowledge of Chesterfield County's natural resources.

The *Virginia Outdoor Plan*, written by DCR, is a framework for meeting Virginia's outdoor-recreation and open-space needs and conserving the environment. This document provides information on broad issues as well as analysis and recommendations specifically for Chesterfield County.<sup>13</sup>

The Virginia Department of Forestry (DOF) partners with the forest industry, nonprofit groups, local governments and other agencies to provide raw materials for a viable economy and ensure a healthy environment through best-management practices for water quality, fire prevention, land conservation and reforestation. Information on both rural and urban forestry is available from the Chesterfield DOF forester.

### RECOMMENDATION 3

#### Commit to the green-infrastructure plan and provide resources.

Additional state and federal sources of data, programs and services for Chesterfield County include the Virginia Department of Historic Resources, Chesapeake Bay Local Assistance Department, the U.S. Environmental Protection Agency and the Department of Environmental Quality.

Once the advisory commission has developed a green-infrastructure plan and the Board of Supervisors has adopted it, the critical work of implementing the plan begins. The implementation of a green-infrastructure plan would be as multifaceted as are the implementation of gray and social infrastructures. Green infrastructure needs a broad, comprehensive, strategic approach that only the county's strategic plan can provide because an infrastructure plan is a critical public investment whose performance is accountable at all levels of county management. This plan should be supported by a new county green infrastructure goal or subgoal in the Chesterfield County Strategic Plan.

#### STRATEGY 3.1

##### Commit resources to manage and implement a green-infrastructure plan.

The significance of green infrastructure being a critical public investment cannot be overemphasized. Planning and implementation of a green-infrastructure plan would involve a mixture of strategies. Many departments, numerous partnerships and a variety of funding sources are required to realize the vision of an integrated network. County leadership will need to find and commit resources to meet this goal through a variety of sources. Some possibilities are discussed later in this report.

#### STRATEGY 3.2

##### Provide an annual assessment of the green-infrastructure plan.

An important part of developing and implementing a green-infrastructure plan is to perform regular assessment and reporting. The plan will require continuing study to be effective as a tool to guide and manage the evolution of the county's and region's green infrastructure. An excellent way to do this is to develop performance measures, time lines and other measurable outcomes that are reported at least annually.

<sup>1</sup> Fluvanna: Our Heritage, Our Future, Our Decision on Open Space. The Fluvanna Heritage Forum. September 2002.

<sup>2</sup> "Conservation Alliance plans community roundtables." The Gainesville Times. Times Community Newspapers 2005 August 19, 2005.

<sup>3</sup> Open Space Acquisition and Management Opportunities in the City of Atlanta and Adjacent Jurisdictions. Research Atlanta Inc.: Georgia State University, Andrew Young School of Policy Studies. May 2003 [www.researchatlanta.org/FullReports/03\\_OpenSpace.pdf](http://www.researchatlanta.org/FullReports/03_OpenSpace.pdf)

<sup>4</sup> Chesterfield County Parks and Recreation Master Plan, The Landmark Design Group Inc. July 2002.

<sup>5</sup> 2002 Chesterfield County Parks and Recreation Master Plan, VI-5-6

<sup>6</sup> 2002 Chesterfield County Parks and Recreation Master Plan, VI-6

<sup>7</sup> 2002 Chesterfield County Parks and Recreation Master Plan. III-2

<sup>8</sup> The Plan for Chesterfield. The Water Quality Protection Plan. Chesterfield County Planning Department. November 2002:WQ1.

<sup>9</sup> The Plan for Chesterfield. The Riverfront Plan. Chesterfield County Planning Department. January 1997:R5

<sup>10</sup> Strategic Plan 2005-2009. Chesterfield Historical Society of Virginia. March 2004:3

<sup>11</sup> VA Natural Heritage Program. Virginia Department of Conservation and Recreation. <http://www.dcr.virginia.gov/dnh/>

<sup>12</sup> Virginia Conservation Land Needs Assessment. Natural Heritage Program. Virginia Department of Conservation and Recreation. <http://www.dcr.virginia.gov/dnh/vclna.htm>

<sup>13</sup> The 2002 Virginia Outdoors Plan. Virginia Department of Conservation and Recreation. 2002:283-294.



# COMMUNICATION

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In the spring 2004, the Committee on the Future met with 16 different groups<sup>1</sup> to discuss the topic of green infrastructure. Following a brief presentation that defined how the committee had approached the topic, participants completed a short survey.<sup>2</sup> The responses to survey questions provided committee members with an indication of the interest in open-space conservation, natural resource stewardship and historic preservation. Citizens acknowledged the value of green infrastructure to Chesterfield County's quality of life and were willing to commit resources to preserving, protecting and managing those areas. Although the majority agreed with the principles of a green-infrastructure plan, they questioned whether it could benefit everyone, and whether it could realistically be implemented under current county policies and planning guidelines. Participants were enthusiastic about contributing to the green infrastructure design process. However, the committee found that not all residents are aware of the many benefits (see Appendix D) associated with implementation of a green-infrastructure plan.

## Information

The Committee on the Future recommends that every effort be made to engage public interest and involvement. This would also serve to inform residents of the economic, environmental, societal and health benefits of a green infrastructure. Knowledge can help improve the dialogue about land protection strategies, build support for adequate funding and motivate people to assist in strategic mapping of a green-infrastructure network design.

### **RECOMMENDATION 4**

**Engage public interest and involvement.**

#### **STRATEGY 4.1**

**Continue providing educational materials and workshops on green infrastructure to the public and to county employees.**

Broad public involvement is needed to gain consensus on a green-infrastructure plan. While many residents are concerned about the preservation of natural and historic resources, many others are unaware of the challenges facing Chesterfield County as the population grows and land is developed. Workshops offered to educate the public on the concept of green infrastructure should continue throughout the planning process. This would raise the level of citizen awareness and expand involvement in the process.

#### **STRATEGY 4.2**

**Report regularly on the progress of a green-infrastructure plan to those living and working in the county.**

As the process of designing and implementing a green-infrastructure plan proceeds, all those living and working in the county should be informed regularly on the advisory commission's progress. This not only garners grass-root support for initiatives, but also provides possible involvement from diverse interest groups who may provide help in implementing this plan.

**STRATEGY 4.3**

**Develop a community, state and national advertising campaign to promote Chesterfield County ecology, history and culture.**

Local citizens, no matter the length of their residency, may be unaware of the depth of resources and attractions that abound in the county. An advertising campaign to promote the ecology, history and culture of Chesterfield County, expanded from the Chesterfield 2007 campaign, would spark awareness and interest that leads to appreciation. The tourism industry states that travelers who are exposed to state and national advertising choose to visit sites of interest no matter the distance. When choosing Virginia, the Richmond area is the top destination for visitors though Colonial Williamsburg remains the most visited site.<sup>3</sup> A well-developed and implemented green-infrastructure plan will provide additional reasons for visitors to choose Chesterfield County. In doing so, they will spend time and money here enjoying our ecological, historical and cultural attractions.

**STRATEGY 4.4**

**Disseminate information through the Internet, local broadcast and print media, and community meetings.**

The committee suggests using a number of vehicles to disseminate information about a green-infrastructure planning process, its benefits and how it relates to Chesterfield County. The advisory commission should use a dedicated page on the county Web site as an information focal point for green infrastructure in Chesterfield County. Information on this site should include an explanation of the issues, news, community events and related links. The Web site [www.trianglegreenprint.org](http://www.trianglegreenprint.org), a public-private partnership in the Raleigh-Durham-Chapel Hill area, is a good example of educating and informing citizens during the planning stages and continuing to keep the community informed as the program evolves.

Other media can provide a broader dissemination of information. For example, Comcast cable government and school channels and local network channels provide broadcast opportunities to reach a large segment of the population. Educational videotapes, talk shows with call-in features, and public-service announcements aired on a regular basis for maximum coverage would go far to gain public support and involvement. Similar public-relations products could be aired on local radio stations in the county and the metro area.

Specially designed print products about a green-infrastructure plan in Chesterfield County could actively promote strategic conservation. This might include frequent press releases to area newspapers, magazines and special-interest publications.

Presentations at magisterial district meetings, civic community meetings and to local organizations would provide good settings to answer questions and receive feedback. An interactive feature on the county's Web site, where citizens could ask questions, receive quick responses and offer opinions, is another opportunity for dialogue.

## Education

Even more important than information of what is being done in a green-infrastructure plan process, is why it is being done. Therefore, present and future stewards of the county's environment will benefit from educational opportunities provided in a variety of ways.

