



Source: Albemarle County Community Development 2010

NATURAL RESOURCES

GOAL:

Albemarle's ecosystems and natural resources will be thoughtfully protected and managed in both the Rural and Development Areas to safeguard the quality of life of present and future generations.

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VISION:

Albemarle County envisions a community with abundant natural, rural, historic, and scenic resources • healthy ecosystems • active and vibrant development areas • a physical environment that supports healthy lifestyles • a thriving economy • and exceptional educational opportunity for present and future generations.

Natural Resources

Relationship to the Vision

Albemarle County's natural resources are essential parts of its rural heritage and scenic beauty. These finite features help to support the County's tourist economy and are enjoyed by residents and visitors alike. Preservation of these features is the highest priority for residents. Creating high quality development and building, and maintaining infrastructure in the Development Areas can help attract new residents to the Development Areas instead of to the Rural Area. Preserving the Rural Area from residential development, in turn, preserves natural resources.

Introduction

As reaffirmed with each citizen survey taken over the past 20 years, natural resources are the most valued feature of the County. They contribute strongly to the high quality of life experienced by both County and City residents. For that reason, natural resource protection is the County's highest priority.

Natural resources include surface water and groundwater, air, soil, and minerals. Together they create landforms such as mountains, hills, valleys, and floodplains. Within the landforms, the natural resources support woodlands and wetlands, and provide ecosystems for flora and fauna. Conservation and preservation of these resources is essential to the health, safety, and welfare of the community. Preventing harm to the natural environment takes precedence over many activities in the County and preservation of the County's natural features is preferred to modifying the landscape in the Development Areas and essential in the County's Rural Area.

The natural environment is composed of various ecosystems and ecological functions that includes:

- purification of air and water;
- mitigation of floods and droughts;
- detoxification, decomposition, and dilution of wastes;
- generation and renewal of soil fertility;
- pollination of crops;
- control of pests;
- maintenance of biodiversity;
- moderation of climate, including temperature extremes and wind;
- aesthetic beauty and intellectual stimulation; and
- recreation.

The natural environment also includes areas where natural hazards can harm people, plants, and animals. Places where these hazards can occur include floodplains (during a major flood event), and the base of slopes when a debris flow occurs. Reducing hazards through careful development and protection of natural land cover is also part of the County's policy.

Both ecosystems and natural resources provide benefits for the community and are inextricably linked. While there are sometimes conflicts between goals regarding use and conservation of materials and goals regarding living systems, this Plan puts particular focus on solutions that benefit both aspects of the County's natural character.

Natural resource protection is an important part of both the Rural Area, which makes up 95% of the County's land area, and the Development Areas, where growth and development are directed. Policies related to land uses in the [Rural Area](#) and [Development Areas](#) can be found in later chapters, while policies on specific resources are provided in this chapter.

Objective 1: Ensure clean and abundant water resources for public health, business, healthy ecosystems, and personal enjoyment by preventing shortages and contamination.

Albemarle County's hilly topography along with approximately 45 inches of rain per year, results in abundant water resources that are enjoyed by many. City and County residents, businesses, and industries are dependent on Albemarle's water resources for a public water supply. Landowners in the Rural Area are dependent on well water for homes, crops, livestock, and rural businesses. Swimmers, fishers, boaters, and tourists enjoy clean streams. Flora, fauna, and the natural environment benefit from plentiful clean water, which the County wants to pass on to future generations.

Water and watershed protection are important because healthy watersheds provide numerous ecosystems services to the community. Well vegetated watersheds provide for recharge of groundwater that supplies both wells and reservoirs. They also help with moderation of flood flows, which reduces water treatment needs and provides for and protects plant and animal habitat in and around streams.

The County has developed its Growth Management Policy around watershed protection as described in [Chapter 3](#). With the exception of the Community of Crozet and a small area in the northern part of Places29, the County's Development Areas are located east of the public water supply watershed. Investment in public utilities in the Development Areas occurs to help prevent sprawl and contamination of groundwater supplies. Retaining groundwater resources is one of the reasons why new residential development in the Rural Area is not encouraged.

History of Watershed Protection in Albemarle County

The County's water resources programs include stormwater management (including water quality treatment, and channel and flood protection), erosion and sediment control, stream buffer protection, collection of groundwater information, capital projects, public education, illicit discharge detection and elimination, and infrastructure maintenance. These activities are a result of comprehensive planning and regulations to protect water resources since the 1970s. In 1980,

Livability Project

Charlottesville and Albemarle County will continue to promote a community of green neighborhoods, healthy waterways, clean air, and sustainable natural resources.

To do this, the City and County will:

Air Quality

- Encourage multi-modal transportation and focus development and redevelopment in urban areas that are supported by multi-modal transportation facilities that will help to reduce emissions of air pollutants and greenhouse gases.
- Encourage industries to be clean and environmentally responsible.

Water Quality

- Protect drinking water supplies, and associated watershed protection areas.
- Improve water quality of all of our waterways.
- Recognize the connection between land use practices and water quality in decision making.
- Coordinate actions intended to address and meet all appropriate water quality standards.

Stormwater

- Improve stormwater infrastructure and reduce stormwater runoff.
- Encourage low-impact development techniques and practices through land development regulations, education, and incentives.

Vegetation and Biodiversity

- Recognize the benefits of biological diversity and encourage the retention and use of native plants.
- Encourage establishment, maintenance, and replenishment of urban tree canopy in the developed areas, as a means of promoting urban green space, as well as supporting stormwater runoff reduction.

most land in water-supply watersheds was designated rural in order to prevent and reduce pollution and development potential in the Rural Area was restricted. In 1982, the Crozet and Ivy development areas, both located in water-supply watersheds, were further reduced. In 1998, the County adopted a Water Protection Ordinance (WPO) that strengthened stream buffers, updated stormwater treatment criteria, and better connected water quality protection to land use issues. The WPO was amended in 2014 to implement new State stormwater and pollution prevention programs. The County's zoning ordinance has provided flood protection measures since 1980, which were strengthened by the WPO. In 2014, the zoning ordinance was amended to implement new FEMA requirements for protecting floodplains, which are on most major streams in the County.

Partners in Water Resource Protection

Several partner agencies work to help protect and enhance water quality in Albemarle County. Two of those groups are StreamWatch and the Rivanna River Basin Commission. These agencies are valuable assets to the community and help residents and local governments find ways to improve stream health. StreamWatch is a voluntary organization that monitors and assesses Rivanna basin streams and rivers to help the community maintain and restore healthy waterways. Data collected by StreamWatch is regularly sent to the Department of Environmental Quality to help determine the health of streams and change in water quality in Albemarle County and the region. The 2011 StreamWatch report, *Stream Health Follows Land Use*, provided information on water quality and land use correlations in the Rivanna River Basin. A summary of the report is provided in the [Reference](#) Documents of this Plan.

The Rivanna River Basin Commission (RRBC) was formed in 2007, as a result of enabling legislation passed by the General Assembly in 2004. The mission of the RRBC is to provide guidance for the stewardship and enhancement of the water and natural resources of the Rivanna River and its watershed. The four jurisdictions participating in the RRBC are Albemarle, Fluvanna and Greene Counties and the City of Charlottesville. The RRBC conducted a study entitled, *2012 Rivanna Watershed Snapshot*, with an accompanying technical report on methodology which may be found in the [Reference](#) Documents. In addition, the RRBC developed a concept for developing a River Corridor Plan which is also included in the [Reference](#) Documents. This concept and framework will provide useful guidance as the City and County begin developing the plan for the Rivanna River Corridor in the Pantops and Woolen Mills areas. It is further detailed in the [Parks and Recreation, Greenways, Blueways, and Green Systems Chapter](#) of this Plan.

