

# **Environmental and Green Infrastructure**

## **General**

Green infrastructure is an interconnected network of landscapes and natural resources that contributes to environmental health as well as the health and quality of life for the citizens of Lexington-Fayette County. Previous Comprehensive Plans have recognized that the interrelationship of the natural environment to land use planning is a critical component to the long-range growth management and development of our community. Green infrastructure planning broadens previous conservation planning concepts by recognizing it as the fundamental framework for meeting current and future ecological, economic and social needs. As our population and energy consumption continue to increase, there is an escalating demand on our natural environment and greenspace. With depleting natural resources and impeded natural processes comes an inevitable decline in the productivity of the environment to support living organisms or human activity, i.e. “sustainability.” Green infrastructure planning recognizes that a healthy ecosystem is the foundation for our community’s prosperity and very existence.

Green infrastructure necessitates a comprehensive, holistic approach to natural resource and greenspace planning and management, resulting in a balance between ecologic and human needs. Infrastructure is defined as the substructure or underlying foundation, especially the basic installations and facilities on which the continuance and growth of a community or state depends. Communities routinely provide “gray infrastructure” such as roads, utilities and public buildings. Like gray infrastructure, designating natural resources and landscapes as “infrastructure” elevates them equally as essential and necessary to the functioning of the community.

Natural resources are composed of biotic (flora and fauna) and physical (land and water) systems. Landscapes in Fayette County range from natural to farmland, suburban to urban, and with varying amounts of greenspace and forest scattered throughout. Human systems and activities include health, economy,

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demographic culture, history, land use, and the built environment. Green infrastructure planning and management look at the processes and functionality of natural systems and landscapes, and how they intertwine with human systems. The built environment impacts natural resources, landscapes, and ecological processes due to deforestation, impervious surfaces, soil erosion, waste disposal, water pollution, air pollution, habitat fragmentation/destruction, land consumption, shifting floodplains, invasive species, and resource depletion. Decisions for the use and management of natural resources and landscapes have socioeconomic consequences as well, including impacts on public health, resource allocation, social equity, economic vitality and quality of life.

By recognizing the reciprocal interaction among biotic, physical, and human systems by planning and managing our actions with consideration for these complex interrelationships and by adequately supporting and funding green infrastructure programs and projects, the environment can be protected, human needs can be met, and quality of life can be improved.

Our decisions determine how and where landscapes, natural resources, and natural processes will be preserved, conserved, restored, or destroyed. Resource conservation, species protection, land management, and pollution control are regulated to various degrees under existing laws and regulations already. However, the integrated and proactive approach inherent with green infrastructure planning and management will promote better compliance with environmental laws and regulations and result in a more efficient use of funding and attainment of goals. Successful implementation of green infrastructure planning requires that it is considered and incorporated into new plans and policies for land use, transportation, stormwater, solid waste, health, and economic development. Green infrastructure, as a planning concept in land use decisions, will fulfill the Comprehensive Plan's Mission Statement, Vision, and Goals and Objectives (see Appendix A).

## *Value of Green Infrastructure*

Quality of life factors, such as safety, heritage, greenspace, alternative modes of transportation and a clean environment, create a livable community that can attract new residents and retain existing ones in today's mobile society. The very features that bring people to a community can be degraded or destroyed to the extent that quality of life is diminished for all who live there.

Quality of life is enhanced by improving ecological viability and linking environmental planning and management to public health, economic revitalization, and community development. According to a report from the Lincoln Institute of Land Policy, quality of life is the third most important factor in determining where a business will relocate. Economically vital regions such as the Research Triangle (North Carolina), Minneapolis-St. Paul and Boston have discovered that in order to provide for and to retain businesses and residents, a region must possess clean and abundant water resources, affordable energy, available construction materials, unique cultural resources and substantial natural areas. These assets ultimately create a competitive edge by elevating a region's quality of life and its economic vitality. Other studies have shown that if natural resources are considered and used effectively, there is a net gain in a cost-benefit analysis.

Santa Fe, Austin, and New York State have created incentives for businesses and consumers to adopt clean energy practices. Other incentives attract clean energy companies or promote local products. For a listing of green infrastructure-related initiatives throughout the nation, see Appendix B.

The Kentucky League of Cities established the NewCities Institute to engage "civic capacity" by looking at how the city of tomorrow's society, economy, and environment should respond to inevitable change. Many of the questions asked in its self-assessment relate to greenspace, community uniqueness, energy use, natural resource protection, health, walkable neighborhoods, viewsheds, recycling, redevelopment, and mass transit.

Just as the road and utility networks that comprise gray infrastructure provide necessary services to the community, natural resources and landscapes that comprise green infrastructure must be actively supported and funded for the wide range of essential ecological and socioeconomic values they provide.

Green infrastructure planning anticipates and meets current and future needs of citizens without increasing the use of natural resources beyond the environment's capacity to supply them indefinitely. Green infrastructure planning strives to balance, improve and enhance biotic, physical, and human systems in an equitable manner. It recognizes that local actions have regional and global ramifications. How we choose to protect and use natural resources, provide equitable access to resources, locate people on the land, and consume energy will determine how sustainable the community will be for future generations.

Our physical well-being and the livability of our community depend upon a healthy environment and vice versa, since survival depends on the interweaving of all living organisms. An ecosystem's ability to resist and respond to change (natural or manmade), may be lessened as biodiversity and abundance declines. Human modifications on plant and animal communities alter ecological functions and thus the benefits vital to humans as well. Processes at the ecosystem level influence plant productivity, soil fertility, water quality, atmospheric chemistry, etc. that ultimately affect human welfare.

Green infrastructure provides a network of landscapes and natural resources whose functional integrity provides the following benefits:

Ecological processes:

- filter and cool water;
- clean the air;
- supply water through the water cycle;
- store and recycle nutrients;
- conserve and develop soils;
- regulate local climate, evapotranspiration;

- reduce impacts from flooding;
- reduce soil erosion;
- provide energy exchange, food and fuel;
- provide pollinators and photosynthesizers
- sequester carbon;
- decompose waste;
- maintain streams, wetlands and aquifers;
- provide important plant-animal interactions;
- conserve native biota;
- maintain and enrich habitat and biodiversity;

Community services:

- improve quality of life;
- provide recreational and leisure opportunities;
- provide scenery and beauty;
- provide buffering, visual screening and glare reduction;
- maintain and improves health and wellbeing;
- create stable neighborhoods with a strong sense of community
- provide alternative transportation opportunities;;
- provide social gathering areas;
- shape our natural and cultural heritage;
- enhance community, character and sense of place;
- define urban form;
- provide opportunity for recognizing, promoting, learning and adopting conservation values, ecological resource stewardship;
- connect people to nature and greenspace;
- provide visual relief and stress reduction;

Economic services:

- attract tourists (especially heritage tourism);
- provide for a diversity of agricultural enterprises and commodities;

- provide the drinking water supply;
- provide products and employment (minerals, timber, fish, hydroelectric power, fuel, fibers, food, building materials, medicines);
- lower public costs for gray infrastructure (storm water management, wastewater capacity, water treatment, solid waste disposal, energy costs, pollution abatement);
- lower risks and cuts costs from hazards and disasters (floods, fires, landslides, sinkholes, subsidence, erosion, air pollution, hazardous wastes)
- lower public and private costs for health care (asthma, obesity, diabetes and heart disease);
- attract/retain business through improved livability, quality of life and natural resource efficiency;
- appreciate value over time (gray infrastructure depreciates over time)
- increase property value;
- provide and lower costs for pest control.

A core value in Lexington that makes it unique and successful is its rural greenspace. To ensure that greenspace is protected, it must be analyzed in context of numerous interests. Green infrastructure planning identifies and factors in the hidden costs of development that degrades our landscapes and natural environment, including pollution of water and air, loss of tree canopy and loss of prime soils.

Sustainable development helps to balance the increase in population in proportion to the increase in land and other resources consumed. A sustainable community is one where sound economic and social practices protect its environmental resources, which in turn, will lead to an increase in economic activity and quality of life. Green infrastructure planning and management is proactive in its protection, conservation and restoration of greenspace and natural environment, while optimizing the use of natural resources by current and future residents.

## **Principles**

Principles for green infrastructure planning and management include:

1. **Benefit to both nature and people.** Human and ecological needs are addressed equally, which in turn, benefit both. Green infrastructure planning promotes ecological health, livable built environments, equitable distribution of resources and the local economy.
2. **Meets current ecological, economic, and social needs without compromising the ability of future generations to meet their own needs.** Green infrastructure planning embraces environmental design to prevent harmful impacts and directs positive interventions that result in a healthier, more sustainable community.
3. **Identifies and protects natural resources and landscapes before development occurs.** The high cost of restoring land and the difficulty in creating human-made systems (that function as well as natural systems) necessitates early identification and protection.
4. **Creates a network.** The network of hubs and corridors protects and links natural areas together, preserves intact landscapes, maintains vital ecological processes, conserves natural resources, and connects people to nature.
5. **Functions at different scales, across borders, and through diverse landscapes.** As with transportation, utility and communication networks, the green infrastructure network functions at site, community, and regional levels and across political boundaries.
6. **Uses scientific and land use planning theories and practices.** Sustainability is the framework for green infrastructure planning and management, taking a holistic approach that incorporates diverse professional disciplines, including conservation biology, landscape ecology, urban and regional planning, soil science, environmental engineering, landscape architecture, and geography.

7. **Includes community-wide engagement.** Successful implementation of green infrastructure planning depends upon the support of elected officials, the public, civic organizations, and landowners.
8. **Is funded as a primary public investment.** As with essential community systems supported by gray infrastructure, green infrastructure initiatives should be financed as a primary budgetary line item. Green infrastructure planning and management is multi-divisional, and links interrelated programs and activities that protect and restore natural resources and landscapes.

### ***Green Initiatives Timeline***

Early pioneers settled Lexington because of the abundant water supply, fertile soils and gentle topography. Over the years, the beautiful landscape and natural resources have continued to attract people to the area. Over the past 200 years, intensive land management has altered the landscape, with very little native habitat remaining. Natural resource and greenspace protection have been goals and objectives for Lexington-Fayette County since the first Comprehensive Plan. Plans, ordinances, or regulations listed below are incorporated by reference into this Chapter.