**RECOMMENDATION 5**

**Promote educational programs that heighten the awareness and appreciation of the county's ecological, historical and cultural resources.**



The Committee on the Future recommends that the county further promote educational programs that heighten the awareness and appreciation of its ecological, historical and cultural resources. The primary vehicle for education of young people is the public school system. The school system also reaches beyond the formative years with its adult education programs. Special-interest organizations provide seminars and workshops on aspects of county history and stewardship of county resources. The committee realizes the value of existing programs and encourages their expansion.

**STRATEGY 5.1**

**Expand Chesterfield County public school coursework and fieldtrips related to county history.**

Chesterfield County Public Schools (CCPS) uses an exemplary curriculum to teach Virginia and U.S. history. The same coursework could be expanded to emphasize the roles that Chesterfield County, located in an area rich in history and folklore, played in those events. Currently, county schools take advantage of some nearby sites to illustrate important historical events. For example, a day at Henricus Historical Park provides a living history of colonial times comparable to, or better than, other areas in the state. Trips to Civil War sites at Bermuda

Hundred make history come alive when it is in your own county. The schools should explore additional ways of exposing students to the role Chesterfield County played in history.

**STRATEGY 5.2**

**Encourage the expansion of Chesterfield County history programs and fieldtrips for adults and families.**

Knowledge and appreciation of historical resources goes beyond the traditional classroom. Scenic byways, linear parks, greenways and trails can provide opportunities for experiential hands-on learning. Family outings could reinforce classroom activities and provide adults opportunities to share their knowledge with family and friends. While Chesterfield Historical Society, CCPS Adult Education, and Parks and Recreation currently have some programs, more people need to be aware of them and use them to understand their importance to our sense of place.

**STRATEGY 5.3**

**Increase natural resource awareness through partnerships between schools, organizations and environmental groups.**

Several high schools in the county have ecology clubs and several schools compete in the Envirothon.<sup>4</sup> Students at Crestwood Elementary School have participated in the Lake Page Project,<sup>5</sup> helping to earn them a yearly distinction of being a Virginia Naturally<sup>6</sup> school since 2000. Six other schools in Chesterfield County have received this honor one or more times. Students in these schools have partnered with Friends of Chesterfield's Riverfront, the James River Soil and Water Conservation District and other environmental organizations.

Every school in the county should have an ecology club and be a Virginia Naturally school every year through partnerships and use of components of a green-infrastructure plan. The achievement would be a credit to the school, our school system and the county, and a tribute to the importance of sustaining natural resources for future generations.

**STRATEGY 5.4**

**Encourage residents and visitors to explore the outdoors.**

Many activities that explore the waters, flora and fauna native to the area are family-oriented occasions and should be encouraged and expanded. Conservation lands and agriculture areas can be outdoor classrooms to teach all ages about natural resources. Nature centers, such as the one at Rockwood Park, provide educational opportunities. The trails and campgrounds at

Pocahontas State Park offer families an outdoor retreat. Unfragmented habitat areas and riparian corridors running through developed areas allow backyard access to nature. Many organizations offer classes and workshops for adults and families. For example, James River Days is a river-related project sponsored by over 35 organizations. From April through September, over 100 exciting programs, events and activities for all ages are offered at different venues along the river. The Parks and Recreation department sponsors activities in more than 30 parks throughout the year. These programs should be promoted to encourage more citizens and visitors to explore the outdoors.

**STRATEGY 5.5**  
**Develop self-guided walking, bicycling and driving tours of the county.**

The committee suggests that self-guided walking, bicycling and driving tours of the county be developed. In this way, county residents and visitors could explore the history and ecology of Chesterfield County along greenways, trails and scenic byways used as linkage corridors within the green-infrastructure network. These self-directed activities, with supporting media such as maps and tapes, will allow residents and visitors to

enjoy the natural, historical and cultural aspects of the county, such as the historic Huguenot Trail, Route 711 in the northern area of the county.

**RECOMMENDATION 6**  
**Offer green-infrastructure courses in Chesterfield University curricula.**

Only a well-informed leadership and work force will be able to develop, manage and maintain a green-infrastructure network. Strategies need to be created to do this. Chesterfield County government has made learning a lifelong priority through the creation of Chesterfield University, an organization that provides continuing education for county employees. The educational opportunities in Chesterfield University are designed to further the mission and goals of the county's overall strategic plan. As stated earlier, the Committee on the Future's most important recommendation is that county government develop a green-infrastructure plan. To help accomplish this, all county employees will need an explanation of the plan and its process, an appreciation of the plan's goals and objectives, and an understanding of how to apply their expertise to implement the plan. The committee, therefore, recommends that the Chesterfield University curriculum include professional-development activities for county employees that provide the background and management tools to accomplish this.

**STRATEGY 6.1**  
**Offer a short course on green infrastructure.**

The committee suggests that one offering be a short course on green infrastructure. The committee found misunderstanding among county employees and citizens, concerning what green infrastructure is and what purposes it serves. The Conservation Fund has developed and taught a green-infrastructure course and could be a resource for the county in tailoring this course for

county employees. To facilitate understanding of a green-infrastructure plan within the community, this course should be offered to citizens, land developers, businesspeople and other interested parties.

**STRATEGY 6.2**  
**Develop and offer courses on Chesterfield County history and culture.**

Many county employees, developers, businesspeople and residents may be unaware of the history associated with specific county sites. Broader awareness could improve the process of identification, and ensure the protection or preservation of valued historic sites. Chesterfield University offerings could include survey and appreciation courses on the different periods

of county history, courses on the historic preservation process, and an overview of the organizations and agencies involved in heritage stewardship. The Chesterfield Historical Society, the planning department and the public library system may have the resources necessary to develop and offer these courses.

**STRATEGY 6.3**

**Offer courses on ecological systems and their value in everyday quality of life.**

The committee believes courses providing an understanding of the ecological systems and their value in everyday quality of life will give employees the tools needed to implement green infrastructure as a guiding principle. The programs and guides used by the Environmental Engineering and Utilities departments contain information that could be used to formulate classes on the role of watersheds in the ecological system.

Similarly, many of the outdoor nature programs offered to the public through Parks and Recreation can be modified for use in Chesterfield University. The state forestry office and the Virginia Department of Conservation and Recreation are other resources that could provide information.

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<sup>1</sup> See Appendix B Green Infrastructure Study Process.

<sup>2</sup> See Appendix C Green Infrastructure Survey.

<sup>3</sup> 2003 Virginia Visitors Study (Richmond, VA: Virginia Tourism Corporation) 9

<http://www.vatc.org/research/Pleasure-RelatedProfile.pdf>

<sup>4</sup> National competition sponsored by local Soil & Water Conservation Districts

<http://www.vaswcd.org/envirothon.htm>

<sup>5</sup> [http://www.chesterfield.k12.va.us/Schools/Crestwood\\_ES/lakepage.htm](http://www.chesterfield.k12.va.us/Schools/Crestwood_ES/lakepage.htm)

<sup>6</sup> <http://www.vanaturally.com/>

# COMMITMENT

**T**his report has discussed at length the need for strong leadership and broad communication to realize the success of a green-infrastructure plan. The third component is commitment. This means that while you can have a great group of volunteers and a terrific green-infrastructure plan, none of it will be successful unless there is commitment.

Commitment translates into three primary facets: **money, people** and **changes of behavior**. The money component represents a financial commitment to the plan's goals and objectives. This would likely be accomplished in a variety of ways including internal and external county resources. The commitment of people may require hiring new employees and some current employees taking on new or expanded roles. The county needs to commit to that investment. Private citizens would also need to commit to helping develop and implement the plan. The final facet of commitment is a change in the way all county operations work – a behavioral change that supports the goals of a green-infrastructure plan.

## Money

An implementation plan would be developed as part of a green-infrastructure network and related policies. The feasibility of implementing much of a green-infrastructure plan relies on identifying revenue sources. Without sound fiscal tactics, the plan will falter. No single source would meet the financial needs of a plan. A green infrastructure's components are varied and require a diversified approach (see Figure 6). The Committee on the Future studied a number of ways other localities finance the various activities of a green-infrastructure plan. Some of these are already used in Chesterfield County. Others may be suitable depending upon the particular needs of a green-infrastructure plan.

### RECOMMENDATION 7

**Finance the various activities of a green-infrastructure plan using a combination of techniques.**

#### STRATEGY 7.1

**Identify a comprehensive list of external funding sources and implement a plan that attracts a significant share of this funding.**

Federal and state resources fund a variety of projects including planning, capital, education or outreach, and maintenance and management. There are a number of financing arrangements to facilitate environmental stewardship. Over the course of seven months, October 2004 through April 2005, the Committee on the Future became aware of over 23 external funding sources for grants and awards pertaining to the environment (see Appendix E). The county or the advisory commission could identify a comprehensive list of external funding sources and implement a plan that attracts a significant share of this funding.