State and federal agencies are also partners in water resource protection and conservation. These groups include the Thomas Jefferson Soil & Water Conservation District, the Virginia Department of Environmental Quality, Department of Conservation and Recreation, the U.S. Army Corps of Engineers and others. A full list of agencies and their responsibilities and activities can be found in the [Reference](#) Documents.

Finally, citizens have been and will continue to be active in stream monitoring, stream clean-ups, and promoting, supporting, and practicing environmental stewardship. Without the help of volunteers, the work to improve the quality of streams could not be done. Two very important citizen based organizations are the aforementioned StreamWatch and the Rivanna Conservation Society. The Rivanna Conservation Society is a volunteer organization whose goal is to safeguard the ecological, recreational, historical, cultural, and scenic resources of the Rivanna River and its tributaries. StreamWatch is the Rivanna Watershed's local stream monitoring organization.

Surface Water

Surface water includes streams, rivers, lakes, and reservoirs. In Albemarle County, surface water flows into three major tributaries of the Chesapeake Bay. Over ninety percent (90%) flows through the Rivanna and

Hardware Rivers into the Middle James River basin while small portions of northeast Albemarle drain into the York and Rappahannock basins.

Each major river basin contains several smaller river watersheds, and each river watershed contains smaller stream and creek watersheds. For example, the watersheds of the Moormans and Mechums Rivers lie within the South Fork Rivanna watershed. A map of County hydrology is shown in Figure 1. A map showing the major river basins, along with the local watersheds that form their building blocks, is shown as Figure 2. A list of local waterways and their corresponding watersheds can be found in the [Reference](#) Documents for this Plan.

In this area, the health of streams and other water bodies is largely affected by the impacts of land development, as well as by the impacts created by agriculture and forestry. Land development can lead to water resource impacts through soil erosion during the construction phase and permanent increases in stormwater runoff and pollutant discharges. Pollutants in suburban and urban stormwater include grease, oil, sediment, fertilizers, pesticides, heavy metals, and bacteriological contaminants. Stormwater runoff from agricultural sites may contain sediment, heavy metals, bacteriological contaminants, fertilizers, and pesticides. In addition to the impact of introduced pollutants, stream channels are scoured by increased runoff rates and volumes, and reservoirs are filled in with the resulting sediment.

Surface water quality is assessed by the Virginia Department of Environmental Quality (DEQ) using data collected by them and various other organizations, including StreamWatch. The DEQ compares monitoring results to water quality standards required to support the designated uses assigned to each water body. Designated uses include 1) aquatic life, 2) fish consumption, 3) shell-fishing, 4) recreation, 5) public water supply, and 6) wildlife. If the observed water quality values are poorer than the standards associated with the designated use, the water body is considered unable to support its designated use and is deemed *impaired*.

Information on stream impairments was made available recently in a document entitled Water Quality Assessment Integrated Report. The result of this work shows the extent of land development and agricultural runoff on County streams. The DEQ collected data for approximately 412 miles of streams within Albemarle County. (Another 457 miles were not assessed.) Of the streams that were assessed, 137 stream miles (31%) were determined to be healthy, and 274 miles (69%) were determined to be impaired.

The results of the DEQ Report are consistent with assessments throughout the Rivanna River basin conducted by StreamWatch. The 2011 Land Use Study from StreamWatch made use of correlations between stream health and watershed characteristics to predict that approximately 70% of streams within the Rivanna River basin would fail the Virginia standard if formally assessed.

Groundwater

Groundwater flows in pore spaces and subterranean metamorphic and igneous bedrock. It is the source of wells and springs used for drinking water. Wells and springs also provide water for livestock and, in some cases, irrigation of crops. Fractures in bedrock are the usual source of well water, since most wells are cased to the depth of bedrock to prevent surface contamination. Fractures decrease with depth, and most occur within one hundred feet of the top of the bedrock. Very small areas of the County have sedimentary bedrock, which provides a readier supply of groundwater, but which is also more susceptible to contamination than metamorphic and igneous rock fractures.

Groundwater is recharged through ground absorption. It changes over time as a result of precipitation amounts, evapotranspiration, extraction from wells, and discharges into streams or springs. When winter

precipitation is below normal or summer drought conditions occur, shortages may occur in the warmer months when increased inflow to streams causes the groundwater levels to fall. Protection of groundwater supply is best achieved through the protection of land covers, such as forest vegetation, that slows surface runoff and allows water to flow into the ground.

There are many groundwater users in the County, including Rural Area residents, golf courses, quarries, and sites under environmental remediation through the DEQ. Approximately 44% of all homes in the County (18,500 units) rely on well water or springs for household use. Some of these residents are on the 17 public community water systems using wells and springs in Albemarle County. There are also 31 non-community systems that generally support non-residential uses such as campgrounds, schools, and fraternal organizations. Farms and agricultural operations also rely on groundwater. For these reasons, it is critical to protect groundwater quality and quantity for the health and welfare of the population. In 2004, the County added a section to its Water Protection Ordinance to require preliminary studies to assess groundwater availability and related factors for new or enlarged development projects that use wells.

The last update of the Natural Resources Chapter of the Comprehensive Plan had extensive recommendations for groundwater protection. From those recommendations, the County developed a requirement for well reports in order to help build a database of groundwater information. The information continues to be required and wells are mapped and shown on the County's GIS web application.

Water Resources that Flow Through the County

Water resources flow from and through the County, and for that reason, Albemarle County practices stewardship for others. The County's surface and groundwater are connected hydrologically (through surface water and groundwater) to the City of Charlottesville, Greene County, Fluvanna County, Nelson County, Louisa County, Orange County, and the rest of the Chesapeake Bay watershed. As seen in Figure 1, the North Fork of the Rivanna River, the Rockfish River, and the James River all originate outside of the County but flow into and through Albemarle County. The Doyle's River, Moorman's River, South Fork of the Rivanna River, the Hardware River, and the Rivanna River all originate in the County and flow southeast. This fact puts a high level of responsibility on the County to keep those stream and rivers free from pollutants.

Strategy 1a: Continue to apply the Watershed Protection Ordinance throughout the County to help protect and preserve water resources.

The County's primary legal mechanism through which the County implements water resource protection programs is the Water Protection Ordinance (WPO). Adopted in 1998 and recently amended and recodified, the WPO is intended to:

- Implement the State mandated stormwater management program;
- Implement the State mandated erosion and sediment control program;