- 1900 Olmsted firm recommendation for parks
- 1920s Ashland Park neighborhood developed with intricate street pattern, landscaped open spaces, and woodland characteristics
- 1931 First Comprehensive Plan
- 1953 Sanitary Sewer Plan for urban growth
- 1958 Urban Service Area Boundary created
- 1963 Comprehensive Transportation Plan
- 1967 Major contraction of Urban Service Area Boundary
- 1971 Environmental Commission formed
- 1972 Landscape and Buffer Ordinance
- 1973 Floodplain Conservation and Protection Ordinance

- 1974 Environmental Planner position created
- 1974 Soil Erosion Control ordinance
- 1975 Raven Run Nature Sanctuary dedicated
- 1978 Kentucky Horse Park opened
- 1979 Tree Board formed
- 1982 Sinkhole Regulations
- 1984 First greenway along West Hickman Creek
- 1984 McConnell Springs Park public/private partnership and restoration
- 1986 Greenway Park
- 1987 Tree City USA (awarded each subsequent year)
- 1987 Corridors Committee formed
- 1988 Comprehensive Plan park recommendations
- 1989 Recycling initiated
- 1990 Greenspace Commission formed
- 1991 The Arboretum created as joint effort between UK and LFUCG
- 1993 Lexington Area Metropolitan Planning Organization formed
- 1994 *Greenspace Plan* adopted
- 1994 Stone fence removal ordinance
- 1996 *Expansion Area Master Plan* directs development to designated planning areas, which included density, town center oriented shopping areas, public facilities, infrastructure, boulevards, greenways and open space
- 1996 Floracliff Nature Sanctuary dedicated
- 1997 Urban Forester position created
- 1998 *Comprehensive Parks and Recreation Master Plan* adopted
- 1998 Parks Advisory Board formed
- 1998 Greenspace Planner position created
- 1999 Adoption of the *Rural Service Area Land Management Plan*
- 1999 Paris Pike Overlay adopted (joint committee with Bourbon County)
- 1999 First Reforest the Bluegrass project

- 1999 Weed Ordinance revised to allow native plants next to streams, swales, and karst areas to grow and remain unmowed
- 1999 Forty-acre minimum lot size adopted (from 10 acre minimum)
- 2000 Air Quality Planner position created
- 2000 *Purchase of Development Rights Ordinance* adopted with a goal of preserving 50,000 acres of farmland in the Rural Service Area
- 2000 *Drinking Water Supply Protection Plan* adopted
- 2000 *Tree Protection Ordinance* adopted
- 2001 *Stormwater Manual* adopted
- 2001 *Floodplain Management Plan*
- 2001 *Royal Spring Wellhead Protection Plan* adopted by LFUCG, Scott County and city of Georgetown
- 2002 “Infill and Redevelopment” Ordinances adopted
- 2002 Bicycle/Pedestrian Coordinator position created
- 2002 *Greenway Master Plan* adopted
- 2003 Energy Management Team formed and Energy Management Plan created
- 2003 LFUCG joined the EPA’s Energy Star Partnership, the Department of Energy’s Rebuild America Partnership, and the EPA’s Million Monitor Drive
- 2004 Bluegrass Partnership for a Green Community Joint Proclamation
- 2005 *Clean Air Ordinance*
- 2005 Air Quality attainment
- 2005 Signing of the U.S. Mayors’ Climate Protection Agreement.
- 2006 Addition of 264 acres to Raven Run Nature Sanctuary

### **Inventory and Analysis**

An inventory of green infrastructure includes locational and statistical data for natural resources, landscapes, networks and socioeconomic factors. The inventory should also include a list of LFUCG Divisions, Commissions, Boards, Committees and community stakeholders involved in the planning and

management of green infrastructure, along with relevant programs, policies, regulations (see Appendix C).

An analysis should be performed to identify the hubs and corridors that will create a green infrastructure physical network. Hubs are areas that provide sufficient space for flora and fauna to flourish and preserve important landscapes. They include sites such as natural areas, working farms, parks and urban greenspace. Corridors serve as biological or migratory channels that connect hubs, and include greenways, transportation, and utility corridors.

Examination of scientific data, carrying capacities, opportunities and constraints and economic cost/benefits will reveal the relationships between the biotic, physical, and human systems that are the true nature of a sustainable community as an inter-related process. Benchmarks and indicators should be developed to evaluate efforts, however, it is important to not see a benchmark as a goal in itself and lose sight of the bigger picture. See Appendix D for examples of potential indicators.

Computer models can quantify environmental and socioeconomic data, then calculate the impacts of decisions on environmental systems, economic costs, and changes to landscapes. The models can create scenarios for potential resource management, built environments, and capital improvement projects. The computer-generated graphics can be used to show citizens possible outcomes and engage them in decision making. Green infrastructure is multifaceted, so a coordinated and holistic strategy using a variety of assessment tools will be necessary to achieve sustainability.

For example, one method to improve air quality is to increase the use of alternative transportation to reduce vehicular miles traveled (VMT). A target might be set to reduce VMT by 20 percent. Direct and indirect impacts may include:

Biotic:

- cleaner air because of less vehicles on the road and emissions reduced;

- cleaner water and improved aquatic habitat because of changes in development/transportation design for pedestrian/bicycle friendly streets (less pavement/runoff, which results in less sediment and contaminants entering streams);

Physical:

- pedestrian friendly neighborhoods are designed at a human scale and include trails and greenspace;
- streets are reclaimed and designed for all users, not just vehicles;

Human:

- commute to work patterns are altered, which impacts transportation planning and where people live in relation to their workplaces;
- less congestion results in an increase in personal time;
- improvements to public health resulting from improved air quality ground and surface water quality;
- transportation, community design, and open space planning impacts on fitness and well-being;
- economic savings from improved energy efficiency (less road maintenance and road construction, vehicular costs);
- economic savings from improvements to loss productivity due to long commutes;
- economic savings from health costs (asthma and obesity related illnesses);
- economic savings from costs associated with cleaning air and water.

Modeling could demonstrate the above impacts, and then adjustments made where needed. Two scenarios could be built to show the different outcomes if the target is set at 10 percent versus 20 percent.

Unfortunately, the gap between the planning and funding of environmental programs and projects is widening. Recognizing these programs and projects as infrastructure is the first step in lessening the gap. The planning and management

of natural resources and landscapes involve numerous LFUCG divisions, commissions and boards. An integrated approach to planning and management should foster support of green programs and projects through an increase in awareness, better coordination of efforts, reduction in adverse impacts on the environment, improvement to quality of life and tax dollars saved.

### **Green Infrastructure Components**

Categorizing green infrastructure components runs a risk of losing sight of the inter-relatedness of the many elements that make up a network. Components may be grouped by division/program, by biotic, physical or social classification, or by landscape type. For instance, categorizing urban forestry is difficult because of the vast number of benefits to air quality, water quality, stormwater management, habitat, ecological processes, property values, aesthetic preferences, visual screening, recreation, economic savings, health, and social setting preferences. For the purposes of description, categorizing components is not critical. However, it may become more important when future ranking and weighting criteria are established for computer modeling.

### **Natural Resources**

#### **Air quality**

In 1990, Fayette and Scott Counties were designated by the EPA as a non-attainment air quality district for the pollutant ozone. In 1995, the area was re-designated to attainment, but required to show conformity to certain standards. In 2004, Fayette and Scott County were in attainment for the eight-hour air quality standard and in 2005, attainment was reached for particulate matter. Many efforts since 1990 were made to reach attainment, including congestion mitigation projects such as reversible lane controls and bike lanes. In accordance with the 1990 Clean Air Act Amendments, transportation projects, programs and plans cannot contribute to violations of air quality standards. Air quality monitors for 2002 – 2004 were very close to non-attainment for particulate matter. Therefore, air pollution reduction activities and projects are still underway to maintain

attainment status. A comprehensive air quality conformity determination analysis is conducted before Updates to the Transportation Plan.

In 2005, Mayor Teresa Isaac signed the U.S. Mayor's Climate Protection Agreement on behalf of the LFUCG, joining other mayors across the nation in a commitment to reduce greenhouse emissions by using the targets outlined in the Kyoto Protocol. Under this agreement, participating communities voluntarily agree to reduce greenhouse gas emissions to 7% less than their 1990 levels by 2012. This is accomplished by taking steps to reduce the use of fossil fuels (petroleum and coal) such as improving energy efficiency, promoting alternative transportation, adopting land use policies that reduce urban sprawl, improving the fuel efficiency of municipal vehicle fleets or increasing recycling rates. By signing, LFUCG committed to conducting an inventory of local greenhouse gas emissions. A local "grass roots" Climate Change Team has been formed to help address this issue (with LFUCG participation), and the LFUCG has taken steps which support this agreement (such as using hybrid vehicles, installing energy efficient LED traffic signal modules, etc). However, an inventory of greenhouse gas emissions has not been conducted nor 1990 emission levels calculated.

### **Water Quality**

The underlying rock of Fayette County is a soluble limestone, which is marked by sinkholes, underground streams, and caverns. Lexington sits on a plateau and the small creeks flow away from the city center into adjoining counties. The Kentucky River creates the southeast county border.

Water quality monitoring locations are selected based on historic or anticipated problem areas. As a result, 100 miles are monitored for impaired use. Streams in all nine major watersheds are impacted, with 51 miles not supporting, and 20 miles partially not supporting Clean Water Act standards for at least one use (see Appendix E). In December 2006, the Environmental Protection Agency and Commonwealth of Kentucky filed a civil action against LFUCG regarding violations of the Clean Water Act. Negotiations are ongoing.

Efforts to improve water quality have the added benefits of establishing terrestrial and aquatic habitat and improving stormwater issues. A restoration project near Fort Sumter Drive restored 1200 feet of a channelized stream back to its natural shape. In April 2005, Boy Scouts helped plant 3000 native wildflowers along the stream. In the same watershed along Eastland and Roland Drives, 200 feet of eroding stream banks were cut back to a more natural angle and covered with permanent turf-reinforcement mat and native grasses and wildflowers. The streambed was stabilized with a series of step-pools to provide habitat and greater oxygenation of the water.

In 2005 and 2006, three restoration projects in LFUCG-owned greenways located in the Masterson Station, Gleneagles and Bluegrass Wilkes subdivisions remediated drainage channels, removed construction debris and planted riparian zones in native grasses and trees. In the Gleneagles greenway, neighbors volunteered their time to plant 700 trees and shrubs.

In 2001, the Kentucky Division of Water began requiring an Agriculture Water Quality Plan to protect streams on all farms with 10 acres or more. It uses National Resource Conservation Service standards for nutrient loads and recommended best management practices.

Other measures to protect water quality include sanitary sewer projects, street sweeping, reduction of salt use, a no-mow policy along stream banks, litter control, and public education. The Division of Environmental and Emergency Management (DEEM) investigates spills, hazardous material incidents, underground storage tanks, and accidents to ensure proper cleanup. DEEM and the Division of Engineering promote water quality awareness through programs such as Katy Catfish, Kentucky River Watershed Watch, and Town Branch Creek Watershed Awareness.

### **Floodplains**

There are approximately 11,200 acres of floodplain designated on the revised 2006 FEMA maps, of which 6,230 acres are within the Urban Service Area. FEMA

maps do not show floodplains on smaller tributaries or drainageways. Under the National Flood Insurance Program's Community Rating System Program, communities exhibiting good prevention and mitigation activities are rewarded with lower insurance premiums. Plans, ordinances, and projects have been undertaken to eliminate or reduce flooding hazards. Before the Floodplain Conservation and Protection Ordinance was adopted in 2001, structures were allowed to be built in floodplains. Starting in 1991, LFUCG began acquiring properties that had repeatedly flooded and removed the buildings. To date, there have been 84 parcels purchased for a total of 29 acres of reclaimed floodplain. Streams and floodplains are designated as conservation areas under the 1996 Expansion Area Master Plan, and in 2001, both the Floodplain Management Plan and Stormwater Manual were adopted. Since 2000, approximately 170 acres of floodplain have been dedicated to LFUCG as greenway (see Greenway section in this text for additional information).

Numerous floodplain studies have been conducted and data are collected in six of the nine watersheds. However, no comprehensive watershed plans have been prepared. Revised FEMA maps for the County are anticipated to be released in Spring 2008.

### **Drinking Water Supply**

Kentucky-American Water Company holds a water withdrawal permit that allows up to 70 million gallons of withdrawal per day (mgd) at the Pool No. 9 intake on the Kentucky River. Jacobson Reservoir is a second source for drinking water and also provides recreation.