#### STRATEGY 7.2

**Consider non-tax-based financing strategies to meet some goals of a green-infrastructure plan.**

External funding is only one strategy used for financially realizing the vision of a green-infrastructure plan. Several non-tax-based financing arrangements may be useful, e.g., loan agreements, state revolving funds<sup>1</sup>, general obligation and mini-bonds<sup>2</sup>, and storm-water utilities charges.

A linked-deposit-loan approach has been used in many jurisdictions to assist small businesses and new homeowners to encourage expansion or development in particular areas. The jurisdiction leverages its interest-earning bank deposits with financial institutions for short, lower-interest loans as incentives to borrowers that meet certain guidelines. This same approach could be considered for developers who meet specified environmentally sensitive criteria, such as smaller footprint, more undisturbed land, wider buffers, etc.

**FIGURE 6.** Tools to Implement Green Infrastructure

		Federal Programs	State Programs	Local Programs	Other Institutions
Public Lands		Chesapeake Bay Preservation Act Community Development Block Grants Land & Water Conservation Fund Migratory Bird Conservation Fund National Historic Landmarks National Natural Landmarks National Oceanic and Atmospheric Administration National Register of Historic Places North American Wetlands Conservation Act Pittman-Robertson Act Transportation Equity Act (TEA-21) Wetlands Reserve Program Wild & Scenic Rivers Act	Forest Legacy Program Historic Preservation Easement Scenic Highway and Virginia Byways Act Scenic Rivers Act Virginia Landmarks Register Virginia Outdoors Foundation (Land Trust) Virginia Outdoors Plan (VOP)	Agricultural/Forest Districts Public Ownership/Acquisition  Rural Historic District Zoning	Conservation Easement Local Corporation Riparian Easement
	Permanent Tools	Cooperative Endangered Species Conservation Fund North American Wetlands Conservation Act National Register of Historic Places National Historic Landmarks National Natural Landmarks Wild & Scenic Rivers Act	Forest Legacy Program Historic Preservation Easement Scenic Rivers Act Virginia Outdoors Foundation (Land Trust) Virginia Land Conservation Tax Incentives Virginia Land Conservation Fund Virginia Landmarks Register	<i>Purchase of Development Rights</i> <i>Transfer of Development Rights</i> <i>Agricultural Reserve Program</i>	Conservation Easement Local Corporations Local Land Trust Riparian Easement VaULT Statewide Conservation Plan
	Temporary Tools	Reforestation Tax Credit – Federal Water Bank Program	Virginia Century Farm Program	Agricultural and Forest District Centennial Farm Program Rural Preservation District Zoning  Rural Historic District Zoning Subdivision Ordinance	

*The committee reviewed a number of possible funding strategies. Figure 6 shows tools for conserving and protecting open space. The appropriate tool would be based on the stakeholders and activities involved. Some of these sources are already at work in Chesterfield County.*

The state revolving fund, primarily a lending program to communities to build wastewater treatment facilities, is used for virtually any type of water-quality project, e.g. non-point-source pollution, wetlands, estuary and other watershed projects. Virginia funds have been used for agricultural best-management practices, brownfields remediation, and land conservation to protect or improve water quality and prevent pollution of state waters.

Chesterfield County residents support general-obligation bonds as a source of revenue for parks and recreation projects. Some localities have issued environmental mini-bonds, a special tax-exempt form of financing. Mini-bonds<sup>3</sup> can be issued in small amounts and in a short period of time because they are purchased directly by participating institutions. Proceeds are used for specific environmental programs or activities, such as stream or forest buffer restoration or land acquisition.

Special assessment districts are used to finance a variety of projects in other localities. For example, Lenexa County, Kan., established a storm-water management utility as a special assessment district. The annual utility charge per household helped pay for the new storm-water management program,<sup>4</sup> which was more attractive but less expensive than the old system, required less maintenance and was more beneficial to the environment.

Virginia offers one of the nation's best tax credit programs<sup>5</sup> to property owners of land in conservation easements. Conservation and open-space easements involve the transfer of development rights from a property owner to a third party and prevent environmentally, historically or culturally valued lands from

### **STRATEGY 7.3**

**Protect donations of valued properties within a green-infrastructure plan by placing them in conservation easements.**

being developed in perpetuity. Incentives for property owners to transfer these rights include federal and state income-tax relief, property-tax relief and estate-tax relief. Chesterfield County, through the Parks and Recreation Department, accepted donation of land that in turn was placed with a third party in a conservation easement. The county holds 635 acres<sup>6</sup> in open-space easements. An additional 902 acres<sup>7</sup> of county property carry easement and open-space covenants on the land.

One of the lands the county received is a 283-acre tract of woodland along the James River. Two non-profit organizations, Virginia Outdoors Foundation (VOF) and Friends of Chesterfield's Riverfront, hold the easement on this tract, known as the Brown and Williamson Conservation Area. Chesterfield County is the first local government in Virginia to protect public property by conservation easement with VOF, which also holds four other privately-owned properties in the county for a total of almost 500 acres.

### **STRATEGY 7.4**

**Consider a Purchase of Development Rights program to assist in the protection of valued properties within a green-infrastructure plan.**

In addition to donations, many counties create a Purchase of Development Rights (PDR) program to obtain development rights from willing sellers, primarily to sustain land for agriculture or forestation. Property owners are compensated for the lost development opportunity. PDR funds are secured from private and public sources. The Kent County, Mich., PDR program, known as Purchase of Agricultural Conservation Easement, meets qualifications for state matching funds to preserve local farmland.<sup>8</sup>

Virginia Code provides even broader possibilities for purchasing development rights.<sup>9</sup> Part of the Virginia Land Conservation Fund's purpose is to acquire property for the protection or preservation of ecological, historical or cultural resources. The criteria include provision for grants to localities for PDR programs. To date, five localities have programs – the city of Virginia Beach and Albemarle, Clarke, Fauquier and James City counties.

### **STRATEGY 7.5**

**Explore a county tax revenue stream to fund some of the green-infrastructure initiatives.**

Although Virginia is not one of the 23 states that earmark a portion of state taxes to the environment, local tax revenue options include dedicated tax levies, e.g., sales taxes and



property tax. The key is to provide a specified dollar amount or percentage of the tax for the intended use. For example, Olathe, Kan., voters approved a 1/8-cent sales-tax increase in November 1999, knowing that a portion of that increase would be used to fund trails and greenways.<sup>10</sup> In 1996, the James City County, Va., Board of Supervisors approved a real-estate-tax hike of 1 cent for open-space land acquisitions.<sup>11</sup> Over \$5 million was allocated in the first five years.

**STRATEGY 7.6**

**Consider a fee system to meet the costs of maintaining some portions of a green-infrastructure plan.**

User or activity fees establish an even more direct link between the demand and the cost of public use areas within a green-infrastructure plan. A well-structured fee system can be an equitable means of matching program costs to program beneficiaries. Providing a modest revenue yield, these funds usually cover only government operating expenses. For example, the Raleigh, N.C., Park Plan calls for facilities fees to provide 13 percent of the total annual funding revenues.<sup>12</sup> Funds could be collected through single-use fees or seasonal and annual passport sales.

**STRATEGY 7.7**

**Consider conservation and mitigation banks to manage large, especially regional, tracts in a green-infrastructure plan.**

A conservation bank is a large tract of geographically identified natural resources protected like a bank protects depositors' money. When someone plans a project that will impact natural resources outside the bank's geographically identified holding, they can buy "credits" in the conservation bank's identified land tract. The bank owner, the county for example, then uses the money from the "credit" purchase to protect the land tract in the bank. This free-market enterprise benefits landowners, developers and especially communities wishing to protect large

tracts of an ecological system. Multiple banks can be established for multiple tracts of land. Banks may offer landowners economic incentives to protect natural resources. They save developers time and money by providing pre-approved protected lands (known as compensation lands). They also provide long-term management and protection of natural habitats.

## People

Funding is not always the needed solution. While government should take the lead in the management of natural resources, many private businesses and industries in Chesterfield County spearhead efforts to preserve and protect natural, historical and cultural resources. Knowledge of the principles of the county's green-infrastructure plan is as important to private business and its workers as it is to county employees. In anticipation of probable green-infrastructure plan outcomes, this means a commitment to provide and train the work force. The committee recommends that partnerships between educational institutions (including county schools, colleges and universities) and businesses be encouraged to train the work force needed to put the strategies of a green-infrastructure plan into action.