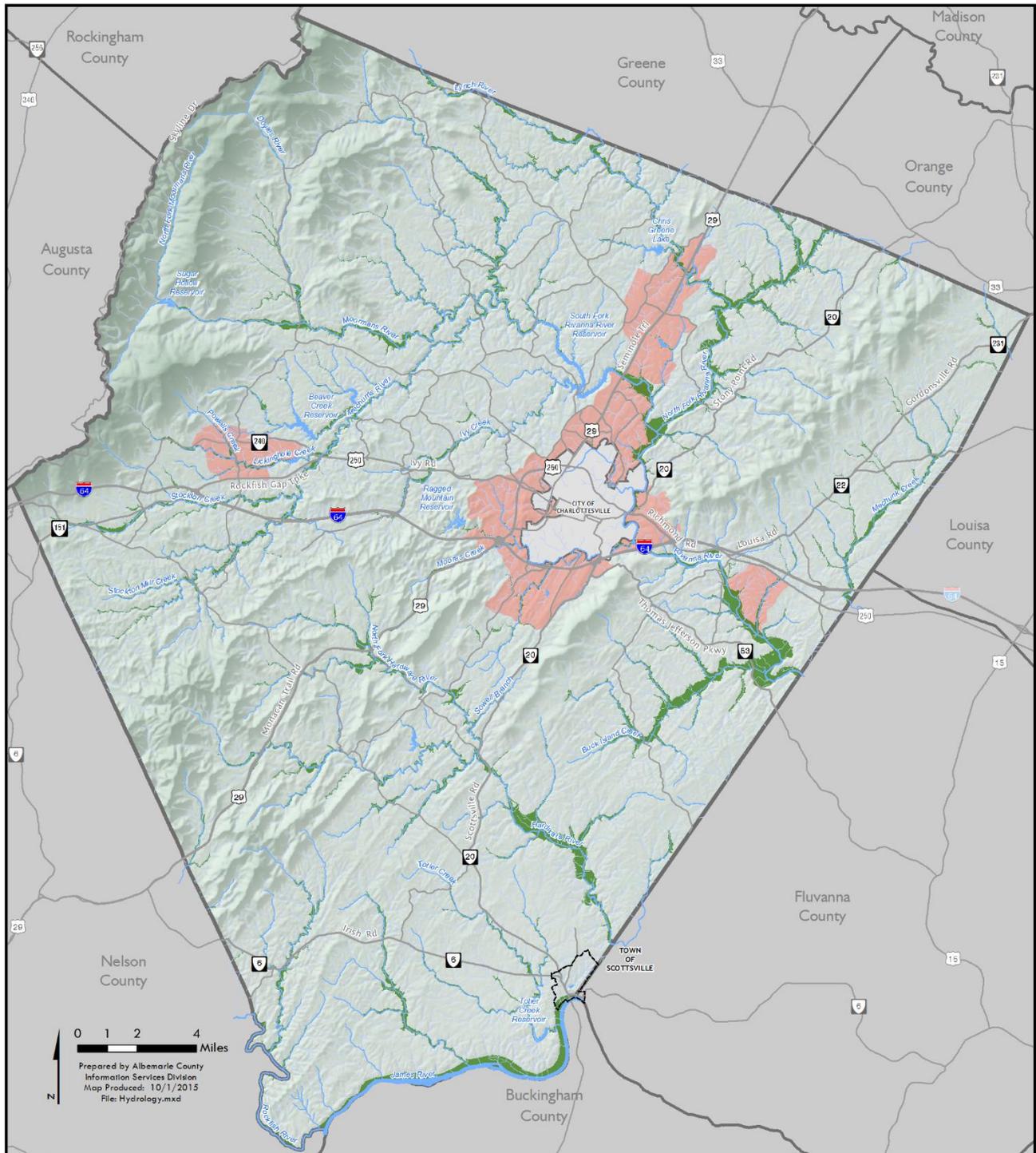


Figure 1: Albemarle County Hydrology



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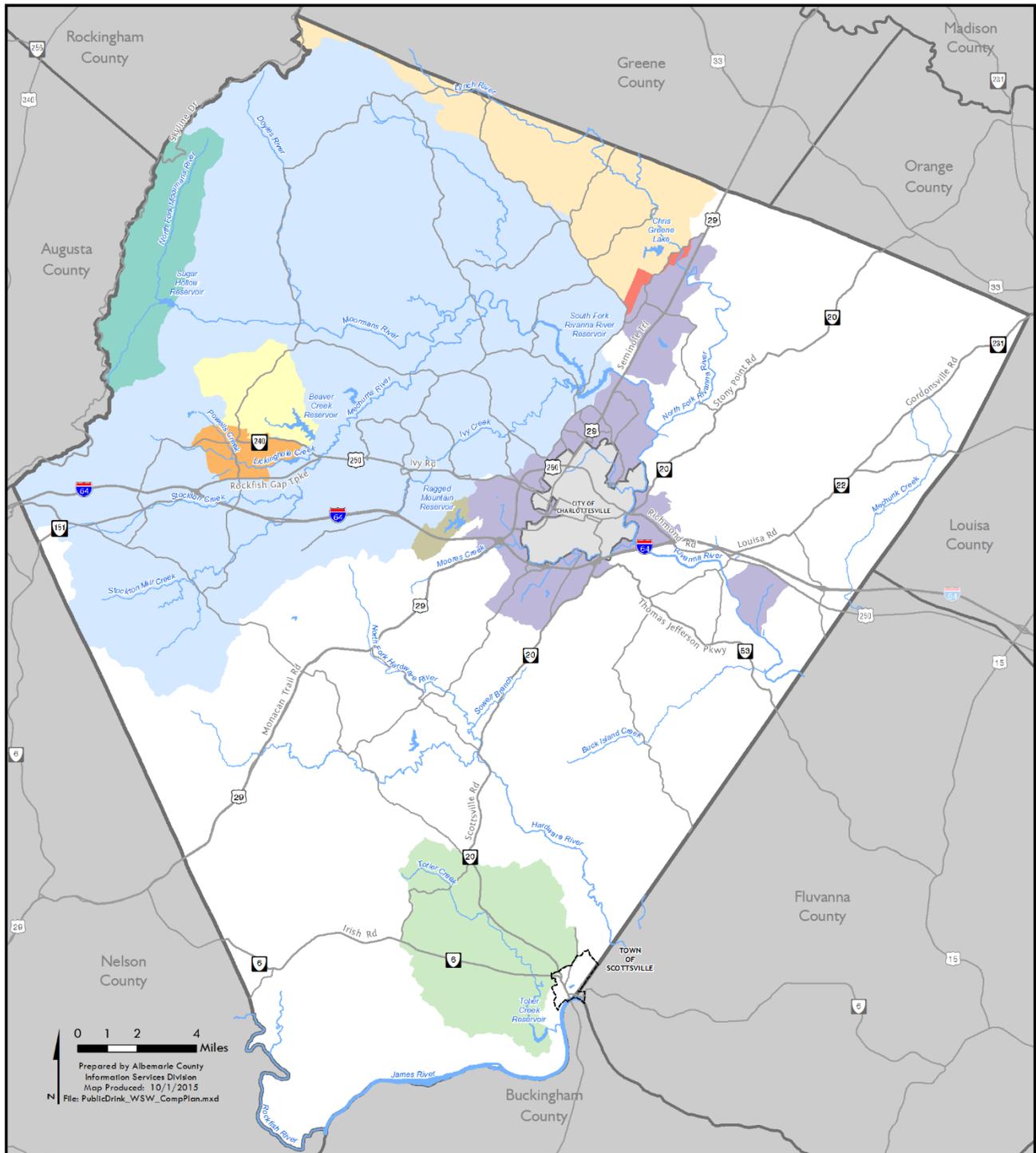
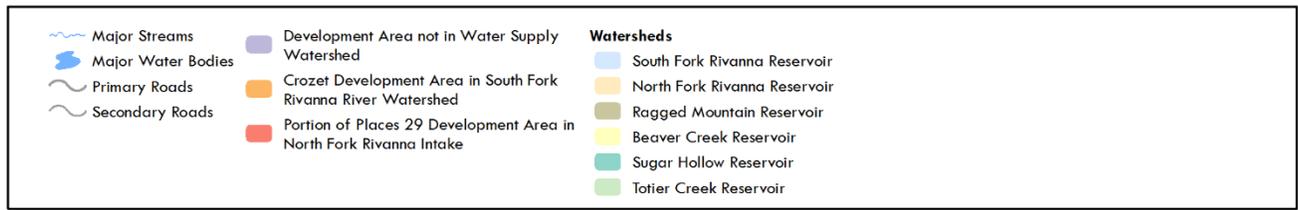


Figure 2: Major River Basins and Watersheds to Public Water Supply



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- inhibit the deterioration of State waters resulting from land disturbing activities; protect the safety and welfare of citizens, property owners, and businesses by minimizing the negative impacts of increased stormwater discharges from new land development and redevelopment;
- protect against and minimize the pollution and eutrophication of public drinking water supplies resulting from land development;
- control nonpoint source pollution, erosion and sedimentation, and stream channel erosion;
- maintain the integrity of existing stream channels and networks for their biological functions, drainage, and natural recharge of groundwater;
- protect the condition of State waters for all reasonable public uses and ecological functions;
- provide for the long-term responsibility for and maintenance of stormwater management facilities and other best management practices;
- regulate the discharge of pollutants into storm drainage systems and State waters by prohibiting illicit discharges and connections and the dumping of refuse and pollutants;
- facilitate the integration of stormwater management and pollution control with other County ordinances, programs, policies, and the comprehensive plan; and
- promote the long-term sustainability of groundwater resources.