LFUCG participates with the city of Georgetown and Scott County in the implementation of the Royal Spring Wellhead Protection Plan for the protection of Scott County's water supply. The Royal Spring Aquifer is a 25 square mile area of which 80 percent is located in Fayette County. It is highly susceptible to pollution due to sinkholes, underground streams and caverns characteristic of karst geology. The aquifer is located in the Cane Run Watershed, which was designated in 2006 by

the Kentucky Watershed Steering Committee as one of five top priority watersheds in the State.

The Kentucky River Authority has announced new plans to stabilize Dam No. 9 on the Kentucky River by creating a new dam behind the existing dam and leaving the old dam in place. With further hydrologic and environmental studies, it may be possible to later add crest gates to the proposed dam to provide more storage for water supply. The replacement of Dam No. 10 is also in the planning stages for repair. Dam No. 10 is critical for Lexington's water supply because it provides a reservoir impoundment upstream of Dam No. 9.

The 20 Year Comprehensive Water Supply Plan recommends that the Kentucky River and its tributaries should be protected from dumping, discharges, spills, and undesirable development for a minimum of one mile upstream of the intake.

### **Drought Water Supply**

Water supply planning is under-appreciated until a drought occurs and water use is curtailed by water restrictions. For the past 35 to 40 years, every study has indicated that given a severe drought, Lexington would have a drought demand water problem (even with conservation efforts). Today, with global warming changing weather patterns and the threat of drought increasing in many parts of the world, it is imperative that a solution be implemented that ensures an adequate water supply in the event of a drought occurring.

The 1930 drought was the worst measured drought and is the benchmark by which all other droughts in Lexington are measured. The drought lasted from July through December, although other records indicate that the effects really started in May and lasted until February 1931. While Lexington did not use the Kentucky River as its water supply in 1930, U.S. Corps of Engineer records indicate that water was not flowing over the top of Dam No. 9, but rather through cracks and holes in the dam at an estimated flow rate of approximately six million gallons a day (mgd). When a drought occurs and the river flow decreases to a certain point,

the water withdrawal permit restricts the amount of water that can be withdrawn for Lexington, in order to have sufficient flow downstream to other communities and to maintain aquatic habitat. In a mild drought, Lexington's water usage is up to 65 million gallons per day.

Since a drought in 1988, the Kentucky American Water Company has been investigating alternatives for Lexington's water supply. The 20-Year Comprehensive Water Supply Plan was adopted in 1999 and it recommended finding an additional supply of drinking water to cover periodic droughts. The Bluegrass Water Supply Commission (BWSC) has been investigating water needs for the Bluegrass region for about six years. Several options have been proposed and studied. On December 2006, the Kentucky-American Water Company announced plans for a second intake and treatment plant on the Kentucky River at Pool No. 3 in Owen County. The BWSC has proposed three possible pipeline routes from the new water plant on the Kentucky River. It is anticipated that the new facility will be completed by 2010 and add 20 mgd with a capacity for 30 mgd. Bluegrass Water Supply Commission is working with Kentucky American to become "owners" of the increased treatment capacity.

### **Flora, Fauna and Natural Habitats**

The County has historically been managed extensively as cropland, pastureland or urban development, so natural and native biodiversity have been severely reduced. Modifications to a landscape create disturbed and fragmented patches of small habitats, edge conditions and decreases in forest interiors. Changes to soils, drainage and vegetation disrupt the balance needed for a healthy ecosystem and allow invasive species to thrive.

Pockets of natural areas have very limited ecological value; migratory birds and many mammals need corridors to move between areas. While a small pocket may appear to be a hub, predators become a problem and most species won't be able to sustain themselves. The size and shape of hubs and corridors are also important to species biodiversity. Early successional species (such as chipmunks, deer,

coyotes, foxes, groundhogs, possums, snakes, and rodents) can adapt to man-made conditions. However, some urban wildlife species are considered a nuisance. The challenge to urban wildlife management is to decrease conflicts, increase biodiversity, enhance existing habitats, create new hubs, and connect them by corridors. Knowledge of species' preferences for diet, water source, nocturnal behavior, cover and spatial requirements help manage wildlife appropriately. Native vegetation, snags, natural wetlands, and buffer strips encourage wildlife. Habitat structure includes ground cover, understory, and canopy layers, and each layer attracts different species.

There are three federally designated endangered species in the County: the gray bat, the Indiana bat, and running buffalo clover. Short's bladderpod (a plant) is another species of management concern (rare plants are listed in Appendix E). There is not a complete inventory of habitat or species for the County. According to the Kentucky State Nature Preserves Commission, there are no known significant plant communities (i.e. large indigenous populations of native vegetation) remaining. Counts for deer and coyote have increased. Potential areas for wildlife habitat include natural springs and stream corridors, especially along the Kentucky River and small streams in the Rural Service Area. Waterfowl and ducks are plentiful on the reservoir during winter.

Within the Urban Service Area, stream banks are often mowed and the riparian area is not wide enough to provide good passage for wildlife. As defined in the Stormwater Manual, all streams in the County are considered greenways. As greenways are established and conservation practices are employed, some habitat will be re-established.

Two areas of particular significance are caves and the Kentucky River. Cave or cave channels are sensitive ecosystems and may be home to endangered species. The karst topography creates many sinkholes and caves, some of which are mapped. Most caves are small, due to the lithology, but may form larger caves when

combined with faults or jointing. These habitats are especially vulnerable to impacts from development and pollution (See Appendix F for a listing of caves).

The Kentucky River and adjacent forest is the largest expanse of natural landscape remaining in the County. This area is known for the Palisades, deep gorges, wet weather springs, caves, limestone outcrops, cliffs, and diverse plant life. The extensively wooded corridor along the River and its tributaries provides a major migration route for birds, a travel corridor for wildlife, and foraging areas for bats. Limestone cliffs and wooded uplands along the river harbor native vegetation including rare plant species. Two areas along the Fayette County side of the River are preserved (see Natural Areas below for descriptions).

Within the Urban Service Area potential hubs include the 100 acre Arboretum and the 170 acre Lexington Cemetery. Because of their acreages and mature trees, they provide natural habitat and attract bird populations.

Exotic pest species are a major problem throughout the County. Bush honeysuckle, Japanese honeysuckle and wintercreeper especially have invaded large portions of natural areas and remaining woodlands, compromising the benefits to wildlife and biodiversity.

For every dollar spent for wildlife conservation, wildlife-related business returns \$117 to the statewide economy. Based on permits issued for 2005/06, there are 6,500 hunters and 14,800 fishermen registered in Fayette County, with a total economic impact to the State of \$43,549,748. There are approximately 88,500 wildlife watchers, with an economic impact of \$55,588,260. In a statewide survey, 97 percent of wildlife watchers said that they enjoy seeing wildlife at their homes.

In 2006, there were 26,897 visitors at Raven Run enjoying the park and the programs offered there. This was an increase of 20 percent from 2005. At McConnell Springs, there were 15,859 visits to that public park. It is estimated that between 125,000 and 150,000 persons visit the Arboretum annually, including visitors from 41 states and 17 nations. Visitors include tourists, walkers, joggers,

students, retirees, and gardeners, along with attendees for Shakespeare in the Park performances and Arbor Day activities.

### **Soils**

Fayette County is known for its fertile soils. Prime soils account for 58 percent of the rural service area, and soils of statewide significance are 27 percent. The PDR ranking system gives the highest points to farms with these soils, thus ensuring that the preservation program recognizes the inherent value of such soils.

### **Landscapes**

“Bluegrass” brings to mind images of a beautiful countryside of farms, gently rolling hillsides, country lanes and wooden fences. Plans and regulations over the years have preserved scenic viewsheds, byways, the agricultural industry, nature preserves and stone fences. A hard edge separates urban from rural uses.

### **Topography**

Land with a slope over 15 percent is considered steep. Comprehensive data on the percent of steep slopes is unavailable. Subdivision Regulations require assessment of these areas for possible geotechnical modifications for development. However, the regulations may need review for increased protection of steep slopes and potential erosion sites, especially where small lots are proposed or they are adjacent to environmentally sensitive/geologic hazard areas.

The Subdivision Regulations state that developments should preserve landforms and follow contours. However, extensive cut and fill still occurs in most developments. One barrier to developments conforming more to the natural contours is because of specifications from the Roadway Manual that require a longitudinal slope on new streets to be less than eight percent.

### **Greenspace**

The Greenspace Plan describes greenspace as more than horse farms and parks; it also encompasses stone fences, natural areas, valuable resources (such as prime soils) and historic buildings. Greenspace refers to the essential characteristics that give the Bluegrass its special identity and quality of life. It can

be experienced while driving scenic roads or traveling by bicycle or on foot through a greenway system. Greenspace is found inside the city and throughout the countryside, and includes both natural and cultural landscapes. Greenspace provides an array of benefits including environmental protection, visual relief, recreational and commuting opportunities, aesthetic enhancement, economic value, commodities, employment, relief from stress, increased property values, improved health, community character, and sense of place.

When thought of as a network that enhances and defines our Bluegrass identity, greenspace should be interpreted broadly as the concept behind urban design that makes a more attractive and livable community for people to reside, work, shop and learn. The Greenspace Plan recommends a greenspace system that includes resources, sites and linkages for both urban and rural greenspace. The Plan recommends three levels of protection for greenspace to include: resource protection (with no public access); visual access and protection (e.g., along scenic roads); and areas open to public access. While there is significant protection of many resources and sites, linkages have been planned but not acquired. There is no regularized source of funding for greenspace acquisition.

### **Urban Greenspace**

Urban greenspace is predominantly within public parks. Other areas include the Arboretum, cemeteries, office parks (e.g. Ashland Oil), school grounds, floodplains and stormwater basins. Grass medians and street trees, such as along the Richmond Road corridor, provide visual relief. The Greenspace Plan recognized the Bluegrass image extends to the visual experience of traveling city streets; therefore it recommended studies and guidelines for streetscape design.

In the Expansion Area, Scenic Resource and Special Design Areas are intended to minimize the visual impact of a development on an adjoining rural road. In both Areas, clustered development and 200 foot setbacks from the rural road are required. The Scenic Resource Area requires 80 percent common open space and the Special Design Area requires 60 percent. Density lost in the Areas may be

transferred. While the boundaries for the Areas were determined for the Plan from ridgelines and hedgerows, field-proofing still needs to be conducted to set the final boundaries. There are no design guidelines in place for structures within these Areas. The Expansion Area Master Plan also reserved 100 foot setbacks from streams that are now considered greenways. In total, 26 percent of the Expansion Area acreage is planned for open space.

Newer subdivisions are setting aside areas for open space, which might double as stormwater detention, buffer, landscaping, environmentally sensitive area protection, or Scenic Resource or Special Design Areas. A parcel-based inventory shows 478 acres designated as open space. Parcels used for stormwater only is 205 acres. These figures do not include greenspace that is not parcel-based, such as large green areas on school property, other stormwater facilities, cemeteries, office parks, green medians, or along roadways.

### **Parks**

The Division of Parks and Recreation manages 102 park sites and over 4,400 acres of land that includes areas for active and passive recreation, golf courses, and natural areas. There is no data for acreages in passive versus active recreation. Private golf courses add an additional 615 acres. The 1998 Comprehensive Parks and Recreation Master Plan analyzed each existing park facility and made recommendations. Although total park acreage exceeded national standards, the Plan identified areas of the city not within a half mile distance to a neighborhood park. The Plan recommended the acquisition of park land in these areas. Many neighborhood parks are heavily used with athletic fields and programs. It was anticipated that as large athletic facilities at Briar Hill, Cardinal Run and Shillito are developed, neighborhood parks can be reclaimed for public open space. The Plan noted that greenway development lags far behind national recommendations of one mile per 5,000 residents. The Master Plan recommended that developers should be required to construct greenways, just as they are required to incorporate planned roads, water and other basic facilities.