**RECOMMENDATION 8**

**Train the work force needed to implement a green-infrastructure plan through partnerships between businesses and educational institutions.**



**STRATEGY 8.1**

**Develop natural-resource-management skills for the work force by working with educational institutions.**

Part of this training – natural-resource management – should involve those in emerging growth areas. Training should also focus on techniques for managing areas that are already developed and those needing revitalization. To accomplish this, local and state schools should be made aware of a green-infrastructure plan goals and objectives in order to develop natural-resource-management training programs.

**STRATEGY 8.2**

**Expand hotel, hospitality and tourism course offerings.**

A well-managed green-infrastructure plan provides added opportunities for recreation and tourism. Additional visitors to the county increase demand for skilled employees in the hotel and hospitality industry. Course offerings should be expanded to reflect anticipated demand for workers in this sector of the labor force.

**STRATEGY 8.3**

**Encourage courses and training to provide preservation, restoration and management of historic resources.**

Restoration, maintenance and preservation of historic sites within the boundaries of a green-infrastructure network will require significant manpower depending upon the current state of the sites. Volunteer hours will not suffice to meet the demands of a growing tourism industry. The committee encourages training opportunities in these areas to meet future needs.

In some instances, the work of concerned individuals and private, non-governmental organizations will be the only resources utilized for projects. A green-infrastructure plan could be used to coordinate the various efforts of these people and organizations. The committee recommends the county harness the expertise, time, resources and commitment of these non-government organizations and citizens, and coordinate their efforts to fully implement a green-infrastructure plan.

**RECOMMENDATION 9**

**Coordinate the activities, resources and commitment of non-governmental organizations and individuals toward realization of a green-infrastructure plan.**

**STRATEGY 9.1**

**Empower non-governmental organizations and people to accept responsibility for portions of a green-infrastructure plan's implementation.**

As suggested earlier, many of these organizations will be invited to be part of the advisory commission. As they help develop the plan, they can also be encouraged to adopt a portion to implement within the context of their respective organizations. In this way, the county will have some of a plan's implementation in the hands of capable, dedicated citizens who are working on multiple facets of a plan in a coordinated way.

**STRATEGY 9.2**

**Create a program to recognize private landowners for their commitment to the goals of a green-infrastructure plan.**

Owners made aware of important resources on their properties are often willing to commit to protecting them on their own. It is the private landowners of Chesterfield County who have shaped its undeveloped landscapes for almost 400 years. It is private landowners who will ultimately determine if the county loses its open spaces. A recognition program acknowledges the commitment of private landowners and recognizes that a property, or portion of a property, is significant and is receiving good stewardship by its owner. A green-infrastructure plan could provide guidelines for this purpose. The

committee suggests the creation of a program to recognize private landowners for their commitment to the goals of a green-infrastructure plan.

**STRATEGY 9.3**

**Seek new ways to protect open space by working with developers.**

Developers and environmentalists are working together to construct developments sensitive to the environment. One strategy is a designated set aside of land in the development. In other words, a specified percentage (example 1/3) of the property would be left for open space land. For example, in Chester County, Pa., developers are encouraged to protect 60 percent of the property for open space and develop the rest on

1/3-acre lots.<sup>13</sup> This may not be appropriate for all landscapes but could be considered. If a project cannot or does not meet a specified percentage, it can participate in the conservation banking initiative mentioned earlier. The committee suggests that developers and county officials seek new strategies in the commitment to protecting open space.

## Changes of Behavior

Change is inevitable. Open spaces, natural resources and heritage sites are changing daily in this county and will continue to change. What those changes will be is dependent upon the choices made by government and residents alike. How those changes affect future generations is dependent upon the behaviors of today.

The committee recognizes the recommendations made in this report will not happen unless changes of behavior occur. In other words, all stakeholders must adopt a green-infrastructure plan as a guiding principle. This would give all stakeholders the shared purpose to understand, leverage and value natural systems. This would strengthen the county's goal of responsible protection of the environment. To achieve a consensus on a strategic approach to planning and managing the green infrastructure of Chesterfield County, those responsible for individual initiatives must view their green projects in light of all other initiatives. Consensus would require compromise. Changes of behavior brought about by compromise and a green-infrastructure plan would lead to efficient and sustainable land use and protection of the environment.

The Committee on the Future understands that change takes time. Though many concerns are immediate, the vision of a green infrastructure plan would take many years to develop. This fact alone should be the motivation to begin the changes now. Without a beginning, it can never happen.

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<sup>1</sup> Clean Water State Revolving Fund. U.S. Environmental Protection Agency. May 2005.

<http://www.epa.gov/owmitnet/cwfinance/cwsrf/>

<sup>2</sup> For smaller projects there are tax-exempt "mini bond" programs, which offer significantly reduced processing fees and lower interest rates, with typically savings of 1.5 to 2 percent over traditional loans. Tax-exempt mini bonds offer financing from \$500,000 to \$2 million.

<sup>3</sup>

<sup>4</sup> Rain to Recreation: Lenexa's Current Approach to Storm Water Management. Kan: Lenexa.

<http://www.ci.lenexa.ks.us/stormwater/index.html> 2000.

<sup>5</sup> Catherine Scott, Director of Land Conservation, Piedmont Environmental Council and Leslie Trew, Conservation Easement Specialist, Virginia Outdoors Foundation.

<sup>6</sup> Chesterfield County Right-of-Way office. August 30, 2005.

<sup>7</sup> Ibid.

<sup>8</sup> Kent County Farmland Preservation Program. Grand Valley Metropolitan Council.

[http://www.gvmc.org/landuse/pdr\\_ranking.shtml](http://www.gvmc.org/landuse/pdr_ranking.shtml) Sept 2002

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<sup>9</sup> §10.1-1020 Virginia Land Conservation Fund. Purposes of Foundation. Code of Virginia. Title 10.1 CONSERVATION. Chapter 10.2 Virginia Land Conservation Foundation. §10.1-1020 Virginia Land Conservation Fund. Purposes of Foundation.

<sup>10</sup> Financing MetroGreen. Mid America Regional Council. Kansas City, Mo. p.6-3.

<http://www.marc.org/mgfinancing.htm>

<sup>11</sup> Greenway Master Plan. James City County, Va. June 25, 2002 Section 11.2 p. 96 <http://www.james-city.va.us/pdf/greenway/section11.pdf>

<sup>12</sup> Raleigh Parks Plan: Parks, Recreation and Greenways Element of the Comprehensive Plan. Raleigh, N.C.: Smith Group JJR. May 2004. p.145. [http://www.raleigh-nc.org/portal/server.pt/gateway/PTARGS\\_0\\_2\\_14052\\_0\\_0\\_18/Appendix\\_A-G-Final-Print.pdf](http://www.raleigh-nc.org/portal/server.pt/gateway/PTARGS_0_2_14052_0_0_18/Appendix_A-G-Final-Print.pdf)

<sup>13</sup> Linking Landscapes: A Plan for the Protected Open Space Network in Chester County, Pa. September 2002. p.13. <http://dsf.chesco.org/planning/lib/planning/pdf/summbroc.pdf>

# CONCLUSION

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What the Committee on the Future is recommending is not an easy task nor will it be short term. Based on the findings of this report a green-infrastructure plan needs to be developed without delay. Other localities have accepted the challenges, overcome the obstacles and enjoyed the benefits. Using the vision of a green-infrastructure plan, Chesterfield County has the opportunity to ensure social, economic and environmental benefits for present and future generations.

A foundation is already in place with many initiatives and considerable interest in a green-infrastructure plan. Education and awareness would strengthen this base and broaden involvement. Leaders will take these well-informed communities of interest forward to develop and implement a green-infrastructure plan.

Good communication and strong leadership generate the commitment needed to continue the vision of a FIRST CHOICE community supporting Captain John Smith's belief that, "Heaven and Earth never agreed better to form a place for man's habitation."

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## **APPENDICES**

## APPENDIX A - Recommendations and Strategies

### **RECOMMENDATION 1    Raise the awareness of green infrastructure through public media and forums.**

- STRATEGY 1.1    Develop educational materials on green infrastructure and offer workshops to the public.
- STRATEGY 1.2    Assign the county administrator the leadership role of development, oversight, implementation and accountability of outcomes for a green-infrastructure plan.