Future changes to the ordinance may be needed if, after development of a comprehensive water resources plan, additional measures prove necessary for water resource protection.

Strategy 1b: Prepare, submit, and implement a Watershed Implementation Plan to control stormwater pollution, as required by the State.

As part of recent State and regional efforts to address stormwater pollution and impaired waters, the County has been delegated the responsibility to implement several new or enhanced programs. These include additional regulatory responsibilities under a delegated Virginia Stormwater Management Program (VSMP), updates to programs implemented under a State permit issued to operators of Municipal Separate Storm Sewer Systems, or MS4s, and programs to reduce the discharge of pollutants to impaired waters (discussed below). Each of these programs will require significant new resources and, as evidenced by the significant changes to the Water Protection Ordinance, effective in July 2014.

The DEQ is required to prepare plans to restore all impaired State waters through a process commonly referred to as a TMDL. This acronym stands for “Total Maximum Daily Load”, which is the maximum pollution amount a water body can assimilate over a given time period while still remaining healthy. However, the term TMDL is more often used to describe the entire analytical and planning process for assessing and restoring a water body. The process includes identifying impaired waters as described above, determining the pollution limits for these waters, and developing an implementation plan to reduce pollution loads to the determined limits. TMDL implementation plans – commonly called “watershed implementation plans” (WIPs) – typically include an allocation of pollution loads and reductions to each contributing watershed or source.

In addition, Albemarle County must also contribute to regional WIPs, such as the Chesapeake Bay cleanup plan. After 25 years of failed attempts to restore the Bay, the Environmental Protection Agency (EPA) was prompted to utilize the TMDL process to address impairments caused by excessive sediment, nitrogen, and phosphorus. As part of this process, Virginia, along with five other states and the District of Columbia, was required to develop a Statewide WIP for the Chesapeake Bay watershed. Ultimately, the responsibility for restoring impaired waters is delegated down to local governments and

other permitted dischargers of pollutants. Albemarle has been mandated the responsibility to prepare and submit detailed action plans specifying how the County will achieve allocated pollutant reductions associated with TMDLs, including those for local streams and the Chesapeake Bay watershed.

Strategy 1c: Develop and implement a comprehensive water resources plan that sets expectations for quantity of public water supply, surface water protection and improvement, and groundwater protection.

The County has put together several different water protection programs over the last 16 years. These programs have been expanded in response to a growing population, which has additional impacts on this limited resource. With recent actions by the County to take over maintenance of more stormwater management facilities, build regional basins, and implement higher standards set by the State, the need for a County-wide comprehensive resource plan has become apparent. Development of such a plan would allow programs to be more coordinated and prevent overlap of responsibilities. A comprehensive water resources plan should address:

- expectations for water quantity and drought response;
- groundwater quality;
- expectations for water quality for all streams in the County;
- stream restoration needs and strategies;
- coordination with other water resource agencies and collaboration on programs;
- coordination of different County programs; and
- implementation including public education on water issues.

It is extremely important that this plan be done soon as State-mandated TMDL Action Plans will include many of these same elements.

Expectations for Water Quantity and Drought Response

A firm set of expectations is needed for how the County should deal with surface water supply and whether and how conservation activities can impact groundwater supply. The County, City, and UVA are tasked with ensuring a sufficient public water supply for current and future residents through the Rivanna Water and Sewer Authority (RWSA). The 2011 Water Resource Plan adopted by RWSA provides detailed information on sources of water, as well as information on water conservation and drought response programs. The County's water resource management plan should take into account the important role these agencies play in ensuring a sufficient supply of potable water to the community. More information on drinking water supply can be found in the [Community Facilities Chapter](#) of this Plan.

Groundwater Quantity and Quality

Over one-third of County residents rely on wells for domestic water, making the protection of this water source very important. However, protecting groundwater quantity is a more difficult task than ensuring a clean and plentiful public water supply. Groundwater in Albemarle is not part of an "underwater stream" nor is it located in an aquifer. Water flow below the surface takes place through rock fractures and wells must be drilled fairly deep into the bedrock before a reliable location is found for drawing water to the surface. These wells have the potential for contamination from failing septic systems as well as reduction in yield. Decision-makers, residents and future residents need to know the limitations of the igneous and metamorphic rock formations to provide for a reliable well water supply to support residents who choose to live in the Rural Areas. Clear information on the limitations of local groundwater

supplies can guide future landowners' decisions and can help the County to make better land-use planning decisions.

Groundwater quantity can be monitored through collecting and analyzing well drillers reports. In addition, obtaining information from test wells in the County will help to gauge changes over time in groundwater level. It is not always clear why wells sometimes see a reduction in yield. However, in general, groundwater-supply protection can best be achieved by protecting land cover (such as forest), which allows for more recharge and avoiding impervious land cover that prevents recharge. Groundwater quality can be monitored through well testing and analysis of well reports can also provide information on changes in water quality. The water resource management plan should address ways to assess the potential impacts to groundwater resources from the practice of hydraulic fracturing (fracking).

Some water quality issues that can show up in an analysis of well water are the effects of septic waste, pollutants from underground storage tanks, or naturally occurring metals in the ground. A recent water quality issue that has been of interest is the relationship between use of alternative septic systems and the rate of residential growth in the Rural Area. Although alternative septic systems were not allowed in the Rural Area until recently, changes to the Virginia State Code make this option available, which could increase the number of Rural Area properties developed residentially. If there is a strong relationship, discussion is needed on whether this issue warrants requests for changes from the General Assembly.

Expectations for Stream Quality for all Albemarle County Streams

Another aspect of a comprehensive water management plan should deal with pollution prevention and water quality improvement. New State stormwater requirements for dealing with stream impairments are discussed in Strategy 1b; however, the comprehensive water plan should set quantified goals for water quality, carry out implementation measures designed to achieve those goals, and continue monitoring water quality to evaluate the effectiveness of those measures. Historically, the County has set higher standards than those required by the State. The extent to which the County wishes to clean up streams, restore stream banks, and provide assistance to landowners should be clearly stated. If the County's goal is to exceed State requirements, the level to which it wants to improve stream health must be identified so that programs and staff can be put in place to accomplish this goal.

Stream and Stream bank Restoration and Strategies

Most streams in the County flow through naturally erosive soils and have been impacted by agricultural and land development uses over many years. Stream bank erosion and steeply cut banks are a common sight. These eroded stream channels are another source of sedimentation to downstream waters.

A stream restoration program could work to reverse some of the damage caused by previous generations and existing development. In turn, this would prevent further damage and sedimentation. Such a program would develop a system for identifying candidate streams in need of stream bank and channel reconstruction or improvement, together with watershed strategies to protect such streams in the future. Program implementation strategies would include schedules, funding, restoration types, permitting, staffing, and other considerations.

Coordination with Other Water Resource Agencies and Collaboration on Programs

As shown in the Reference Documents, at least 20 different regional, State, and federal agencies have a role in or responsibility for water quality in Albemarle County. It is important that the water resources plan recognize the importance of collaboration with these agencies to share and receive data and coordinate activities. In addition, working with the City, UVA, and other local stakeholders will be

important in restoring impaired streams and waterways and protecting healthy ones, as well as addressing new State stormwater mandates. Data collection, sharing, maintenance and use of information should be an integral part of the collaborative work. Other issues that can be coordinated include groundwater quality and quantity, underground storage tank investigations, and septic systems.