Since 1996, the Expansion Area has seen over 3,500 new homes built on 1,100 acres (houses started as of December 2005). Deerhaven Park's 25 acres is the only park acquisition, and virtually all of the homes built to date are beyond the half mile national standard.

Besides natural areas at Raven Run and McConnell Springs Parks, 416 acres in parks are managed as greenway, including 220 acres at Coldstream Park. The Division of Parks recognizes that the Master Plan needs updating. A step towards the update is a community needs analysis, to be completed in 2007.

Besides local parks, the State operates the 1,200 acre Kentucky Horse Park and the 10 acre Waveland Museum.

### **Greenways**

Greenways are linear greenspaces that greatly enhance the quality of life for residents in addition to protecting natural resources and providing stormwater control. The Greenway Master Plan designated stream corridors as Conservation Greenways and identified stream, utility, and rail corridors that create a countywide trail system. Conservation greenways protect ecosystems, improve water quality, provide wildlife habitat and control flooding. There are 700 acres of greenways owned by LFUCG, with approximately 115 additional acres near ready for dedication. Homeowner associations own and manage another 120 acres.

A Greenway Manual has been prepared to be a technical document on the use, acquisition, development and management of greenways. Regardless of ownership, the Manual explains principles, sets standards and recommends guidelines for best management practices to improve water quality, provide wildlife habitat, restore streams and build trails. It is anticipated that the draft Manual will be adopted into the Engineering Manuals. In the meantime, a policy was initiated in 2006, and efforts are underway to educate homeowners on the value of no-mow zones and native vegetation along streams.

The Greenway Master Plan proposes a countywide system of primary, secondary and tertiary trails, which includes both on-road and off-road facilities. Currently,

there are 8.4 miles of existing trails and funding for an additional 10.5 miles. Shared use trails provide a means for alternative transportation and access to community destinations close to where residents live and work. Trails can become destinations themselves, providing open space for community events, social gatherings and opportunities for recreation and fitness.

In the Expansion Area, it is a requirement that greenway acreage is dedicated to LFUCG. However, trail construction is not included in exaction fees for basic infrastructure improvements. In other sections of the community, greenway property must be acquired through donation or purchase. Due to limited funding, little progress has been made in the acquisition, restoration, development, or maintenance of greenways since the adoption of the Greenway Master Plan in 2002.

### **Natural Areas**

Raven Run is a unique nature sanctuary dedicated to preserving the natural beauty of the Kentucky River Palisades and early Kentucky history. Owned by the LFUCG Division of Parks, the 734 acres includes 226 acres purchased in 2006. Over 10 miles of hiking trails provide access to streams, meadows and woodlands characteristic of the area. The public park is primarily first succession stands with some second and third successional growth. Over 600 species of plants and 200 species of birds at the park allow visitors to become acquainted with and appreciate the natural world.

The second natural area along the Kentucky River is Floracliff Nature Sanctuary. Dedicated in 1996, the Floracliff Board of Directors owns the preserve and jointly manages it with the Kentucky State Nature Preserves Commission. Floracliff has 287 acres of old field upland, second-growth forest, and a rich and diverse wildflower display. The rich flora, ravines, cliffs, and waterfalls of Floracliff make it one of the more scenic areas in central Kentucky. Floracliff also has a unique geological feature called a tufa formation, which resembles a frozen waterfall. It is considered one of the best examples in the eastern United States.

The mission of the sanctuary is to care for the sanctuary property, ensure its protection as a nature preserve, and promote public education of the natural history of the Inner Bluegrass region.

Another natural area is located on a historic site within an industrial area near Downtown. McConnell Springs is a 26 acre public park with 2 miles of trails running along the spring, stone fences, and vestiges of historical buildings. McConnell Springs boasts more than 130 species of plants and numerous species of urban wildlife. Its mission is to protect the unique geological, natural and historic features of McConnell Springs and to provide natural, cultural and historical education opportunities.

### **Rural Greenspace**

The Rural Service Area (RSA) is predominantly agricultural in use. Of the 200 square miles in the RSA, greenspace, natural areas and agriculture equal 95 percent of the total acreage. Nonagricultural uses include historic rural settlements, circulation, large residential lots, Rural Activity Centers and rural residential subdivisions. The Greenspace Plan identifies natural and cultural resources that are proposed for preservation, restoration and enhancement. Resource preservation is discussed further in the Rural Service Area Land Management Plan, the Greenway Master Plan and the Rural Settlement Study. Through the Purchase of Development Rights (PDR) program, growth management, zoning and overlays, many resources are under protection.

Rural resources recognized in the Greenspace Plan include farms, rural roads, stone fences, rural settlements and natural areas. The Plan identified Five Focus Areas that are considered to be exemplary examples of the Bluegrass landscape type. They are the North Elkhorn Creek, South Elkhorn Creek, Boone Creek, the Kentucky River and the Old Frankfort Pike corridors. The PDR Program awards points for farms located in a Focus Area. In addition, points are awarded for the protection and proper management of prime and statewide

significant soils, environmentally sensitive areas, greenways, rural roads, scenic viewsheds, historic areas and natural areas.

The goal of the PDR Program is to protect, at a minimum, 50,000 acres in conservation easements over the next 20 years. PDR now has over 17,000 acres in conservation easements. The protected farms include equine, general agriculture, and other farms (historic, sod, trees, etc.) The program has received \$24,384,454.00 in local, state and federal match grants for the purchase of conservation easements, and 13 of the protected farms were donated as conservation easements. Besides agriculture and the horse economies, the program conserves and protects natural, scenic and open space resources.

Urban development and the agricultural industry are incompatible land uses because of noise, odors, sprays, pollution, traffic, and security issues. The goal of the PDR program is to achieve a critical mass of farmland necessary to support the general agriculture, horse, and agri-tourism industries. Expansion into the Rural Service Area not only affects the farm to be developed, but affects the adjacent farm’s subsequent eligibility for the PDR program (unless the parcel is in a Focus Area/rural greenway or is a community icon).

Over the past four decades since the inception of the Urban Service Area, the consumption of land has increased at a faster rate than the increase in population. Differences in the population to land ratio may be attributed to factors such as smaller household size, aging population, increase in single family housing, increase in open space requirements, and wider streets. Besides the loss in agriculture, increases in land consumption means a loss of greenspace and cultural landscapes, displacement of flora and fauna, and a disruption of ecosystems.

<b>2005</b>	<b>USA</b>	<b>RSA</b>
Population(2000 Census estimate)	253,876	14,204
Total Square Miles	85.3	200.2
Vacant Land and Farms	14.0	

Developed Square Miles	71.3	
Population Density per sq mile	3560.7	70.9
<b>2000</b>		
Population(2000 Census)	246,853	13,659
Total Square Miles	85.3	200.2
Vacant Land and Farms	21.7	
Developed Sq Miles	63.6	
Population Density per sq mile	3,881.3	68.2
<b>1995</b>		
Population(1996 Comp Plan)	227,767	12,494
Total Square Miles	84.8	200.2
Vacant Land and Farms	26.6	
Developed Square Miles	58.2	
Population Density per sq mile	3,913.5	62.4
<b>1986</b>		
Population(estimate)	213,844	11,663
Total Square Miles	79.9	207.1
Vacant Land and Farms	26.9	
Developed Square Miles	49.0	
Population Density per sq mile	4,364.2	56.3

### **Working Lands**

Fayette County ranks second in the State in farm products, generating \$339,000,000 in cash farm receipts in 2004. According to the 2002 Census of Agriculture data, there were 738 farms in the County, down by 11 percent from 1997. Farm acreage was 119,098 (down 14 percent) and the average farm size was

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161 acres, (down four percent). Market value per farm increased by 42 percent to \$142,401. While the County is known primarily for the equine industry, the area is experiencing relatively high growth in non-equine related commodities. In 2002, cattle sales generated \$6.9 million. Tobacco sales are expected to continue to decline.

This unique rural landscape is the basis of the tourism economy and provides the unique character and sense of place known worldwide as a place that values its agricultural land to the extent of naming it “Horse Capital of the World”. Tourism in Fayette County generated \$880,190,000 and supported 13,130 related jobs in 2004. Local tax receipts from tourism were \$14,650,000.

The World Monuments Fund named Fayette and 11 other counties in the Inner Bluegrass region as one of the world’s most distinctive cultural and agricultural landscapes. However, over the past decade, it has been threatened by rapid development and suburbanization. Because of the resulting loss of rural farmland and sense of place, the Fund has placed the cultural landscape on its 2006 Watch List of 100 Most Endangered Sites in the World.

### **Rural Corridors**

The Rural Service Area Land Management Plan listed many rural roads as scenic. Viewsheds were identified through interpretation of mapped features such as tree stands, ridgelines and field review. It was recommended that viewsheds from the Interstate also be protected. Mapped tours along scenic byways attract tourists in vehicles; however, opportunities to experience the scenic countryside at a slower pace on bicycle or foot is impeded by the lack of trails or signed bike routes. The Rural Service Area Land Management Plan and Greenway Master Plan call for the development of a rural greenway system. Proper design and planning can avoid conflicts with agricultural operations and identify the rural roads that are safest to travel by bicycle.

Stone fences along rural roads are rapidly diminishing. An inventory conducted in 1990 found 247 rock walls with a total length of 38.7 miles. The

inventory has not been updated. An ordinance adopted in 1994 protects the walls that are located in the public right-of-way. Unfortunately, this leaves many walls on private land unprotected. Another problem is that there is little enforcement, and fines for violations are so low that it is cheaper to pay the fine than to protect the wall. The Ordinance does not cover routine maintenance or repair.

### **Urban Forestry and Land Cover**

The urban forest is one of the most effective tools known to protect and maintain the urban environment. Urban trees can substantially reduce electrical costs in cooling buildings and help reduce the “heat island” effect of cities, thereby reducing energy demand. Trees clean the air by removing noxious gases and particulates, such as dust and pollen. They absorb carbon dioxide, whose excessive buildup in the atmosphere can cause long term increases in the earth’s temperature. Trees slow and absorb surface runoff of stormwater and help control soil erosion. They provide food, nesting sites, and protection for birds and animals. Trees beautify neighborhoods and can increase residential property value.

Urban Forestry began in the 1970s, when the Lexington-Fayette Urban County Tree Board was created and a number of urban forestry studies were initiated to inspect and analyze the state of our urban forests. Street tree planting was brought back to the community as a mandatory green infrastructure necessity to create more livable subdivisions. The National Arbor Day Foundation has recognized Lexington for over 19 years as a Tree City USA making it the oldest Tree City community in the State.

In the mid-1990s, LFUCG Division of Planning created an Urban Forestry Program and created initial ordinances. Later, it was relocated to the Division of Streets, Roads and Forestry as the Program became more operational in nature. The Urban Forestry Program administers the Tree Protection Ordinance, the Street Tree Ordinance, and the Hazard Street Tree Cost Share Program. The Urban Forester also reviews Tree Protection Plans in the planning and development process. The Program maintains trees in medians, parks and LFUCG-owned

greenways. Adjacent property owners are responsible for the maintenance and replacement of all other trees.