### **RECOMMENDATION 2    Develop a green-infrastructure plan.**

- STRATEGY 2.1    Form an advisory commission and appoint an executive committee.
- STRATEGY 2.2    Train county leadership and the executive committee on green-infrastructure strategic planning.
- STRATEGY 2.3    Perform a gap analysis.
- STRATEGY 2.4    Consider design parameters that follow the Plan for Chesterfield’s guiding elements.
- STRATEGY 2.5    Support the goals of the 2002 Parks and Recreation Master Plan that pertain to green infrastructure.
- STRATEGY 2.6    Support the goals of the proposed Greenways and Trails Strategic Plan.
- STRATEGY 2.7    Support the goals, policies and implementation strategies of the Water Quality Protection Plan.
- STRATEGY 2.8    Consider utilizing the strategic concepts of the Riverfront Plan.
- STRATEGY 2.9    Complete the inventory of structures built in Chesterfield County.
- STRATEGY 2.10    Coordinate and partner with adjacent jurisdictions and regional planning agencies.
- STRATEGY 2.11    Connect green-infrastructure plan components with those of adjacent jurisdictions.
- STRATEGY 2.12    Incorporate state and federal sites in a green-infrastructure network.
- STRATEGY 2.13    Utilize relevant data, programs and services pertaining to green infrastructure from state and federal agencies.

### **RECOMMENDATION 3    Commit to a green-infrastructure plan and provide resources.**

- STRATEGY 3.1    Commit resources to manage and implement a green-infrastructure plan.
- STRATEGY 3.2    Provide an annual assessment of a green-infrastructure plan.

### **RECOMMENDATION 4    Engage public interest and involvement.**

- STRATEGY 4.1    Continue providing educational materials and workshops on green infrastructure to the public and to county employees.
- STRATEGY 4.2    Report regularly on the progress of a green-infrastructure plan to those living and working in the county.
- STRATEGY 4.3    Develop a community, state and national advertising campaign to promote Chesterfield County ecology, history and culture.
- STRATEGY 4.4    Disseminate information through the Internet, local broadcast media, the print media and community meetings.



**RECOMMENDATION 5 Promote educational programs that heighten the awareness and appreciation of the county’s ecological, historical and cultural resources.**

- STRATEGY 5.1 Expand Chesterfield County public school coursework and fieldtrips related to county history.
- STRATEGY 5.2 Encourage the expansion of Chesterfield County history programs and fieldtrips for adults and families.
- STRATEGY 5.3 Increase natural resource awareness through partnerships between school classes, organizations and environmental groups.
- STRATEGY 5.4 Encourage citizens and visitors to explore the outdoors.
- STRATEGY 5.5 Develop self-guided walking, bicycling and driving tours of the county.

**RECOMMENDATION 6 Offer green-infrastructure courses in Chesterfield University curricula.**

- STRATEGY 6.1 Offer a short course on green infrastructure.
- STRATEGY 6.2 Develop and offer courses on Chesterfield County history and culture.
- STRATEGY 6.3 Offer courses on ecological systems and their value in everyday quality of life.

**RECOMMENDATION 7 Finance the various activities of a green-infrastructure plan using a combination of techniques.**

- STRATEGY 7.1 Identify a comprehensive list of external funding sources and implement a plan that attracts a significant share of this funding.
- STRATEGY 7.2 Consider non-tax-based financing strategies to meet some goals of a green-infrastructure plan.
- STRATEGY 7.3 Protect donations of valued properties within a green-infrastructure plan by placing them in conservation easements.
- STRATEGY 7.4 Consider a Purchase of Development Rights program to assist in the protection of valued properties within a green-infrastructure plan.
- STRATEGY 7.5 Explore a county tax revenue stream to fund some of the green-infrastructure initiatives.
- STRATEGY 7.6 Consider a fee system to meet the costs of maintaining some portions of a green-infrastructure plan.
- STRATEGY 7.7 Consider conservation and mitigation banks to manage large, especially regional, tracts in a green-infrastructure plan.

**RECOMMENDATION 8 Train the work force needed to implement a green-infrastructure plan through partnerships between businesses and educational institutions.**

- STRATEGY 8.1 Develop natural-resource management skills for the work force by working with educational institutions.
- STRATEGY 8.2 Expand hotel, hospitality and tourism course offerings.
- STRATEGY 8.3 Encourage courses and training to provide preservation, restoration and management of historic resources.

**RECOMMENDATION 9**    **Coordinate the activities and resources of non-governmental organizations and individuals toward realization of a green-infrastructure plan.**

- STRATEGY 9.1    Empower non-governmental organizations and people to accept responsibility for portions of a green-infrastructure plan's implementation.
- STRATEGY 9.2    Create a program to recognize private landowners for their commitment to the goals of a green-infrastructure plan.
- STRATEGY 9.3    Seek new ways to protect open space by working with developers.

## APPENDIX B – Green Infrastructure Study Process

### ORGANIZATION OF REPORT

March and April 2003

*Select report topic and develop work plan*

The committee viewed panel presentations on the following topics:

- County Overview Bill Handley, Planning
- Open Space, Planning & Design, Pedestrian Walkways Tom Jacobson, Planning  
Mike Golden, Parks and Recreation  
Dr. Margot Garcia, VCU Urban Studies and Planning
- Workforce Development Karen Aylward, Economic Development  
Anne Dale, Greater Richmond Chamber of Commerce and Workforce One  
Dr. Blue Wooldridge, VCU Political Science and Public Administration
- Ethnic Composition Sarah Snead, Social Services  
Ann Vargo and Monica Murelle, LESP Coalition  
Dr. Dirk Philipsen, VSU History and Institute for the Study of Race Relations
- Incarceration Levels Glen Peterson, Community Corrections  
Clay Bowles, Sheriff's Office  
Maj. Thierry Dupuis, Police department  
Dr. Jill Gordon, VCU Criminal Justice

### ENVIRONMENTAL SCAN

May through September 2003

*Complete preliminary topic research and determine scope of the report*

The following documents were read and discussed:

- “Greenways for America” by Charles E. Little
- “Growing Greener: Putting Conservation into Local Plans and Ordinances” by Randall Arendt
- “Design with Nature” by Ian L. McHarg
- “Community Culture and Environment” compiled by the U.S. Environmental Protection Agency
- Green-infrastructure, greenways, and comprehensive plans from other jurisdictions

The committee viewed panel presentations on the following key issues:

- County Greenways Plan Stuart Connock and Jennifer Wampler, Parks and Recreation
- Parks and Recreation Master Plan Mike Golden, Jennifer Wampler, Mark Askins,  
Parks and Recreation
- Forested Lands and Urban Forestry Rich Reuse, Virginia Forestry Department
- Conservation Easements Leslie Trew, Virginia Outdoors Foundation  
Janit Potter, Friends of Chesterfield's Riverfront
- Conservation Design, Matoaca Village Plan Jim Bowling, Planning

The committee spent two days on guided tours of the county:

- County Tour I – southern and eastern areas
- County Tour II – northern and western areas

### KEY STRATEGIC ISSUES

October 2003 through February 2004

*Collect and analyze research and develop preliminary strategies*

Staff attended a short course and workshops, briefed the committee and provided exercises on:

- Green Infrastructure: A Strategic Approach to Natural Resource Planning and Conservation  
The Conservation Fund, The U.S. Fish and Wildlife Service
- Green Infrastructure Workshop on Virginia Natural Heritage Program
- Green Infrastructure Workshop on Winchester, Va., Green Circle concept

## **KEY STRATEGIC ISSUES (continued)**

**October 2003 through February 2004**

*Collect and analyze research and develop preliminary strategies*

The committee viewed panel presentations on:

- Societal Aspects of Green Infrastructure  
Stuart Connock and Jennifer Wampler, Parks and Recreation  
John Cogbill, Mary Moody Northern Foundation  
Dr. Rick Hermann, Chesterfield County Health Department  
Bill Hastings, Chesterfield County Public Schools  
Dennis Farmer, Chesterfield Historical Society
- Economic Aspects of Green Infrastructure  
Jim Dunn, Economic Development  
Bob Dunn, I.E. Dupont Inc.  
Dick Collier, R.E. Collier Inc.  
Avrah Shriar, VCU School of Government and Public Affairs
- Environmental Aspects of Green Infrastructure  
Joan Salvati and Scott Flanigan, Water Quality Office  
Steve Carter-Lovejoy, Virginia Department of Conservation and Recreation Natural Heritage Program  
Cathy Taylor, Dominion Generation  
Alisa Bailey, Virginia Tourism Corp.