Coordination of Different County Programs

A comprehensive water resource management plan can help identify opportunities to better coordinate the various programs implemented by the County. At present, the Departments of General Services and Community Development are responsible for the majority of water protection-related functions at the County. Through the authority of the WPO, Community Development is responsible for ensuring that land development and other land disturbing activities minimize impacts on water resources and other natural resources. Programs include erosion and sediment control, stormwater management for new development, stream buffer and floodplain protection, and groundwater management. General Services is responsible for various programs designed to minimize or reduce the water resources impacts of existing land uses and activities and of County operations. These programs include planning for and implementing plans to address impaired waters and illicit discharge elimination, long-term maintenance of County-owned stormwater management facilities, and public education. In the Development Areas, General Services has undertaken capital projects such as construction of the Woodbrook lagoon and the Crozet stormwater basin south of downtown to address drainage and water quality issues. General Services also ensures that the County remains compliant with dam safety regulations. There is significant overlap in responsibilities and involvement between staff of these and additional County departments. A water resources management plan could facilitate more effective organization and collaboration between departments and result in more successful implementation of these programs.

Implementation of the Plan

The success of a water resources protection program is dependent on the level and effectiveness of implementation. Implementation includes education, testing, verification, enforcement of design requirements, enforcement of mandatory construction practices, proper long-term maintenance of constructed facilities, finding and correcting violations, investigating complaints, documentation, and reporting. Sometimes program and environmental benefits can be best realized through increased implementation via funding, staffing, policy changes, or other means, rather than additional studies and regulation. This should be a consideration for future water resource efforts.

Strategy 1d: Educate the public on how they can help with water resource protection.

The RW SA plans for and manages drinking water supplies in the City of Charlottesville and Albemarle County. Water conservation is promoted through the Authority as well as the ACSA. More information on drinking water supply can be found in the [Community Facilities Chapter](#) of this Plan.

Not all landowners and residents are aware of how their actions, or inaction, affect water. Educational programs for the public are needed and should be included in a water resource management plan. The ACSA and RWSA have roles to play in water conservation education; however, the County should also take a role in this endeavor. The community's need for information on water conservation, stream buffer protection, well testing, and groundwater protection is great.

An important piece of education will be helping the public understand the distinctions between pervious and impervious cover. Impervious cover affects runoff. Since surface water and groundwater are interconnected systems, the quality and quantity of one is interdependent on the quality and quantity of the other. The public can help protect and improve water quality by understanding how land use

and development can work with natural processes to minimize impacts on streams and groundwater. This includes reducing impervious cover and incorporating design features that consider runoff quantity and quality, the integrity of natural stream channels, and aquatic habitats. Another aspect of public education will involve coordination with State agencies to encourage development and transportation design that reduces impervious cover, and that minimizes, by design, adverse impacts on water resources.

Also important is education on the significance of having septic systems pumped regularly, well testing, and wellhead protection measures to help prevent public health problems. Programs for land developers on different design options can help them to better work with natural processes to minimize, by design, impacts on streams and groundwater. This includes designing features that reduce runoff quantity and improve runoff quality, improving the integrity of natural stream channels, and promoting robust aquatic habitats. If successful, these education programs can also help the County meet its goals for pollutant reduction in Albemarle's rivers and streams. Volunteers in the community, such as StreamWatch, Rivanna Conservation Society, the James River Association, Envision the James, the Alliance for the Chesapeake Bay, and the Chesapeake Bay Foundation should continue to play an important role in spreading the word on ways to protect water resources.

Strategy 1e: Secure funding for water resource management programs.

Funding for water resource management programs is essential to their success. At present, the County is considering a stormwater utility fee to help pay for the higher level of environmental protection required by the State. Grants are available from different State and federal agencies to help with specific projects, such as stream bank restoration. Coordination with the Parks and Recreation Department on greenway development can also open more opportunities for grant money. The water resource management plan should help to identify other sources of funding to help decision-makers with budget decisions as it moves the County forward.

Strategy 1f: Continue to allow and manage recreational uses of drinking water reservoirs and adjacent public land only as incidental uses to the primary function of water supply and in such a manner as to prevent cumulative impacts that may impair the primary function.

Because many of the County's large lakes are reservoirs for the public water supply, maintaining their quality is essential to public health. Several of the reservoirs allow for minimal recreational use, which is described in the [Parks and Recreation; Greenways and Green Systems Chapter](#) of this Plan. Given the importance of clean drinking water to the community, only those recreational uses that do not impair water quality should be permitted in these areas. Details on preservation strategies for public water supply reservoirs are found in [Chapter 11](#).

Objective 2: Protect air quality.

Many things affect air quality including emissions from combustion of fossil fuels, animal generated gasses, and other vapors emitted as a result of energy use. Emissions that contain sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead or particulate matter can injure health, harm the environment, impair visibility of scenic resources, and cause property damage. The Virginia Department of Environmental Quality (DEQ) monitors and regulates air quality at the State level. The DEQ also prepares and distributes an annual ambient air monitoring data report where information on air quality in Albemarle can be found. The monitoring site is at Albemarle High School on Hydraulic Road. More information on air quality in Albemarle County and Virginia may be found in the [Reference Documents](#).

Strategy 2a: Help protect local and regional air quality by reducing the County's carbon footprint and by promoting alternatives to single-occupancy vehicles, such as walking, bicycle use, ride-sharing, and public transit services.

Local air pollution in the form of greenhouse gases comes mainly from the combustion of fossil fuels from the transportation sector. For many years, air quality in Albemarle County has been in the Good to Moderate Category. In general, this means air is healthy for all populations. More information on this strategy may be found in [Chapter 10 – Transportation](#).

Figure 3: Charlottesville Albemarle Daily Air Quality Index 4/2008-12/2012

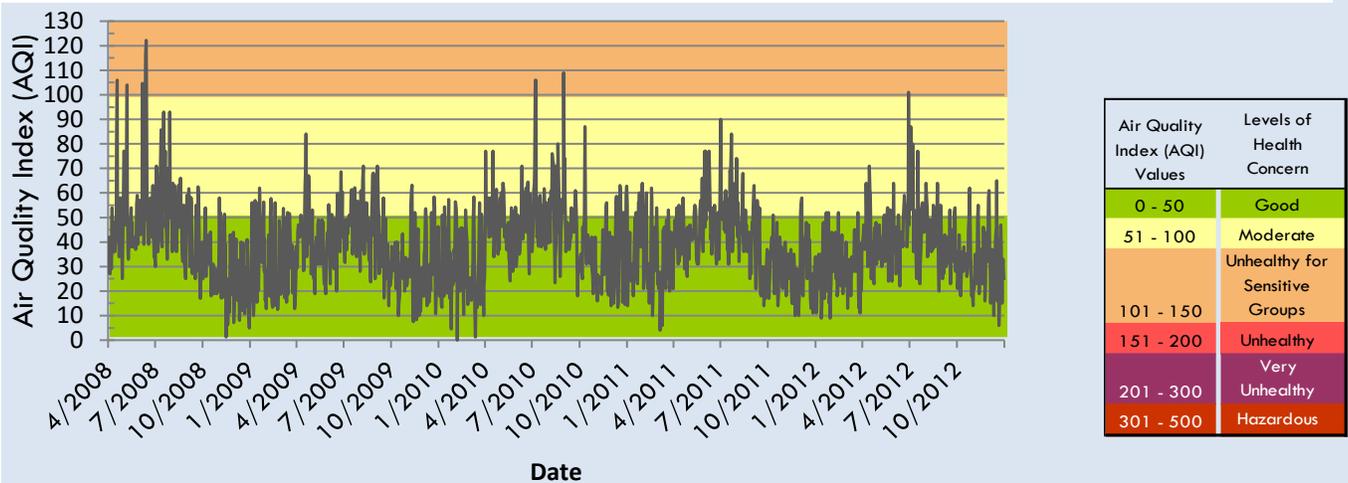


Figure 3 shows that the County is beginning to have days of air quality that are categorized as “Unhealthy for Sensitive Groups.” More than three days in one year of measured air quality in this category will bring the County into “nonattainment.” In nonattainment areas, additional planning requirements are needed which can include examining baseline emissions levels to determine necessary control strategies, examining transportation needs for future growth, and, if necessary, creating plans for EPA review and approval to bring the area into attainment with the air quality standards. The extent of the planning requirements depends greatly on the classification of the nonattainment area and the severity of the air pollution problems. Air quality can be maintained or improved by a variety of activities, such as protection of forests and wooded areas, promotion of efficient land use configurations, ridesharing, public transit, bicycle and pedestrian facilities, and energy efficiency in buildings. The County can be a leader in this area by promoting and supporting these activities. As a start, Albemarle County government adopted an [Environmental Management Policy](#) in 2004 committing the County to pollution prevention and continual environmental improvement in its own facilities and services. Since 2007, County government has reduced its energy consumption by 30%.