The Tree Protection Ordinance establishes the standards and procedures for county-wide tree protection and planting in new developments, and helps to meet minimum tree canopy coverage requirements. A goal set by the Urban Forester is to meet the national standard of 40 percent canopy coverage for the County. Approximate coverage is currently at 18 percent. The Tree Protection Ordinance should be reviewed to evaluate target canopy coverage within specific zones in order to meet the national standard.

The Hazard Street Tree Cost Share Program helps property owners with the removal of hazard trees and replacement. The Program continues to receive many more requests than funds in the budget. A common problem throughout the community is the removal of trees without replacement. A Cost Share Program for replacement only would help property owners to be in compliance with regulations.

The quality of Lexington's urban forests, especially in the older sections of Lexington in the right-of-way, is an issue being addressed by the Urban Forester. Many of the urban-forested areas were planted in the 1930s and, as a result, are now in a state of tree decline due to age. Pilot projects have been initiated to address some of the maintenance and tree removal needs. The Urban Forester also oversees private and public street tree maintenance decisions.

Data on the urban forest is needed to model its costs/benefits. There is no comprehensive tree inventory county-wide; however, a street tree sampling was conducted in 2005. Of the 51,077 trees surveyed, 26 percent of all street trees were Callery pear trees, 22 percent were red maple and 13 percent were pin oaks. As a best management practice, no species should account for more than 10 percent of a total population; however, monocultures continue to be planted in new subdivisions.

The survey did not include other data such as missing trees, tree health or size. Street trees are required through regulations; however, there is little enforcement to require property owners to remove hazardous trees or replace

missing ones. The urban forest was severely damaged and compromised by the 2003 ice storm; however, there is no data to compare before and after conditions. An inventory of trees in LFUCG-owned greenways began in 2005. It is estimated that over 1,000 trees are dead or dying between the curb and the sidewalk in the public right-of-way.

The historical agricultural land use of our county is that of extensive pasture for horse and cattle with croplands dispersed throughout our agricultural areas. Extensive tree stands both in the Urban and Rural areas are scarce, except along fence-rows, property boundaries, creeks, and roads. Satellite data shows no significant forest cover in the County except adjacent to the Kentucky River Palisades. Some remaining vestiges of isolated woodlands occur and should be protected, especially if they are over one acre in size. However, they should be inspected on a site by site basis to determine if their condition is suitable for conservation measures (such as the extent of invasive species removal). While not particularly valuable for habitat (because of its isolation or lack of under story growth), modeling could show benefits of small wooded lots to air quality, water quality, economic savings and societal interests that may merit protection or rehabilitation. Satellite data categorizes land cover by water, developed land and vegetation (including deciduous trees, evergreen trees, shrubs, cropland, and grassland). From this data, canopy cover and impervious cover can be tracked over time.

New tree planting is ongoing in the community through the Corridors Committee planning efforts for corridor enhancement, and through the “Reforest the Bluegrass” program for planting in riparian zones. The Reforest the Bluegrass Program began in 1999 as a community effort to restore the riparian forest. To date, approximately 155,000 seedlings have been planted in 160 acres of floodplains by 5,500 volunteers. The Natural Resource Conservation Service and the Center for Watershed Protection have declared that forest cover is the best use of land for

water storage, recharge, runoff reduction, pollutant reduction and erosion control; therefore, forest cover is the leading indicator of a watershed's health.

### **Resource Extraction**

Limestone is the primary mineral mined in Fayette County. There are three rock quarries located in Fayette County, and each has the capability of extracting 1,000,000 tons of rock per year.

### **Green Infrastructure Network**

Hubs and corridors that make up a green infrastructure network have yet to be identified, however, there are components existing and proposed that can form the basis of a network. Potential hubs include parks, natural areas, woodlots and other urban greenspaces. Corridors include the proposed countywide greenway system and Kentucky River.

### **Energy**

#### **Recycling**

LFUCG began a recycling program in 1991. Each year, participation has grown, and in 2006, 70 percent of households recycled. In 2006, 16,721 tons of glass, cardboard, office paper, newspaper, plastic, aluminum, steel and other fiber were processed through the Recycling Center, an increase of approximately 6.5 percent from 2005. An addition 1,892 tons of material were accepted from 17 nearby Counties. In addition to saving \$374,884 in landfill tipping fees, over \$1,248,078 was recouped from the sale of these materials.

LFUCG Division of Fleet Services recycled 10,781 gallons of used oil, 4,970 oil filters, and 719 batteries. The Outdoor Firing Range for the Division of Police has received a Best Management Practices Certificate of Recognition from the EPA for its plan for protecting the environment. The Plan calls for periodically recycling expended ammunition recovered from the range. In 2005, over 39,000 pounds of expended metal ammunition were collected and recycled.

Since 2000, LFUCG has had an internal collection and recycling program for unwanted mercury containing equipment, such as thermometers and mercury

switches, burned out lamps, rechargeable batteries and fluorescent light bulbs. Recycling these materials (as opposed to landfilling these materials) reduces potential environmental liabilities under federal regulations. In 2006, LFUCG collected and recycled approximately 23,034 lamps (equivalent to over 10 miles of fluorescent lamps).

### **Composting**

In 2006 19,711 tons of yard waste and 4,067 tons of brush were composted at the LFUCG compost pad (to include over 17,000 tons of leaves and eight tons of Christmas trees). This is up from 2005, when approximately 15,332 tons of yard waste and 4,364 tons of brush were composted by LFUCG. Horse muck generated by the Police Mounted Patrol and vegetable food waste generated by the Adult Detention facility is also composted.

### **Energy Efficiency**

During 2006 the LFUCG continued efforts to become more energy efficient. Some of the more significant efforts included installing a (second) used oil heater at Fleet Services, purchasing a solar powered aerator for a pond at the Adult Community Corrections facility along with motion controlled lighting for selected office space, purchasing 392 LED EXIT signs and 235 programmable thermostats, buying 20 vending misers to minimize energy use at Parks and Recreation soda machines, participating in and sponsoring the Bluegrass Green Living and Energy EXPO, and facilitating the LFUCG Energy Efficiency Annual Awards which recognize Divisions that take steps to save energy. The Division of Traffic Engineering continued to facilitate use of LED traffic signal modules. Since LEDs use significantly less energy than incandescent signals, this upgrade has lowered LFUCG energy costs for these signals by approximately \$120,000 per year. This has also reduced maintenance costs significantly and reduced greenhouse gas emissions equivalent to planting over 4,000 trees or taking 400 cars off Lexington roadways each year.

The Lexington Public Housing Authority announced last year that they would begin a project to build Energy Star Rated housing. The Public Housing Authority currently plans 24 Energy Star rated rental apartments that will be opened in 2007. There are also plans to start construction on 60 new energy star homes that will be available in 2008.

Since 2003, six homes built for Habitat for Humanity were tested and received a five-star energy rating. The organization builds all of its homes with the same standards and specifications so they will all meet the five-star rating standards, and they continue to test annually to maintain the rating.

### **Transportation**

It is well established that a community's walkability is an important factor in measuring its livability. Transit ridership, cycling, and walking as alternate modes of transportation reduce air pollution and provide opportunities for an active lifestyle. Current facilities include:

- bike lanes: 10.5 miles existing and 24 miles funded;
- shared use trails: 8.4 miles existing and 10.5 miles funded;
- signed shared roadway: 4 miles existing.

In 2003, a sidewalk inventory was conducted on 48 percent of the streets in the urban service area, concentrating on areas around public schools, universities and Downtown. Only 55 percent of the streets had sidewalks present on both sides, and 13 percent had sidewalks on one side only. Sidewalk condition was good on 44 percent, fair on 39 percent and poor on 15 percent of those inventoried. A Safe Routes to School Program will begin in two schools starting in 2007.

According to Census data, the percent of trips to work on foot dropped from five percent in 1990 to four percent in 2000. Bicycle commuting increased from 0.35 percent of trips to 0.6 percent. Public transportation decreased from 1.6 percent to 1.3 percent. Carpooling remained constant at 11 percent. Commuting times under 20 minutes over the ten years dropped from 64 percent of commuters to 58 percent.

Current transit data shows that trend reversing. From July to December 2006, there were 1,337,442 riders using transit. This is an increase of 28.7 percent from the same months of 2005. Four additional routes were added in 2006, along with an increase to 30 minute headways.

**Infill/Redevelopment**

Energy consumption is dramatically lessened by accommodating growth first with infill and redevelopment within the current Urban Service Area. In December 2006, a land use survey was conducted. A parcel was considered vacant if there was no building foundation observed on the site. From 2001 through December 2005, 76.4 percent of the land that was vacant in 2001 was still vacant in the Expansion Area. In the remaining Urban Service Area, 58.4 percent of the vacant land from 2001 remained.

<b>Area</b>	<b>2001 Vacant Land</b>	<b>2006 Vacant Land</b>	<b>Percent Change</b>
Expansion Area	4,404	3,366	76.4
Non-Expansion Area	9,604	5,611	58.4
Total	14,008	8,977	64.1

Since the Infill and Redevelopment boundary was created in late 2002, there have been 794 housing building permits issued. In the past two years, there has been a significant increase in the number of mixed use development in or near downtown. There is currently over \$500 million invested in downtown with projects completed, under construction, or planned. Average density is 55 units per acre.

**Socioeconomic**

**Public Health and Safety**

Land use, development patterns and transportation planning have impacts on public health and well-being, including:

- air quality: asthma and other respiratory diseases are thought to be caused by a combination of genetic and environmental factors;

- water quality: streams are too polluted for swimming;
- physical activity: In 2004, 63 percent of Kentuckians were obese or overweight, with 30 percent of high-school students overweight or at risk of becoming overweight, and 35 percent of low-income children between two and five years of age;
- drinking water supply: there were no outbreaks of waterborne diseases in 2005.

### **Tourism**

Tourism is a strong economic sector in Fayette County. For 2005, the economic impact from tourism sales in Fayette County was estimated at \$1,430,479,973 and an employment of 22,881 (an increase of 9.2 percent from 2004). The most requested information from the Lexington Convention and Visitors Bureau was for horses and history. The preservation of agriculture, scenic viewsheds and cultural landscapes is critical to attracting tourists.

In 2010, Lexington-Fayette County will host the World Equestrian Games at the Kentucky Horse Park. This will be the first time that the Games have been held in the United States. It is anticipated that there may be 600,000 visits to the Park during the two week event.

### **Property Values**

National studies show that property values adjacent to parks and greenways are usually higher than other properties off of the greenspace. A preliminary study of home sales along the West Hickman, Town Branch, Masterson Station and Beaumont greenways indicates that values along the trail are higher than neighboring properties. Additional sales tracked over time will verify these findings.

### **Partnerships**

Public-private partnerships improve the chances of successfully implementing green infrastructure programs and projects. A number of

partnerships have been created over the years (see Appendix C for a listing of existing or potential partnerships).

One recent venture into organizing “green” efforts is through the Bluegrass Partnership for a Green Community. In 2004, LFUCG, the University of Kentucky and the Fayette County Public Schools signed a proclamation for the purpose of “sustaining and preserving regional quality of life; protecting the environment and conserving resources; minimizing waste and preventing pollution.” Additional outcomes expected in the collaboration of projects include a cost savings through purchasing agreements and setting an example for others to follow. Since its inception, other organizations have become partners, including the Bluegrass Community and Technical College, Bluegrass PRIDE, Kentucky Division of Renewable Energy and Energy Efficiency and the Kentucky Environmental Education Council. There are nine teams working on separate projects, including: Green Buildings; Reduce, Reuse and Recycle; Environmental Education; Green Purchasing; Transportation; Outreach and Education; Water and Storm Water; Food and Lands; and Greenspace.