## **INTERNAL/EXTERNAL ANALYSES**

**March through August 2004**

*Coordinate and conduct public input meetings*

The committee conducted 16 meetings to explain the topic and gather input:

- County Employees Focus Group
- Clover Hill District community meeting
- Human Services Division staff meeting
- Bermuda District community meeting
- Leadership Group
- Dale District community meeting
- Community Development Division staff meeting
- Boards, councils, committees, commissions, societies
- Business, industry, real-estate agents, government agencies, environmental groups, civic associations, and history and tourism groups (2 meetings)
- Midlothian District community meeting
- Builders and developers quarterly meeting
- Matoaca District (north) community meeting
- Management Services Division staff meeting
- Matoaca District (south) community meeting
- Friends of Chesterfield's Riverfront board meeting

## **STRATEGIES AND ACTION PLANS**

**September 2004 through June 2005**

*Draft recommendations and strategies with supporting documentation*

## **PRESENTATIONS**

**July through November 2005**

*Present final document to Board of Supervisors and distribute copies*

## **MONITOR RECOMMENDATIONS**

**annually**

*Review the implementation status of recommendations and strategies*

## APPENDIX C – Green-Infrastructure Survey

**1. How valuable do you feel our natural resources are (e.g., clean air and water, open land, animal habitat, etc.) in Chesterfield County?**

*(Choose one)*

- ☐ *Very valuable*
- ☐ *Valuable*
- ☐ *Not valuable*

**2. How concerned are you about the loss of natural resources (e.g., clean air and water, open land, animal habitat, etc.) in Chesterfield County?**

*(Choose one)*

- ☐ *Very concerned*
- ☐ *Concerned*
- ☐ *Not concerned*

**3. How committed should Chesterfield County be to developing and implementing a green infrastructure?**

*(Choose one)*

- ☐ *Very committed*
- ☐ *Committed*
- ☐ *Not committed*

**4. Where would Chesterfield County receive the most benefits from green infrastructure?**

*(Choose one)*

- ☐ *Environment*
- ☐ *Economy*
- ☐ *Society*
- ☐ *Health*

**5. Should green infrastructure be the underlying element in the county planning process?**

*(Choose one)*

- ☐ *Definitely should*
- ☐ *Probably should*
- ☐ *Probably should not*
- ☐ *Definitely should not*

**6. To what extent are you willing to commit resources (e.g., money, people, etc.) to preserve and restore natural resources?**

*(Choose one)*

- ☐ *Very willing*
- ☐ *Willing*
- ☐ *Not willing*

**7. To what extent do you believe neighbors and other county residents are willing to commit resources to the protection of our county's natural resources?**

*(Choose one)*

- ☐ *Very willing*
- ☐ *Willing*
- ☐ *Not willing*

**8. To what extent should citizens be involved in the design and implementation of green infrastructure?**

*(Choose one)*

- ☐ *In all respects*
- ☐ *In most respects*
- ☐ *In few respects*
- ☐ *Not at all*

**9. How satisfied are you that county government is currently managing properly our county's natural and historical resources?**

*(Choose one)*

- ☐ *Very satisfied*
- ☐ *Satisfied*
- ☐ *Dissatisfied*
- ☐ *Very dissatisfied*

**10. How satisfied are you that county government is planning the preservation of natural and historical resources for future generations?**

*(Choose one)*

- ☐ *Very satisfied*
- ☐ *Satisfied*
- ☐ *Dissatisfied*
- ☐ *Very dissatisfied*

**11. What components of a green infrastructure do you feel are most important?**

*(Please select three)*

- ☐ 1. *Air quality*
- ☐ 2. *Water resources*
- ☐ 3. *Animal and marine habitat*
- ☐ 4. *Historical resources*
- ☐ 5. *Forested areas*
- ☐ 6. *Recreational areas*
- ☐ 7. *Agricultural areas*
- ☐ 8. *Viewsheds*

**12. We would like to have your comments or concerns. Please share additional information.**



## APPENDIX D – BENEFITS OF A GREEN INFRASTRUCTURE

A green-infrastructure plan would provide associated benefits to the community. The same network that conserves natural ecosystems can also support economic development and increase quality of life. The synergy between economic development and green infrastructure is a powerful asset to a locality.

### Economic Development

In many cases taxes generated by increased growth do not cover the resultant increased costs of public services. For example, in Chesterfield County the average annual cost of services for each residence exceeds its average annual tax contribution. Several studies<sup>1</sup> have examined the relationship between land conservation and property taxes. They have shown that although every community is different communities that protect land also enjoy **an improved tax base**, in general. This is partly due to the reduced need for public facilities and services. Farms, forests and open space lands generate far more in property taxes than they demand in services. A study done in York County, Pennsylvania on cost of community services showed for every dollar of revenue generated by farms, forests and open space lands there was a cost of only 17 cents for public services while the residential cost was \$1.22 for every revenue dollar generated.<sup>2</sup>

A planned green infrastructure can **reduce the long-term costs for existing and future services** by utilizing natural environmental patterns when designing man-made systems. Chesterfield County's storm-water management undertakes the maintenance of water retention areas (wet ponds or small lakes for long-term holding) and water detention areas (dry ponds or usually dry areas used for temporary storm water holding). Rather than localized drainage facilities, the government of Johnson County, Ks., a suburb of the greater Kansas City metro area, uses a systems approach, called Rain to Recreation.<sup>3</sup> Officials estimate this approach will reduce costs of storm-water management by 25 percent, be more effective at reducing flooding and provide recreational assets. In the 1990s, New York City avoided the need to spend \$6–\$8 billion on new water filtration and treatment plants by purchasing and protecting watershed land in the Catskill Mountains for about \$1.5 billion. Likewise, Arnold, Mo., has dramatically reduced the cost to taxpayers of disaster relief and flood-damage repair by purchasing threatened properties and creating a greenway in the flood plain.

A more apparent benefit of green infrastructure is **access to active and passive recreation**. Chesterfield County enjoys one of the best county park systems in the region, one that could be readily incorporated into a green-infrastructure plan. ReserveAmerica.com lists Pocahontas State Park in the top 100 family campgrounds in America. Citysearch named it one of the top 10 in the United States in 2005. Spending by local residents and visitors at recreation-oriented local businesses is a benefit to the economy. Recent studies<sup>4</sup> conducted for the Virginia Department of Conservation and Recreation discuss the economic impacts and net economic benefits of non-local-user recreational spending at three Virginia recreation sites. Figure 5 illustrates the economic impact of visitor spending in the regional economy. These effects are quantified in dollars of output and number of jobs. Net economic benefit, or consumer surplus, is “a measure of the total dollar amount users are willing to pay above and beyond what they must pay.”<sup>5</sup> For example, users of the waterway at New River State Park pay no fee to access the facility, however, non-local users spent an average of \$30.46 per person per visit within a 15-mile radius of the trail and \$76.10

per person for total trip expenditures. These costs include lodging, food, fuel and vehicle expenses, canoe rentals and souvenirs.

**FIGURE D-1.** Economic Impacts and Net Economic Benefits of Three Virginia Sites. (2003 dollars)

	<b>Length, Trail and Virginia Localities</b>		
	<b>39 MILES</b>	<b>45 MILES</b>	<b>34 MILES</b>
	<b>Waterway at New River State Park</b>	<b>Washington &amp; Old Dominion Transportation &amp; Recreation Trail</b>	<b>Virginia Creeper Rail-Trail</b>
	Carroll, Grayson, Pulaski and Wythe counties	Arlington, Fairfax and Loudoun counties	Washington and Grayson counties
<b>SPENDING DIRECTLY RELATED TO USE OF THE TRAIL</b>			
Estimate of local users' spending	\$265,000	\$5,300,000	\$160,000
Estimate of nonlocal users' spending	\$2,000,000	\$1,400,000	\$2,200,000
% of Users - Nonlocal	43%	5%	53%
<b>ENTIRE TRIP SPENDING BY NONLOCAL USERS</b>			
	\$5,000,000	\$6,600,000	\$3,900,000
<b>IMPACT TO THE REGIONAL ECONOMY OF RECREATIONAL SPENDING BY NONLOCAL USERS</b>			
Estimate of Economic Output Supported	\$2,272,000	\$1,800,000	\$1,587,627
Job Equivalent Supported	50	34	27.4
Personal Income Generated	\$752,000	\$642,000	
Labor Income			\$610,372
Other Property Type Income			\$126,098
Indirect Business Taxes			\$104,153
<b>NET ECONOMIC BENEFIT</b>			
(total dollar amount users are willing to pay above and beyond what they must pay)			
Value of the Resource	\$1,203,000	\$1,005,000	\$921,362

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Activities such as biking, kayaking, walking or bird-watching **attract small businesses** that offer and repair equipment, educate and train enthusiasts, and provide food and lodging. For example, a study<sup>6</sup> of the 27-mile Little Miami Scenic Trail in Ohio, estimates 150,000—175,000 visits annually by joggers, bicyclists and skaters. These visits generate \$3.1—\$3.7 million dollars in trip-related expenditures and trail-related durable goods. A 1999 survey of 480 users of the Heritage Rail Trail in York County, Pa., showed 65 percent had made a trail-related purchase within the previous year, with the average purchase totaling \$337.<sup>7</sup> This boost to the local economy benefits the entire community.