Objective 3: Recognize the economic value of the County’s mineral resources while giving due consideration to the potential harm mineral extraction activities and byproducts can have on human health and property values.

The County’s geology is made up mostly of metamorphic and igneous rocks. Soapstone, iron ore, slate,

clay, sandstone, and limestone have all been quarried in the past. Other minerals known to exist in Albemarle are amethyst, asbestos, barite, copper, feldspar, garnet, gold, limonite, hematite, and pyrite. The geologic features are important because they underlie the mountains and because they affect groundwater. At present, natural gas has not been found in Virginia outside of a small area in the southwestern part of the State. However, if natural gas ever were to be discovered in Albemarle County, extraction would not be appropriate due to fracking and its potential impact on water resources.

Strategy 3a: Provide educational materials to owners of properties in the Natural Resource Extraction Overlay District about geological assets and limitations on extraction in the Rural Area.

The Natural Resource Extraction Overlay District is a zoning district that allows for mineral extraction in areas where the extraction will not conflict with adjacent land uses. Additionally, the quarrying must be carried out without adverse effects on other environmental resources or living systems, or to public health, safety, and welfare. Property often changes hands without new owners fully understanding the assets of and limitations on their purchase. New property owners may not be aware of their own mineral rights or mineral rights leasing. Alternatively, they may be aware and ready to extract those resources without understanding the County's requirements. For this reason, educational materials should be prepared and distributed to owners of those properties on geological assets and limitations of the Rural Area. In addition, the County should study other ways to help inform owners of the need to find out about mineral rights on their properties. One possibility might be to require that a prominent disclosure statement regarding leased mineral rights be indicated on preliminary and final plats.

Objective 4: Protect the biological diversity and ecological integrity of the County in both the Rural Area and Development Areas.

Biological diversity, or “biodiversity” for short, has been defined as “the diversity of life in all its forms, and at all levels of organization” (Hunter 1996). While there are numerous ways to think about how life and all organisms are organized, the most common ways of viewing biodiversity include species diversity, genetic diversity, and ecosystem diversity. Biodiversity is sometimes described as the totality of genes, species, and ecosystems of a region.

The health of biological systems is often indicated by the amount of native variety they contain. Native species have evolved to live in their current habitats and, generally, the more diverse a system is, the healthier it is. The breadth of species creates strength for all species; when a species is lost, it signals a change that may affect all species.

Biodiversity is important to human populations for numerous and diverse reasons. In a narrow but critical sense, we depend on the services that ecosystems, and the living things found in them, provide. Ecosystem services refer to the many benefits that humans receive, at no direct economic cost, from natural environments and functioning ecosystems. Some essential ecosystem services include purification of air and water, pollination of crops and natural vegetation, generation and renewal of soil and fertility, and mitigation of floods and droughts. Healthy, functioning ecosystems provide many other benefits and also contribute greatly to the quality of life of County residents.

Protection of biodiversity is important in both the Development Areas and the Rural Area. Because the quantity of resources is much greater in the Rural Area, most of the efforts in protecting biodiversity are focused there. However, Development Areas are very important for conserving biodiversity. They are home to a number of key species and ecosystems. Preservation of environmental corridors, such as those

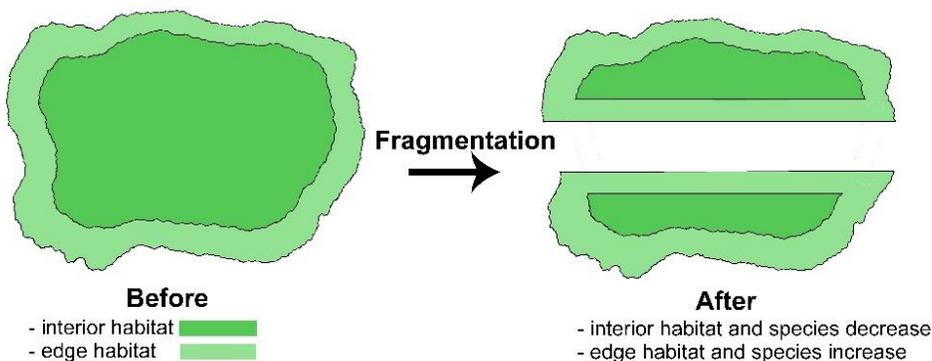
shown on Parks and Green Systems plans in Development Area Master Plans, helps to maintain biodiversity in the Development Areas. Equally important is the preservation of wooded corridors that extend from the Rural Area into the Development Areas. Developing and maintaining a diverse, connected urban forest can provide important biodiversity resources as well as many other environmental and societal benefits.

There are a variety of threats to biodiversity, ranging from the local to the global scale. An ongoing threat in Albemarle County and beyond is habitat fragmentation. When large patches of habitat are fragmented into smaller areas, species dependent on large “interior” habitats or large ranges cannot survive.

As shown in Figure 4, which depicts the potential results of a new road or utility right-of-way being constructed, the amount of interior habitat is reduced, minimizing area for food, cover, and movement. This negatively impacts many wildlife species found in the County that rely on interior habitat. Examples include forest interior breeding birds, such as the cerulean warbler and scarlet tanager, that are harmed by nest predators and nest parasites that are common in edge habitat. Some amphibians are also impacted by the loss of interior habitat, including the red-spotted newt and eastern red-backed salamander.

Figure 4 also illustrates that the overall amount of habitat is often reduced by fragmentation. Species that require large areas of habitat, such as the bobcat and river otter, may be negatively impacted. The increase in edge habitat often benefits many commonly occurring species, such as white-tailed deer, raccoon, and opossum. While these and other common species are important components of biodiversity, they can present problems too. Vehicle-wildlife collisions are perhaps the most serious issue. The County and its residents can work closely with agencies and County partners, such as Virginia Department of Game and Inland Fisheries, in reducing human-wildlife conflicts.

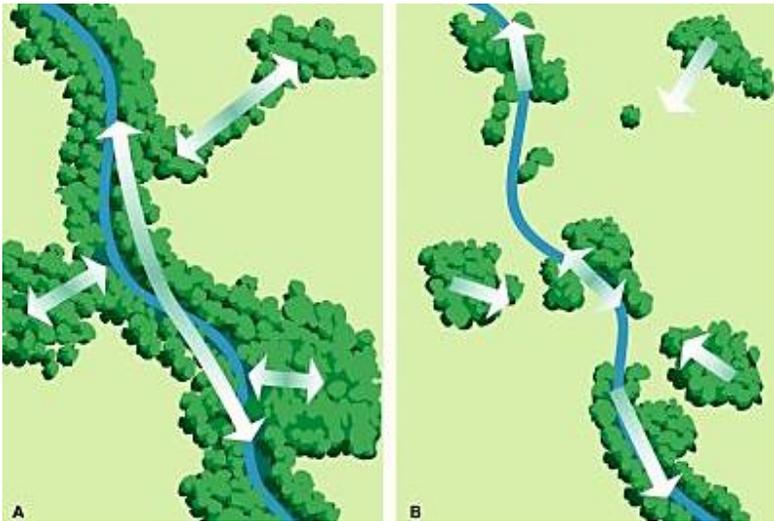
Figure 4: Illustration of Habitat Size and Fragmentation



Fragmentation also reduces viability for species. Loss of safe passages between habitats (shown in picture B of Figure 5) prevents species from reaching needed habitats or recolonizing habitats that have lost those species. Connectivity of habitat is critical for healthy, functioning ecosystems.