### **Public Support**

Education is imperative for gaining support of green infrastructure initiatives and movement towards a sustainable community. Numerous surveys and public input during the 2006-2007 Comprehensive Plan process have shown that the public is devoted to our cultural rural heritage. Support may include the following:

- Private citizens volunteer to serve on many commissions, boards and committees. These advisory groups assist LFUCG formulate policy, prioritize projects, and educate the public on various green programs (see Appendix C, Inventory, for a listing);

The public participates in a number of events sponsored by LFUCG. They include:

#### **Water quality events:**

- Clean Sweep, an annual event that in June 2006 removed approximately 1.74 tons of trash from the Kentucky River;
- Great American Cleanup, when 3,700 volunteers collected 415 tons of garbage, debris and trash;
- Spring Clean Household Hazardous Waste event, that in April 2006, over 1900 households, Fayette County Public Schools and UK participated in collecting 94 tons of hazardous waste, including 2300 gallons of solvents, 440 gallons of antifreeze, 4500 gallons of pesticides and fertilizers and 24 “totes” of paint;
- Reforest the Bluegrass: over 150,000 trees have been planted in riparian zones since 1999;
- Adopt a Creek program recruits volunteers to clean streams and educate citizens on water quality. Friends of Wolf Run and Friends of Cane Run are citizen groups dedicated to improving water quality and aquatic habitat at the watershed level.

#### Engineering:

- The Division of Engineering conducts workshops to inform the development community of changes to the Engineering Manual, and provide a forum to address issues;
- The Division of Engineering sends educational material to homeowners who live adjacent to greenways.

#### The Division of Planning, Air Quality:

- “It All Adds Up to Cleaner Air” program, public education campaign and “Tree Madness”.

#### Solid waste recycling efforts in 2006 include:

- 304,070 pounds of electronic components; the events are now done quarterly;
- 536 pounds of batteries were recycled; there are 13 locations throughout the city for battery collection;
- 18,613 tons taken in by The Recycling Center;

- 5,568 appliances weighing 367 tons were recycled;
- In September, 2006, the National Aluminum Recycling Challenge event was held; Lexington participated in this contest for the first time in 2006 using the theme of Yes We Can!. Over 3,780,000 cans were recycled, and LFUCG won the “Most Innovative Ideas” category for cities with a population of 250,000 or more, receiving a \$5,000 monetary award. This contest was a joint initiative between the LFUCG and the Bluegrass Partnership.

## **General Recommendations**

Just as the road and utility networks that comprise gray infrastructure provide necessary services to the community, natural resources and landscapes that comprise green infrastructure must be actively supported and funded for the wide range of essential ecological and socioeconomic values they provide. It is recommended that a Green Infrastructure Plan be developed that will integrate the Principles into the planning and management of natural resources and landscapes. The Plan should include a vision, goals and objective, and specific recommendations for steps in achieving sustainability.

## Appendices to Environmental and Green Infrastructure Chapter

### Appendix A

#### Excerpts from 2006-07 Comprehensive Plan Mission, Goals and Objectives

Mission Statement: “promoting economic development... while preserving the quality of life that makes it a desirable place to work and live and protecting and enhancing... the rural Bluegrass cultural landscape”;

Visions:

- “...cherished our unique rural landscape...”
- “It is through these ... rural settings that Lexingtonians experience an uncommon quality of life every day”
- “The challenge of planning efforts will be to sustain this extraordinary development pattern while preserving, enhancing and allowing for redevelopment of the built environment and maintaining a high quality of life for current and future residents”
- “Implementing infill and redevelopment...”
- “Preserving horse farms, rural settlements and rural Bluegrass landscapes by balancing agricultural and urban area needs in a manner that maintains a viable economy while retaining the strong sense of place...”
- “Enabling the creation, growth and retention of jobs that promote a strong ... rural economy”
- “Developing a green infrastructure system with open space, facilities and amenities that serves all citizens and helps create a sense of community”; and
- “Providing infrastructure improvements...”

Goals: goals and objectives: all but three goals have references to green infrastructure elements.

- Goal 2: regional planning: environmental issues, alternative growth management techniques, more efficient use of land, unique identities, preservation of agriculture, natural resources and cultural resources; storm water planning, parks, greenspace, viewsheds and greenways,
- Goal 3: environmental framework: protect rural open space, scenic vistas, environmentally sensitive areas, unique areas, natural areas, resources and biodiversity; soils, trees, plant life, natural drainage, creeks, promote good design and preservation; monitor and minimize pollution; promote proper use of natural resources; impact analysis, improve water quality, reduce toxic emissions, enhance visual quality,
- Goal 4: greenspace system: urban and rural identity, framework for regional and local planning, balancing development and protection, enhance natural resources, biodiversity, environmentally sensitive areas, wildlife corridors, historic and cultural areas, landscapes, unique identity, scenic vistas, corridors, riparian areas, recreational open space; create plans, programs and regulations for green infrastructure comprehensive system that encompasses a multitude of

## Appendices to Environmental and Green Infrastructure Chapter

environmental , social and economic functions; regional protection of greenspace, environment and land,

- Goal 5: preserve, protect and enhance natural and cultural landscapes, unique identity and image,
- Goal 6: maintain and enhance agriculture and rural character; continued funding for PDR, balance development and protecting rural resources and landscape; support agricultural markets and value-added agriculture; monitor use of prime and statewide significant soils; support equine industry for economic development; buffer greenspace
- Goal 7: Evaluate the costs and impacts of future urban development,
- Goal 8: fund and implement infill and redevelopment,
- Goal 10: recognize tourism and encourage preservation of cultural, historic, ecological and agricultural resources upon which they are based, protect rural scenic corridors, enhance urban scenic corridors,
- Goal 11: encourage expansion of agricultural employment; retention and expansion of existing business; permit only economic development that is consistent with natural environment protection; identify long-range strategy for economic development that reflects Lexington's comparative advantage,
- Goal 12: encourage redevelopment, pedestrian access and downtown open spaces,
- Goal 14: development neighborhoods that are self-sustaining, such as mixed use and recreational uses,
- Goal 15: plan and promote infill and redevelopment, bicycle and pedestrian-friendly neighborhoods, landscape buffers, urban forest,
- Goal 16: provide a system for pedestrian and bicycle facilities; encourage connectivity, provide essential public facilities and services, parks, walkable neighborhoods,
- Goal 17: coordinate planning with water supply and infrastructure needs; protect streams, aquifers and corridors, preserve natural water storage systems; work with agencies and organizations to address water quality and supply; reduce water usage,
- Goal 18: maintain existing infrastructure; balance capital improvement expenditures, upgrade storm sewer systems,
- Goal 19: promote traffic patterns that provide alternatives, interconnectivity, comply with Clean Air Act, promote multi-modal transportation, minimize disruption to farming, reduce demand for single-occupancy vehicles, enhance visual character of roads,
- Goal 20: encourage cooperation between schools and parks, including use and location of parks, greenspace, greenways, outdoor classrooms; develop and implement plans for floodplain, environmentally sensitive areas for recreation; develop incentives for acquisition of park land; encourage park funding; provide for park opportunities; and
- Goal 21: use the Rural Land Management Plan and PDR program when evaluating expansion.

## **Appendix B**

### **Examples of Green Infrastructure and Sustainability Nationwide**

In the 1999 report “Towards a Sustainable America – Advancing Prosperity, Opportunity and a Healthy Environment for the 21<sup>st</sup> Century”, the President’s Council on Sustainable Development identified green infrastructure as one of several key strategies for achieving sustainability.

Communities, regions and states that have embraced green infrastructure or sustainability have created offices to operate their programs.

- Portland has a Green Investment Fund through the Office of Sustainable Development, and has developed handbooks for green street design, which incorporates stormwater management and sustainability principles,
- Portland and Multnomah County’s 2001 Local Action Plan on Global Warming has plan objectives for transportation, energy efficiency/renewable energy, water reduction and recycling; forestry and carbon offsets,
- Portland; energy efficiency programs since 1990 reduced city emissions by forty percent and saved homeowners and small businesses three hundred million dollars. Savings adds three hundred jobs to the state each year as an indirect effect of residents having more dollars to spend locally.
- Portland loss of Green Infrastructure from 1972 to 2000: Economic Cost include twenty two percent total tree cover loss countywide (from forty six percent to twenty four percent) nine percent total tree cover loss in city (twenty one percent to twelve percent); fifty eight million tons of carbon NOT sequestered; nine hundred sixty three million cubic feet of stormwater flow NOT intercepted; one hundred thirty eight million pound of SO<sub>2</sub>, CO, O<sub>3</sub> and NO<sub>2</sub> NOT removed.
- Minneapolis (Region) has an Alternative Urban Area wide Review process to address cumulative effects of development on natural resources in a larger area and identify effective mitigation strategies,
- Berkeley’s Office of Energy and Sustainable Development provides leadership and practical solutions to help businesses, residents and city agencies create a healthy physical environment, a more livable community and a prosperous local economy, now and for the future. Includes green building, transportation, toxic waste management, storm water management, recycling, energy, green business
- Washington D.C. Council of Governments, environmental programs includes a green infrastructure tour, and publishes a newsletter. Strive to balance built environment and greenspace, sustained by natural processes and able to support and enhance the quality of life for citizens.
- Santa Monica’s Environmental Programs Division has produced a Sustainable City Plan with progress reports and website for information
- Chicago Center for Green Technology; Openlands Project, Biodiversity Atlas, Green Building Agenda, Environmental Action Agenda. Chicago Mayor Daley

## Appendices to Environmental and Green Infrastructure Chapter

wants Chicago to be the greenest city in the Nation. There are more green roofs in Chicago than rest of the County combined. Seventy linear miles of medians have been planted, one hundred miles of bike lanes and codes rewritten. There is a goal of twenty percent of city's energy to use renewable energy sources.