Many localities strive to **attract tourists** by protecting scenic views and by preserving trees and historic buildings. Tourism was a \$15.2 billion dollar industry<sup>8</sup> in Virginia in 2003. It accounted for \$2 billion<sup>9</sup> that year in state and local revenues. A 2003 Virginia Tourism Corp. survey<sup>10</sup> lists metro Richmond the number one visitor destination city in the state. Tourism is changing rapidly as nature, heritage and recreational destinations become more important. Ecotourism is considered the fastest-growing market in the tourism industry. This is reflected in a U.S. Fish and Wildlife Service survey showing 51.3 million

Americans who say they watch birds. This makes birding the fastest growing outdoor activity in the country.<sup>11</sup>

Complementing the ecology, the rich heritage of Chesterfield County provides a variety of opportunities for visitors to explore American Indian history, colonial history, Civil War sites, and early agriculture and industrial practices. Living history centers, like the Citie of Henricus, bring the past to life. This heritage could be a tourism boost to the economy similar to visits to the River Heritage Museum in Paducah, Ky., which the Kentucky Cabinet of Economic Development estimated would bring \$20.1 million to the community over five years.<sup>12</sup> Often heritage corridors become links to connect parts of a green-infrastructure plan. Partnerships with the Virginia Tourism Corp., the Chamber of Commerce and the business councils would advertise and promote eco-tourism and Chesterfield County history to residents and visitors.

**Corporate relocations** that bring jobs to a community and support local businesses are often the result of a successful green-infrastructure plan. For example, quality of life for employees is the third most important factor in locating a large business, behind access to domestic markets and availability of skilled labor.<sup>13</sup> Owners of small companies rank recreation/parks/open space as the highest priority in choosing a new location.<sup>14</sup> Many businesses and their employees, no longer tied to industrial centers, are free to shop for an appealing location with a high quality of life. This feature is defined as low crime with safe streets and access to greenery and open space.<sup>15</sup>

A green-infrastructure plan would not attract only corporate relocations; it would also promote **corporate retention**. As it grows, Chesterfield County could rely on the open areas within office, industrial and business parks to offer respite from an increasing urban environment. These natural areas provide opportunities for social interaction and exercise.

A green-infrastructure plan can help the county in **revitalization efforts**. Some communities have been successful in reclaiming abandoned or run-down properties for inclusion in the network of green areas. For example, Chattanooga, Tennessee has received national recognition for its riverfront redevelopment, including an extensive greenway system that meanders through historic areas and several parks.<sup>16</sup> Abandoned railroad rights of way have become greenways and trail systems similar to the county's Chester Linear Park.

Redevelopment of brownfields<sup>17</sup> is another opportunity to integrate the landscape into a green-infrastructure plan. Many properties have low levels of contamination and can be mitigated, such as a former industrial site in Fond du Lac, Wis., that is being turned into a small park with a trail along the Fond du Lac River.<sup>18</sup> Mount Trashmore in Virginia Beach is another excellent example. Vacant, abandoned and neglected lots can be woven into a green-infrastructure plan as pocket or neighborhood parks, and community gardens. Revitalization of the Parramore neighborhood in Orlando, Fla., blended the creation of park amenities with stimulation of private development.

Real estate agents have long known the value of nearby parks, trails and open spaces in relation to residential and commercial properties. A green-infrastructure plan would **shape growth and development while protecting natural resources and improving the quality of life**. For example, in Seattle's University District, residents may take a short walk into Ravenna Park, a green oasis, to escape the noise and activity of urban life.<sup>19</sup> A study<sup>20</sup> undertaken by the Montgomery County, Pa., Planning Commission to determine the effect of current zoning on future growth and development found existing laws set up primarily to segregate land uses. In 1993, Pittsford, N.Y., commissioned a fiscal analysis associated with existing and potential land use. It showed "that it would be less expensive to implement a new land use plan rather than continue the current zoning policy."<sup>21</sup>

Many communities are saving money and land by encouraging the clustered-housing concept with large community open spaces in new-growth areas. Developments using this concept could only be created with suitable zoning designators and land-use policies. Using the rate of real-estate appreciation as a measure of consumer demand, research shows the average clustered home appreciates more rapidly than comparable homes on conventional lots.<sup>22</sup> A primary reason for this is access to permanently protected land used for parks, greenways and trails.

## Environmental Benefits through Natural Resource Management

For many years, open-space land left after development was considered sufficient to sustain the natural environment. As larger areas of a locality become developed, the health of the ecosystems becomes dependent upon the quality, not just the quantity, of open-space land. A green-infrastructure plan would create a way to sustain natural resources through proper management, providing benefits for the environment and future generations.

Chesterfield County's vegetation acts as a "green filter" to protect public drinking-water supplies, diminish the impacts of storm-water runoff, and reduce the degradation of streams and the James and Appomattox rivers. A green network throughout the region provides vital habitat for a variety of mammals, birds and fish species. Adequate riparian buffers provide cleaner, more temperate waters for fish.

**Maintaining the quality of water resources** becomes more difficult with increased development. In the 1940s and 1950s, before development, Montgomery County, Md., had the foresight to begin buying riparian lands.<sup>23</sup> Today all its major stream corridors are protected by an extensive park system. With or without a riparian buffer, any stream must be assessed for the presence of pollutants. For many years, Chesterfield County streams were sampled after storm events to develop a program to reduce pollutants. Although much was learned, it became evident that more useful data could be gathered by analyzing the health of streams rather than from storm-water sampling. The Chesterfield County Office of Water Quality initiated the Watershed Assessment and Stream Protection (WASP) program focusing on stream bioassessments. The objectives of this program are to identify and prioritize the watersheds, streams and other water resources that will benefit from management, preservation, protection and restoration opportunities.<sup>24</sup> This proactive approach supports the principle that a green-infrastructure plan should be grounded in scientific knowledge.

Chesterfield is blessed with abundant forest resources. The **preservation of large forested tracts**, such as the 7,000-acre Pocahontas State Park, provides the habitat requirements for much native wildlife. So do the commercial timberlands in the southwest sections of the county. But tracts of land without linking corridors for natural movement of plant and animal species are not sufficient for the balance of nature. Although forests of some type blanket most of the Mid-Atlantic states, these lands are fragmented. Tracts broken into small pieces make it difficult for owners to manage timber wisely and effectively. Large, unfragmented tracts provide a bigger central core buffered from disturbances on the edges and are able to maintain natural ecological functions. Forestry partnerships within a green-infrastructure plan could preserve large intact forests providing multiple uses of conservation, recreation and commerce. A managed network could create corridors that link together the larger areas most efficiently for the needs of man and nature.

Proper landscaping in residential and commercial areas can reduce air-conditioning needs up to 30 percent<sup>25</sup> by **reducing the "heat-island" effect** caused by concrete, asphalt and steel. This will become increasingly important as the county continues to develop. Trees provide a buffer for wind and noise. Tree canopies help to settle out, trap and hold pollutant particles while replenishing oxygen in the air. In fact,

one acre of trees produces enough oxygen in one day for 18 people.<sup>26</sup> This same acre in one year absorbs carbon dioxide equal to the amount produced by an automobile traveling 26,000 miles.<sup>27</sup> Elements of urban forestry are part of a green-infrastructure plan.

Use of vegetation and natural features to control storm-water runoff reduces costs and increases storage to more effectively **reduce flood damage** – and it can serve several purposes within a green-infrastructure plan. For example, two city agencies in Bellevue, Wash.,<sup>28</sup> – the Storm and Surface Water Utility and the Parks and Recreation Department – use the same land to accomplish multiple objectives. The parks department manages much of the utility’s land as parks, ball fields, playgrounds, interpretive areas and trails, while the utility is responsible for water resources and land acquisition. The slower rate of runoff also increases groundwater recharge. This becomes especially important during the sporadic rains that fall during a multi-year drought. Surveys<sup>29</sup> show Chesterfield County residents want more diverse recreational opportunities closer to home. The Chesterfield County Parks and Recreation Master Plan says “among expressed priorities [of residents] were trails for hiking, biking and jogging; preservation of historic sites; riverfront access; open space and wildlife areas; and nature centers and programs.”