Subdivision of parcels into smaller parcels is conceptually distinct from habitat fragmentation and has been referred to as “parcelization” (Downing 2016). However, parcelization often leads to habitat fragmentation. Parcelization and subdivision of land can result in the size and/or shape of parcels that are generally usable only for residential purposes, thus complicating land management for forestry, agriculture, or conservation.

Figure 5: Illustration of Habitat Range and Connectivity



A: A well connected landscape. B: A poorly connected landscape.
Source: Federal Interagency Stream Restoration Working Group (FISRWG)

Conversion of wildlife habitat to land uses that remove the key elements for survival result in many fewer native species and pose the greatest threat to biodiversity. As discussed in the Rural Area Chapter (page 18), there is potential for much residential development in the Rural Area, which could negatively affect biodiversity.

Aquatic habitats are also degraded by soil erosion when land is cleared for development. As a result, aquatic life declines and affects the health of rivers and streams. Any effort to protect the quality of ecosystems must include both terrestrial (land-based) and aquatic (water-based) ecosystems.

Strategy 4a: Implement an Action Plan for Biodiversity that includes protection of significant areas of biological importance in the County.

The Natural Heritage Committee (formerly the Biodiversity Committee) was appointed by the Board of Supervisors in 2005 to create and maintain the County's Biodiversity Assessment, advise the Board of Supervisors, the Planning Commission, and County staff on applying biodiversity information to land-use decision-making, and support biodiversity education in the County. Their mission is to help maintain and restore the County's native biological diversity and provide a healthy environment for the citizens of Albemarle County.

After adoption of the 2015 Comprehensive Plan, County staff worked with the Natural Heritage Committee to develop a Biodiversity Action Plan which is included in the [Reference Documents](#) section of this document. Included as Reference Documents and part of the plan are an Executive Summary, Appendices, and maps. The Biodiversity Action Plan builds upon work conducted by the Biodiversity Work Group from 2002-2004. The work group was created as a temporary body and developed a biodiversity report for Albemarle County in 2004. That report, a summary report, and appendices are also available in the Reference Documents section.

The Biodiversity Action Plan (BAP) provides both a broad overview and detailed information about biodiversity in the County. A key component of the plan is a spatial analysis of the Albemarle County landscape and the habitat it contains. Figures 6, 7, and 8 illustrate some of the data, analysis, and results of the plan. These figures correspond to Maps 1, 2, and 4 respectively in the BAP.

The BAP affirms the need to minimize and reduce habitat fragmentation County-wide by maintaining existing habitat connectivity. It promotes establishing new connectivity where possible and appropriate. It identifies non-native invasive species and climate change as significant threats to biodiversity both locally and on grander scales. It builds and expands upon recommendations in Objectives 1, 5, and 6

of this Chapter that call for protecting and preserving water resources, retaining mountain resources, retaining and improving land cover near rivers and streams, and protecting wetlands. The BAP also highlights the need to restore impaired or degraded ecosystems. Returning these systems to better health and functionality is often possible and a very important conservation tool.

The BAP should be reviewed and updated on a regular basis to account for changing conditions and to incorporate new knowledge and data. The BAP was intended to cover a five year period and should be reviewed and updated as needed in 2023.

The strategies that follow provide specific ways to protect and conserve biodiversity in Albemarle County. Since most of the County land is in private ownership, a strong community-based stewardship approach toward the County's natural resources will be a tremendous asset in effectively implementing the strategies.

Strategy 4b: Use existing tools (e.g., conservation easements), develop strategies, and implement new conservation programs to protect lands in the three conservation focus areas, other conservation targets (e.g., examples of the five key ecosystems described below, large forest blocks or other intact, important habitat), and lands that can serve as habitat corridors or connections among important habitat areas.

The BAP identifies three areas of the County that are rich in biodiversity and have significant conservation value (see Figure 8). Conserving lands and resources within the three focus areas – Northwestern Albemarle, the Southern Albemarle Mountains, and the Rivanna River Corridor - prioritizes efforts and should maximize conservation effectiveness. There is significant potential for enhanced conservation through good stewardship and land management in these focus areas. The total acreage of the areas is approximately 156,539 acres. Approximately 12% of the land is publicly owned, approximately 88% is in private ownership, and approximately 20% of the privately owned land is under conservation easement.

Five types of ecosystems are also identified as key for conserving biodiversity: 1) forests, 2) outcrops, bluffs, and other xeric habitats, 3) relict Piedmont prairies and grasslands, 4) rivers, streams, and riparian areas, and 5) wetlands. While not as widely recognized as some ecosystems, the biological importance and historical significance of Piedmont prairies and grasslands have become better studied and understood in recent years.

These five ecosystems may be important conservation targets regardless of their location. That is, they do not need to be located within the conservation focus areas to merit protection. Similarly, lands that can connect areas of habitat may be important conservation targets regardless of location in the County. In addition to their importance as habitat, rivers, wetlands, and other water features form key connectors that aquatic species, birds, and other wildlife use to move through the landscape. Protecting riparian and wetland areas is very important in supporting healthy, functioning ecosystems and providing good water quality.

The County's conservation easement programs, Acquisition of Conservation Easements (ACE) and Albemarle Conservation Easement Authority (ACEA), can be effective tools for helping conserve biodiversity. In addition to revising the criteria for these programs to include biodiversity values (as stated in Strategy 4e of this chapter), these programs should be strengthened. This is consistent with Strategy 5d of this chapter and Strategies 2b, 2d, 2e, and 2f of the Rural Area Chapter.

Other land and resource protection tools should be investigated for use in Albemarle County. For example, a Transfer of Development Rights (TDR) program should be investigated as a possible method for conserving biodiversity. Lands within the three conservation focus areas and other identified conservation targets could be the focus of TDR programs. Researching a TDR program that is appropriate for Albemarle County is consistent with Strategies 1a and 2g of the Rural Area Chapter.

Strategy 4c: Protect and conserve natural resources on County-owned land to enhance biodiversity.

Public lands and the ways they are managed play an important role in protecting open space, wildlife habitat, and biodiversity. Several land management practices, if implemented consistently on County-owned land, will contribute to enhancing biodiversity. Examples include controlling non-native invasive species, using locally native plants in landscaping, promoting natural plant communities on site when possible (e.g., establishing native grassland habitat in place of turf or large lawn areas), maintaining wide riparian buffers along waterways, and reducing stormwater runoff.

County parks in particular should play a critical role in conserving biodiversity. Many parks contain examples of the five highlighted ecosystems, and several current and future County parks occur within or near the conservation focus areas. If managed properly, parks can conserve large, intact areas of forest and other habitat types. Management plans for the parks should include strategies to conserve and enhance biodiversity. Simple examples include controlling access to sensitive areas, designating specific locations for non-disturbance (e.g., reducing areas maintained by mowing), and using boardwalks and signage to limit access to sensitive areas while providing unique educational opportunities. Where possible, prescribed burning can be used to promote biodiversity.

Strategy 4d: Preserve existing vegetation in areas shown as Parks and Green Systems on Development Area Master Plans.

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Strategy 4e: Revise criteria for ACE (Acquisition of Conservation Easement Program) and ACEA (Albemarle Conservation Easement Authority, formerly the Public Recreational Facilities Authority) easement applications to more accurately identify biodiversity resources and conservation needs.