- Clean Ohio: funding for greenspace, greenways, natural resource assistance
- Maryland Green Infrastructure Assessment
- Frederic, Md.: Green Infrastructure Mapping
- Delaware Statewide Green Infrastructure Plan
- Lenoir Ct., N.C.: Green Infrastructure as Economic Development
- New Jersey Greenprinting
- In the 1990's, New York City needed a new water filtration and treatment plant. Instead of spending \$6-8 billion on a conventional system, the City purchased and protected watersheds in the Catskill Mountains for a cost of approximately \$1.5 billion.
- New York City's "High Performance Infrastructure Guidelines: Best Practices for the Public Right-of-Way", 2005
- British Columbia: Sustainable Resource Management Plans
- Florida's County Land Conservation Program
- Texas Parks and Open Space Plan
- Southwest Pennsylvania Green Infrastructure mapping
- Pennsylvania Cultural Landscape Initiatives integrates ecological science and recreational science to increase economic and social values; enhance recreational and heritage resources. Interdepartmental coordination to protect natural, heritage, recreational resources and quality of life. Fitness and health; engine for economic growth, natural resource education, stewardship.
- Philadelphia is aiming to retrofit its stormwater system to mimic nature by daylighting streams and habitat. It is encouraging small swales for detention, and removing asphalt at schoolyards, reworking street medians and right-of-ways to minimize runoff, and advocating urban gardening, green roofs and enforcement of known polluters.
- Louisville has chosen a stellar parks system as its community icon and identity.
- Numerous local, regional and state greenway plans
- Kansas City metro region Green Infrastructure Plan
- San Jose "Greening the Code"
- Kansas City metro region: creating quality places, trails, watersheds, stormwater, clean air actions (utility controls, diesel emissions,) education, sustainability (heat islands, transit oriented design, green infrastructure, urban forestry); integrated watershed, land use and transportation planning)
- Central Texas Sustainability Indicators Project, five county region around Austin formed to discuss citizens' vision of sustainability and to create quality of life indicators to track progress towards a sustainable future

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- Vancouver, B.C is known for as the most sustainable city in North America
- Denver's Greenprint Denver Initiative: In order to ensure that Denver remains competitive in a changing world, and protects the environmental quality valued by its citizens for future generations, Mayor Hickenlooper launched the city's sustainable development initiative. Their Action Agenda is for the purpose of demonstrating that local government can be an effective force for innovation and leadership to improve the environment
- State of Oregon Sustainable Facilities Standards and Guidelines, 2004, for siting, design, construction, operation and maintenance of state buildings and state leased buildings.
- State of Oregon Sustainable Facility Self Assessment includes point system for 'green' site and building criteria,
- State of Illinois in 2005 began the Green Government Coordinating Council to promote the incorporation of pollution prevention and resource conservation practices into government management and operations. Initiatives include rain gardens, green main streets, green communities, carpooling and sustainable universities.
- Seattle's sustainable building sector creates between 1370 and 4160 jobs. The City is developing policies to accelerate this sector's growth.
- Seattle's Street Edge Alternatives Project designed stormwater to mimic natural landscape, by providing detention in swales and adding over one hundred evergreen trees and eleven hundred shrubs. Results show that total volume of stormwater leaving the street decreased by ninety eight percent for a two-year storm event.
- San Diego: a fire in 2003 covered about thirteen percent of the city's area. Comparing pre and post conditions, there was a loss of forty nine percent of the tree canopy and a seventy three percent loss of shrubs. This resulted in increasing stormwater runoff by twelve million six hundred seventy four thousand four hundred ninety cubic feet at an estimated value of \$25,349,000. The lost tree canopy diminished the removal of air pollutants by three hundred fourteen thousand eight hundred seventy pounds per year, at a value estimated a \$798,000 annually. The city has used the analysis to rewrite ordinances and incorporate green infrastructure into its Stormwater Management Plan and Phase II planning.
- Satellite images of Charlotte NC show that from 1984 to 2003, there was a 20% loss of tree cover and open space, while impervious surface increased by 127%. The loss of green infrastructure, valued at \$5.3 billion dramatically increase the volume of stormwater that the county manages.
- Montgomery County, Md reduced NOx by thirty one percent as a result of a new infill project located near transit that saw a drop in vehicular miles traveled by forty two percent. Similarly, an infill project in Baltimore found a fifty five percent reduction of vehicular miles traveled, resulting in a thirty six percent reduction of VOCs and forty percent reduction in NOx.

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### Appendix C Inventory

An inventory includes both spatial and tabular data. Sources include GIS data, site assessments, aerial photography and remote sensing at various scales. The inventory may include the following data:

<b>Natural Resources:</b>	
Hydrology:	watersheds, streams, wetlands, lakes, floodplains, springs, recharge areas, reservoirs, drinking water intake
Flora and Fauna:	native species and wildlife habitat, endangered or threatened species, important plant communities nuisance species
Air, Climate:	wind direction, air quality standards
Soils:	prime and statewide significant agricultural soils, hydric
Physiography:	steep slopes
Geology:	geologic hazard areas, sinkholes, caves
	minerals, stratifications
<b>Landscapes and land use:</b>	
Disturbed	urban, suburban, rural, impervious cover
Greenspace	natural areas, working farms, parks, parkways, other outdoor recreational sites greenways, greenbelts, college campus greenspace, office park greenspace, trails, trailheads, staging areas, scenic resource areas, scenic buffers, scenic easements, scenic byways; scenic designations in Rural Land Management Plan, five focus areas (Greenspace Plan), tree protection areas, community gardens, arboretums, rooftop gardens,
Urban Forest	significant trees woodlands, street trees, canopy, riparian, number of species, condition, age
Hazardous Areas	landfills, injection wells, brownfields, hazardous waste disposal sites, hazardous waste suppliers
Land Use	urban service boundary, expansion area, rural settlements, rural activity centers, wastewater treatment plants,

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	<p>urbanized areas unsewered,  storm water facilities,  vacant and underutilized lands,  natural, cultural, historic or archeological sites,  Bluegrass driving tour; walking tours,  Rural Road Bike Routes  historic districts, Paris Pike Overlay district  PDR, other conservation easements  core agriculture, buffer  drinking water intakes, reservoir,  quarries</p>
Ownership and management	land managed publicly (federal, state, university, local), managed areas (preserved, conserved, restored),
Network	connectivity or fragmentation of hubs and corridors;
<b>Stakeholders, Programs and Regulations</b>	
Divisions, Commissions, Boards and Committees	<p>Division of Planning,  Rural Land Management Board,  Division of Streets, Roads and Forestry,  Division of Engineering,  Division of Parks,  Division of Solid Waste,  Divisions of Code Enforcement and Building Inspection,  Division of Environmental and Emergency Management  Division of Risk Management,  Purchase of Development Rights,  Lexington Area Metropolitan Planning Organization,  Bluegrass Partnerships for a Green Community,  Greenspace Commission,  Environmental Commission,  Parks Advisory Board,  Tree Board,  Corridors Committee,  Rural Land Management Board,  Water Quality Task Force,  Greenway Coordinating Committee,  Lexington Beautiful Committee, and  The Arboretum</p>
<b>Programs</b>	<p>Purchase Development Rights,  Urban Forestry: Tree City USA, Hazardous Tree Program,  Reforest the Bluegrass, Champion Tree Program  Greenways, (currently ad hoc)  Water Quality,  Air Quality, including Biodiesel Program  Bluegrass Mobility Office,</p>

## Appendices to Environmental and Green Infrastructure Chapter

	<p>Solid Waste: recycling,  Risk Management,  Large scale composting,  Transit, Bike transit,  Hybrid pool cars,  Repetitive flooding buyouts,  KU's Demand Conservation program,  Energy office;  Environmental Services (DEEM)  Household Hazardous Waste Disposal</p>
<p><b>Plans &amp; Regulations:</b></p>	<p>Comprehensive Plan Update,  Greenspace Plan,  Greenway Master Plan,  Storm Water Manual, Greenway Manual (draft),  Congestion Mitigation Plan,  Bike/Ped Plan (in progress)  Parks Master Plan,  Lexington Area MPO Long Range Transportation Plan  Zoning Ordinance (Open Space requirement,  Infill &amp; Redevelopment Ordinance,  Tree Protection Ordinance,  Floodplain/Erosion/Sediment Control Ordinance,  Clean Air Act,  Clean Water Act,  Engineering Manuals;</p>
<p><b>Potential Partnerships:</b></p>	<p>Federal: NRCS, EPA,  State: Ky. Heritage Land Conservation Fund, PACE,  State: Ky. Divisions of Conservation, Energy, Forestry and Water, Environmental Quality  State: Ky. Transportation Cabinet,  Regional: Bluegrass Area Development District committees, Kentucky River Watershed Watch, Bluegrass Regional Working Group, Water Consortium, Thoroughbred Research, Conservation and Development Council, Wellhead Protection Commission, Bluegrass Regional Recycling Corp;  Local: Fayette County Extension Office, Bluegrass Partnership for a Green Community, universities. The Arboretum,  Non Profits: Bluegrass Conservancy, Bluegrass Tomorrow, Nature Conservancy, Sierra Club, Neighborhood Associations, Friends of (Park, McConnell Springs, Wolf Run, Arboretum), Town Branch Inc., Lexington Council of Garden Clubs, Triangle Foundation, Lexington Homebuilders Association, Bluegrass Cycling Club, BRTF, Kentucky Rails To Trails</p>

## Appendices to Environmental and Green Infrastructure Chapter

	Council, American Lung Association Fayette Alliance, U.K., Fayette Co. Public Health Dept., Fayette Co. Schools Fayette Co. Farm Bureau, Research Partnerships with Federal, State or non-governmental laboratories, Private: volunteerism in natural activities, UK Tracy Farmer Center for the Environment, UK Green Thumb Environmental club, Lexington Farmer's Market, Bluegrass PRIDE, Water, gas and electric companies Adjacent counties Chamber of Commerce, local businesses and developers
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### **Appendix D** **Indicators**

To evaluate the effectiveness of planning and management of green infrastructure, indicators should be established to measure progress, write reports and grants, and conduct a cost/benefit analysis. Indicators may include the following:

<b>Natural Resources:</b>	
Water Quality:	miles of stream impaired, pathogens, biological and chemical indicators, miles of stream entrenched, channeled or piped, miles of stream restored or protected, sediment deposition in lakes; bacterial loading, phosphorus loading, recharge rate of groundwater; soluble pollutants, pathogens, acres of wetland mitigated, restored and/or protected, number of sinkholes and springs restored and/or protected, watershed plans produced, acres of greenways protected, acres or riparian vegetation or floodplains planted, acres of impervious surface, acres of reduced storm water discharge; use of low impact development, instances of nonpoint source pollution, point pollution, miles of stream affected by pollution; fish kill statistics, recharge areas, aquifers, reservoirs, drinking water intake
Flora and Fauna:	species richness,

## Appendices to Environmental and Green Infrastructure Chapter

	<p>number and location of species of concern (endangered, threatened),  sightings,  acres of invasive species removed,  acres in tree protection,  protected acres of high species diversity,  number and/or acreage of native grasses, trees and shrubs planted,  miles of stream sections with significant aquatic species</p>
Air Quality:	<p>vehicle miles per day, commuter travel time and mileage,  transit ridership, bicycle and pedestrian trips,  mode used for all types of trips and mileage  public schools with Safe Routes to School program</p> <ul style="list-style-type: none"> <li>• tree planting (see Flora and Fauna),</li> </ul> <p>Air Quality Index, per capita carbon dioxide emissions  asthma cases per capita</p>
Soils:	<p>acreage and percent of total preserved or conserved for prime, statewide significant agricultural land, hydric</p>
Energy and Water Consumption:	<p>use of hybrid cars or other alternative fuels,  credits or rebates for energy-efficiency  transit ridership, bike/pedestrian % trips  per capita gasoline use  household electricity and natural gas use  household water use  number green buildings constructed or rehabilitated  energy savings for LFUCG</p>
Land and Landscapes:	<p>tree canopy coverage, coverage by neighborhood,  number of replaced or new street trees,  acres of preserved, conserved or restored natural areas, including wildlife habitat, migratory corridors, woodlands, riparian vegetation,  acres of protected or restored environmentally sensitive areas,  acres of protected geologic hazard areas,  acres of protected farmland; categories  acreage of loss or fragmentation of wildlife habitat including wetlands, woodlands, streams,  acres of sustainable growth patterns,  urban, suburban (density, land consumption) rural, managed  areas (preserved, conserved, restored),  acreage in greenspace; public or semi-public ownership,  percentage of total County acreage in greenspace or open space</p>