<sup>1</sup> Deb Brighton, “Community Choices: Thinking Through Land Conservation, Development, and Property Taxes in Massachusetts” (Boston, MA: Trust for Public Land, 1998). <http://www.tpl.org/tech>

<sup>2</sup> The South Central Assembly for Effective Governance. “Cost of Community Services” June 2002 [http://www.shrewsburytownship.org/pdfs/Shrewsbury\\_COCS\\_Report.pdf](http://www.shrewsburytownship.org/pdfs/Shrewsbury_COCS_Report.pdf)

<sup>3</sup> City of Lenexa Public Works Department, “Rain to Recreation”. (Johnson County, Kansas) <http://www.raintorecreation.org>

<sup>4</sup> Bowker, J.M., Bergstrom, John, Gill, Joshua, Lemanski, Ursula. The Washington and Old Dominion Trail: An Assessment of User Demographics, Preferences and Economics. The Waterway at New River State Park: An Assessment of User Demographics, Preferences and Economics. The Virginia Creeper Trail: An Assessment of User Demographics, Preferences and Economics. Athens, GA: U.S. Forest Service Science Research Station, University of Georgia Department of Agricultural and Applied Economics, National Park Service. Prepared for the Virginia Department of Conservation and Recreation. December 9, 2004.

<sup>5</sup> Ibid.

<sup>6</sup> Don Burrell and John Heilman, “Little Miami Scenic Trail Users Study” (Cincinnati, OH: Ohio, Kentucky, Indiana Regional Council of Governments)

<sup>7</sup> Communities Benefit! The Social and Economic Benefits of Transportation Enhancements. Washington DC: National Transportation Enhancements Clearinghouse. p.10-11 [www.enhancements.org/misc/benefits.pdf](http://www.enhancements.org/misc/benefits.pdf)

<sup>8</sup> “A Comprehensive Understanding of the Economic Contribution of Travel and Tourism in the State of Virginia” (Eddy, PA: Global Insight, Summer 2004) <http://www.vatc.org/research/VATSA2003-ExecutiveSummary.pdf>

<sup>9</sup> Ibid.

<sup>10</sup> Virginia Visitor Study Profiles “What is Virginia’s Number One Attraction 2003?” Virginia Tourism Corporation. September 2004 <http://www.vatc.org/research/WhatstheNo1attraction2003.pdf>

<sup>11</sup> Birdwatching Dot Com “Frequently Asked Questions” <http://www.birdwatching.com/birdingfaq.html>

<sup>12</sup> Communities Benefit! The Social and Economic Benefits of Transportation Enhancements. Washington DC: National Transportation Enhancements Clearinghouse. p. 14-15 [www.enhancements.org/misc/benefits.pdf](http://www.enhancements.org/misc/benefits.pdf)

<sup>13</sup> National Park Service, 1995 1-8; taken from “The Economic Benefits of Parks and Open Space” (Boston, MA: Trust for Public Land) [http://www.tpl.org/tier3\\_cdl.cfm?content\\_item\\_id=1145&folder\\_id=727](http://www.tpl.org/tier3_cdl.cfm?content_item_id=1145&folder_id=727)

<sup>14</sup> The President’s Commission on Americans Outdoors, *Americans Outdoors: The Legacy, The Challenge, The Report of the President’s Commission* (Washington, DC: Island Press, 1987), 24.

<sup>15</sup> Garvin and Berens, Urban Parks and Open Space. 27.

<sup>16</sup> The 21<sup>st</sup> Century Waterfront Project. Chattanooga, TN.

<http://www.chattanoogaofun.com/general/waterfront/default.htm>

<sup>17</sup> Brownfield site means real property, the expansion, redevelopment or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Public Law 107-118 (H.R. 2869) “Small Business Liability Relief and Brownfields Revitalization Act” signed into law January 11, 2002. [www.epa.gov/brownfields](http://www.epa.gov/brownfields)

<sup>18</sup> Greenspace and Public Facilities Grant Program. Wisconsin: Department of Natural Resources. Press release February 10, 2004. [http://www.wisgov.state.wi.us/journal\\_media\\_detail.asp?prid=397](http://www.wisgov.state.wi.us/journal_media_detail.asp?prid=397)

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<sup>19</sup> <http://www.ci.seattle.wa.us/parks/parkspaces/ravenna.htm>

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<sup>21</sup> A Green Print that Makes Fiscal Sense. Pittsford, NY.

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<sup>22</sup> Jeff Lacy and Randall Arendt, “An Examination of Market Appreciation for Clustered Housing with Permanently Protected Open Space,” Center for Rural Massachusetts Monograph Series (Amherst, MA: August 1990).

<sup>23</sup> Montgomery County, Maryland Legacy Open Space Program.

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<sup>24</sup> PowerPoint presentation by Joan Salvati and Scott Flanigan, Chesterfield County Water Quality Office. March 2004.

<sup>25</sup> *ibid.*

<sup>26</sup> “Urban and Community Forestry: Improving Our Quality of Life” U.S. Department of Forestry.

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<sup>27</sup> *ibid.*

<sup>28</sup> How Cities Use Parks for Green Infrastructure. The American Planning Association: 05 City Forum Briefing Papers. 2003 <http://www.planning.org/cpf/pdf/greeninfrastructure.pdf>

<sup>29</sup> A countywide survey conducted during the Chesterfield County Parks and Recreation Master Plan amendment process. 2002.



## APPENDIX E

### Some Potential Sources For External Funding

Date Notified	Name	Expected Number of Awards	Estimated Total Funding	Award Ceiling	Purpose
10/8/04	North American Wetlands Conservation Act Small Grants	40	\$2,000,000	\$50,000	to promote long-term wetlands conservation
10/13/04	American Rivers-National Oceanic and Atmospheric Administration Community-Based Restoration Program		\$330,000	\$5,000-\$25,000	to restore and protect the ecological integrity of rivers and improve freshwater habitat
10/19/04	Fund for Wildlife				for broad areas to save native species and wild ecosystems
10/25/04	Environmental Law Institute National Wetlands Award	6-8			to recognizes individuals who have shown extraordinary effort, innovation and excellence to protect wetlands, educate their communities and foster cooperation
11/17/04	National Fish and Wildlife Matching Grants			\$10,000 - \$150,000	for projects that host migratory wildlife and other U.S. trust resources
11/17/04	Chesapeake Bay Small Watershed Grants				for watershed stewardship activities
1/3/05	Boat U.S. Foundation Clean Water Grant Program			\$4,000	to educate boaters about good environmental habits
2/15/05	Private Stewardship Program				for conservation efforts to benefit controlled or endangered species
2/17/05	Landowner Incentive Program grants	45	\$20 million	\$1 million	to protect or restore habitats of federally-listed species or species determined to be at-risk.
2/28/05	Dominion Educational Partnership Grants		\$200,000	\$5,000	to strengthen math and science in environmental education
3/8/05	Partnership to Promote Innovation in Environmental Practice		\$300,000		to promote innovations that can improve environmental results from state and federal programs
3/10/05	Chesapeake Bay Watershed-Conservation Innovation Grants	15	\$5,000,000	\$1,000,000	to stimulate the development and adoption of innovative conservation approaches and technologies
3/21/05	Communities, Outreach and Education	2	\$700,000	\$100,000	to protect and restore the Chesapeake Bay ecosystem
4/11/05	National Fish and Wildlife Matching Grants			\$10,000 - \$150,000	for projects that host migratory wildlife and other U.S. trust resources
4/12/05	US Fish and Wildlife Services Fish Passage	30	\$3.96 million	\$3,960,000	to reconnect fish species to historic habitats
4/18/05	Wal-Mart and U.S. Fish and Wildlife Foundation Acres for America Matching Grants Program		\$3 million		to conserve important habitat through requisition of real property
4/22/05	Charles A. and Anne Morrow Lindbergh Foundation			\$10,580	for work in seven areas including natural resource conservation, and waste minimization and management
4/22/05	Laura Jane Musser Fund			\$35,000	to support environmental programs in rural areas
4/22/05	Earth Island Institute Brower Youth Awards Program	6		\$3,000	to recognize the efforts of young environmental and social-justice leaders
4/25/05	Virginia Environmental Endowment Mini-Grant Program			\$5,000	to strengthen environmental education and stewardship of Virginia's waterways
4/25/05	Fund for Wild Nature			\$3,000	to save and restore native species and wild ecosystems
4/26/05	National Fish and Wildlife Nature of Learning Grants			\$5,000	to support environmental education
4/28/05	The Conservation Fund Conservationist Award			\$50,000	for outstanding leadership and service to preserving and protecting the nation's natural and historic resources for the benefit of their communities and future generations

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