## Appendices to Environmental and Green Infrastructure Chapter

	<p>percentage of population within ¼ and ½ mile of a park or other open space,          number of trail and/or park users,          miles of trails and other bike facilities          acreage for farmers market, community gardens, or          number of vendors,          acres in impervious cover, recharge capacity,          acres in each land cover classification,          acres in low impact development,          trailheads, staging areas and boat docks,          acres in land consumption</p>
<b>Network:</b>	<p>acreage, status of hubs and corridors; functioning, buffering</p>
<b>Socioeconomic:</b>	<p>population increases; shifts, density,          dollars spent on obesity, asthma, diabetes, heart          number of park and trail users, number of persons exercising outdoors,          tourists: revenues, employment, where visited,          number of outfitters, bike shops,          number and size of farms,          agricultural sales, employment,          farmers market, local sales per capita,          sand and rock quarries: sales and employment,          number and costs of storm water projects,          cost for storm water basin management,          number of reported flooded buildings,          number of incidents for hazardous waste and cleanup costs,          tonnage of solid waste, number of households that participate in recycling,          improvements to landfill and associated costs,          costs associated with congestion mitigation,          dollars spent per capita on parks, sidewalks, trails, park recreational and fitness programs,          dollars spent on water facilities, water treatment costs or water billing rate,          water conservation/consumption,          dollars spent on wastewater projects,          costs for pest control, costs for herbicides and mowing in natural areas,          costs for Hazardous Tree Program, Reforest the Bluegrass, tree maintenance,          costs from floods, sinkholes, subsidence, erosion, noise pollution,</p>

## Appendices to Environmental and Green Infrastructure Chapter

	<p>new business start-ups; retention, property value, energy costs, number of green buildings constructed and certified, use and investment in renewable energy (solar, wind, geothermal, alternative fuels), land use and built environment: green building, (see landscapes above), culture and history recreational and learning opportunities, green economy (clean technology incubator, green business directory, farmers markets/capita, LEED/capita), etc., costs associated with natural disaster (floods, tornadoes, subsidence, sinkholes) % green buying</p>
<b>Policy, Incentives and Strategies</b>	<p>new energy policies (e.g., incentives for green buildings, reduction of dependence on car), incentives and strategies for a green economy, incentives and strategies for smart growth, incentives for low impact development, incentives and strategies for carpooling, transit ridership, cycling and walking, incentives and strategies for recycling buy local</p>
<b>Partnerships:</b>	<p>new partnerships formed, volunteerism</p>
<b>Education and Outreach</b>	<p>programs and participation outdoor classrooms exhibits, media</p>

### **Appendix E**

#### **Condition of Streams**

Municipalities are required by the Federal Clean Water Act to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and systems, design and engineering methods, and other provisions, as the Administrator or the State determines appropriate for the control of pollutants into the streams of the Commonwealth. According to the 2006 Draft Integrated Report to Congress on the Condition of Water Resources in Kentucky Volume II. 303(d) “List of Surface Waters In Lexington-Fayette County”, the following streams are impaired: \*

#### **Baughman Fork into Boone Creek**

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## Appendices to Environmental and Green Infrastructure Chapter

From River Mile 0.0 to 2.7      Segment Length: 2.7 miles  
Impaired Use(s):      Aquatic Life (Partial Support)  
Pollutant(s)      Nutrient/Eutrophication Biological Indicators  
Organic Enrichment (Sewage) Biological Indicators  
Suspected Sources:      Livestock (Grazing or Feeding Operations)  
Municipal Point Source Dischargers

### **Baughman Fork into Boone Creek**

From River Mile 0.0 to 2.7      Segment Length: 2.7 miles  
Impaired Use(s):      Aquatic Life (Partial Support)  
Pollutant(s)      Nutrient/Eutrophication Biological Indicators  
Organic Enrichment (Sewage) Biological Indicators  
Suspected Sources:      Livestock (Grazing or Feeding Operations)  
Municipal Point Source Dischargers

### **Boone Creek into Kentucky River**

From River Mile 0.0 to 7.4      Segment Length: 7.4 miles  
Impaired Use(s):      Aquatic Life (Partial Support)  
Pollutant(s)      Nutrient/Eutrophication Biological Indicators  
Suspected Sources:      Livestock (Grazing or Feeding Operations)  
Municipal Point Source Dischargers

### **Boone Creek into Kentucky River**

From River Mile 7.4 to 12.6      Segment Length: 5.2 miles  
Impaired Use(s):      Aquatic Life (Partial Support)  
Primary Contact Recreation (Nonsupport)  
Pollutant(s)      Nutrient/Eutrophication Biological Indicators  
Pathogens  
Suspected Sources:      Livestock (Grazing or Feeding Operations)  
Municipal Point Source Dischargers

### **Cane Run into North Elkhorn Creek**

From River Mile 9.6 to 17.4      Segment Length: 7.8 miles  
Impaired Use(s):      Aquatic Life (Nonsupport)  
Primary Contact Recreation (Nonsupport)  
Pollutant(s)      Pathogens; Organic Enrichment (Sewage) Biological  
Indicators  
Suspected Sources:      Livestock (Grazing or Feeding Operations)  
Unspecified Urban Stormwater

### **East Hickman Creek into Hickman Creek**

From River Mile 4.2 to 10.2      Segment Length: 6.0 miles  
Impaired Use(s):      Aquatic Life (Partial Support)

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## Appendices to Environmental and Green Infrastructure Chapter

Pollutant(s) Primary Contact Recreation (Nonsupport)  
Pathogens  
Nutrient/Eutrophication Biological Indicators  
Suspected Sources: Livestock (Grazing or Feeding Operations)  
Unspecified Urban Stormwater

### East Hickman Creek into Hickman Creek

From River Mile 12.6 to 14.0 Segment Length: 1.4 miles  
Impaired Use(s): Primary Contact Recreation (Nonsupport)  
Pollutant(s) Pathogens  
Suspected Sources: Unspecified Urban Stormwater

### North Elkhorn Creek into Elkhorn Creek

From River Mile 66.0 to 73.8 Segment Length: 7.8 miles  
Impaired Use(s): Aquatic Life (Partial Support)  
Primary Contact Recreation (Nonsupport)  
Pollutant(s) Sedimentation/Siltation  
Nutrient/Eutrophication Biological Indicators  
Pathogens  
Organic Enrichment (Sewage)  
Biological Indicators  
Suspected Sources: Highway/Road/Bridge Runoff (Non-Construction Related)  
Highways, Roads, Bridges, Infrastructure (New  
Construction)  
Municipal Point Source Discharges  
Site Clearance (Land Development or Redevelopment)  
Source Unknown  
Agriculture  
Habitat Modification – Other Than Hydromodification  
Urban Runoff/Storm Sewers

### Town Branch into South Elkhorn Creek

From River Mile 0.0 to 9.2 Segment Length: 9.2 miles  
Impaired Use(s): Aquatic Life (Partial Support)  
Primary Contact Recreation (Nonsupport)  
Pollutant(s) Pathogens  
Nutrient/Eutrophication Biological Indicators  
Organic Enrichment (Sewage) Biological Indicators  
Suspected Sources: Municipal Point Source Discharges  
Agriculture  
Urban Runoff/Storm Sewers

### Town Branch into South Elkhorn Creek

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From River Mile 9.2 to 10.6      Segment Length: 1.4 miles

Impaired Use(s):            Aquatic Life (Non Support)  
                                 Primary Contact Recreation (Nonsupport)  
Pollutant(s)                Pathogens  
                                 Nutrient/Eutrophication Biological Indicators  
                                 Organic Enrichment (Sewage) Biological Indicators  
Suspected Sources:        Municipal Point Source Discharges  
                                 Urban Runoff/Storm Sewers

### **Town Branch into South Elkhorn Creek**

From River Mile 10.6 to 12.1      Segment Length: 1.6 miles

Impaired Use(s):            Aquatic Life (Partial Support)  
Pollutant(s)                Impairment Unknown  
Suspected Sources:        Source Unknown

### **Unknown Tributary of North Elkhorn Creek into North Elkhorn Creek**

From River Mile 0.0 to 5.6      Segment Length: 5.6 miles

Impaired Use(s):            Aquatic Life (Partial Support)  
Pollutant(s)                Sedimentation/Siltation  
                                 Total Dissolved Solids  
                                 Nutrient/Eutrophication Biological Indicators  
Suspected Sources:        Loss of Riparian Habitat  
                                 Managed Pasture Grazing  
                                 Post-Development Erosion and Sedimentation  
                                 Streambank Modifications/Destabilization

### **Wolf Run into Town Branch**

From River Mile 0.0 to 4.1      Segment Length: 4.1 miles

Impaired Use(s):            Primary Contact Recreation (Nonsupport)  
                                 Aquatic Life (Partial Support)  
                                 Pathogens  
                                 Nutrient/Eutrophication Biological Indicators  
Suspected Sources:        Channelization  
                                 Unspecified Urban Stormwater

\* some of the data has changed from the 2004 plan to the 2006 plan for some of the streams in Fayette County as well as in other counties. This is due to better stream delineation in terms of stream miles (measuring by GPS) and better methods of data collection.

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### **Appendix F**

#### **Rare Plant Species**

*Elymus svensonii* - Svenson's Wildrye  
*Juglans cinerea* - White Walnut  
*Lesquerella globosa* - Globe Bladderpod  
*Lonicera prolifera* - Grape Honeysuckle  
*Malvastrum hispidum* - Hispid Falsemallow  
*Oenothera triloba* - Stemless Evening-primrose  
*Onosmodium hispidissimum* - Hairy False Gromwell  
*Prenanthes crepidinea* - Nodding Rattlesnake-root  
*Sagina fontinalis* - Water Stitchwort  
*Schizachne purpurascens* - Purple Oat  
*Trifolium reflexum* - Buffalo Clover  
*Trifolium stoloniferum* - Running Buffalo Clover  
*Viburnum molle* - Softleaf Arrowwood  
*Viburnum rafinesquianum* var. *rafinesquianum* - Downy Arrowwood  
*Viola walteri* - Walter's Violet

### **Appendix G**

#### **Caves**

Fayette County Cave name	length, ft.
Barnes Cave	37
Boggs Cave	1000
Boone Creek Cave	65
Breck Smith Cave	55
Carcass Cave	187
Carl House Cave	Unknown
Crystal Cave	3468
Crystal Springs Cave	Unknown
Double Entrance Cave	167
Gentry Cave	124
Georgetown Road Cave	272
Hanover Cave	Unknown
Headley Cave	100
Hughes Cave	Unknown
Idlehour Cave	68
Joyland Cave	380
Kearns Cave	160

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King Ranch Cave	318
Lindsay Spring Cave	135
Mason Headley Cave	60
Merrick Place Cave	111
Patterson's Cave	330
Patterson Cave Spring	Unknown
Phelps Cave	1473
Picadome Cave	300
Preston's Cave	408
Red mile Cave	175
Rimstone Cave	178
Russell Cave	5200
Sandfilled Cave	Unknown
Scott's Crawl	72
Sergent's Cave (Boiling Springs Cave)	83
Shoust Cave	120
Stonewall Cave	81
Stonewall Pit Cave	78
Tucker's Cave	3060
Turtle Cave	123
UK Pits	
Maxwell Springs - pit	not mapped
Administration Building - pit	not mapped
Commerce Building - pit	not mapped
Home-Economics Building pit	not mapped
White Horse Sink	filled in
Unconfirmed Caves	
Indian Cave	
Post Office Cave	
Quarry Caves	
Seminary Cave	
New Found Caves	
Marehaven Cave	90
McConnells Trace Caves - 2	500

## **Appendix H**

### **Resources**

- Berea Ecological Sustainability Education program,
- KSU Organic Agriculture Working Group,
- Kentucky solar Partnership,
- Ky Association for Environmental Education,
- Ky Office of Energy Policy,
- Ky Pollution Prevention Center
- Ky Energy Services Coalition