Conservation easements typically restrict development and protect agricultural, scenic, historic, and aquatic resources. They could be more effective at protecting specific habitat areas. While recognizing the value of biodiversity, current criteria for assessing biodiversity on ACE properties are limited in scope, with biodiversity data coming into play on a very limited basis. The criteria should be revised to include additional information and data sources, including BAP data. Improved criteria will allow biodiversity to be more easily considered in evaluating properties for ACE easements. For all County-held easements, terms and language need to be developed that provide effective methods for permanently protecting specific habitat areas that support biodiversity.

Strategy 4f: Evaluate opportunities and take steps to conserve and protect high priority Important Sites in the County.

Important Sites are defined as “locations of special plant communities, unusual habitats, or species rare to scarce in the County.” An initial list of Important Sites was developed by the Biodiversity Work Group in 2004. The Natural Heritage Committee (NHC) has maintained and revised the list in the ensuing years. Appendix C of the BAP provides descriptions of all 53 sites and a list of the 24 high priority sites. Map 3 of the BAP shows generalized locations of the sites.

The Important Sites represent significant opportunities for good stewardship, land management, and enhanced conservation of lands in the County. The total amount of land in the 53 sites is approximately 30,543 acres. Of this total, approximately 7% is public land and 93% is in private ownership. Approximately 23% of the privately owned land is under conservation easement. One of the 53 Important Sites is a landscape scale area of 21,588 acres. If this very large landscape scale site is not included, the remaining 52 sites represent a smaller area of approximately 9,786 total acres. They are comprised of approximately 21% public land, 79% privately owned land, and 30% of the privately owned land is under conservation easement.

Important Sites were evaluated based on their conservation value and the potential for conservation action that can be taken in the five years following completion of the BAP. The NHC intends to serve as an advocate for thirteen of the sites, working with landowners and local residents to raise awareness about them and discuss options for appropriate management and protection. Based on pending actions, the County is well positioned to positively influence activities and land management at nine Important Sites, and should take lead responsibility for them. The pending actions include development of new County parks, joint planning with the City of Charlottesville and Thomas Jefferson Planning District Commission on a Rivanna River corridor, and updating the Pantops Master Plan. The County and the NHC should share responsibility for two Important Sites. One site is adjacent to a future County park. The other site is within the Shenandoah National Park.

Strategy 4g: Encourage the use of locally native plants in landscaping to protect and provide habitat for native biodiversity, to save water, and to connect landowners to the local ecosystem.

The term “locally native” refers to plants that are native to the central Piedmont region of Virginia. The use of locally native plants in landscaping, land management, and development projects is important to protect native biodiversity against invasive species, to save water compared to plantings not

adapted to the local climate, to provide additional habitat for native species, and to help connect residents to the local ecosystems. In 2012, Albemarle County Department of General Services (since renamed Facilities and Environmental Services) staff developed a native plants database and currently strives to plant at least 80% native plants in County projects. Community Development Department staff should also promote use of native plants in conjunction with the site development process.

Strategy 4h: Collaborate with resource management agencies, partners, and landowners to manage non-native invasive species to reduce their impacts and limit their spread.

The threat that non-native invasive species pose to biodiversity, agriculture, forestry, and other concerns is widely documented and accepted. Numerous state and federal agencies, nonprofit groups, and other organizations are actively engaged in trying to manage the threat. Examples include the Virginia Department of Forestry, Virginia Department of Conservation and Recreation, Blue Ridge PRISM, Thomas Jefferson Soil and Water Conservation District, The Nature Conservancy, and the Virginia Native Plant Society. Efforts on this front by the County can be significantly strengthened by collaborating with these and other organizations.

Strategy 4i: Include aquatic and riparian habitat enhancement with strategies for water quality when developing the comprehensive water resources plan.

Strategy 1c of this chapter calls for developing and implementing a comprehensive water resources plan for the County. The strategy includes stream restoration needs and strategies, public education efforts, and coordination of different County programs. This represents a logical and practical opportunity to enhance aquatic and riparian habitat as part of the comprehensive water resources plan. Biodiversity and stream health are associated with water quality. The Virginia Department of Environmental Quality designates aquatic life, as determined by benthic macroinvertebrate data, as one of six designated uses for surface waters, and thus a standard for assessing water quality.

The County's network of rivers, streams, and riparian areas are a vital component of regional biodiversity, as stated under Strategy 4b of this chapter. Greater efforts should be made to protect these resources, for purposes of both improving water quality and protecting biodiversity. Taking actions for these purposes is consistent with Objectives 1 and 6 of this chapter, Strategies 1a, 6a, 6b, and 6c of this chapter, Objective 8 and Strategies 8a and 8b of the Development Areas Chapter, and Strategy 3a of the Parks and Recreation, Greenways, Blueways, and Green Systems Chapter.

Strategy 4j: Increase the community's awareness of the importance of biodiversity to encourage protection of biological resources.

Volunteers and the County can support private conservation efforts by developing and disseminating educational and technical material to the general public, developers, and private land owners, including residents of the Development Areas. The material should contain information on the value of biodiversity, voluntary techniques that can be used to protect biological resources located on their land, and resources available to them. Typical examples that are often appropriate on small parcels and in urbanized areas include creating rain gardens, pollinator habitat, and xeriscaping with native plants.

Strategy 4k: Continue to collaborate with federal, state, and regional partners, who have geographic information on biological resources, to help build a biodiversity inventory.

Many federal, state, and regional agencies collect data on biological resources and work towards species protection. These data can be used in conjunction with information from the BAP and other County-generated data to develop a broad dataset on biodiversity. Developing and maintaining good working relationships with cooperating agencies and organizations is important.

One very useful strategy would be to work with the Virginia Department of Transportation to design and test wildlife overpasses and underpasses to reduce the loss of wildlife to habitat fragmentation by roads, especially between large habitat blocks. A variety of overpass and underpass sizes can contribute to biodiversity protection, including, for example, very small tubes and tunnels that can help amphibians move between upland and wetland habitats as needed for reproduction

Strategy 4l: Retain a position for a County staff member with expertise in conservation biology.

In the years following creation of the Natural Heritage Committee in 2005, County resources were limited and no staff was available to work with the committee. With the hiring of a natural resources staff person in December 2015, a liaison between County staff and the NHC was established. The staff position supports the NHC and made development of the BAP possible. The staff position also strengthens County efforts to improve stream health, helps monitor proposed projects for impacts to biodiversity, provides additional resources for project review, and increases County support, outreach, and education for landowners.

Staff is in a unique situation to help make the connections between science, conservation management, and planning in the County. Staff time for conservation enables the County to be more effective and ensure that resources expended on these programs are put to the best use.

Strategy 4m: Develop indicators and monitor data that reflect the state of biodiversity in the County. Regularly repeat the land use/land cover data gathering process (as begun in 2009) for the purpose of monitoring landscape changes.

The state of biodiversity in Albemarle County is continually evolving. Indications of change are important in monitoring and assessing the current state, for tracking changes through time, and for effective conservation planning. Indicators may directly or indirectly reflect biodiversity resources. Examples of indicators could include the amount of land and landscape areas that are protected, the level of protection provided, indices of habitat connectivity and fragmentation, water quality and stream health data, and the status of threats to biodiversity (e.g., non-native invasive plants).

In 2007, Albemarle County, along with the Nature Conservancy, the Rivanna River Basin Commission, and StreamWatch (merged with the Rivanna Conservation Society in 2016 to form the Rivanna Conservation Alliance) funded mapping of land cover in the County and the rest of the Rivanna River watershed. The first map was completed in 2009 and is provided as a layer on the County's GIS web application. Because it is such a useful tool to track change over time, it is essential to repeat because

it provides feedback on the effectiveness of conservation programs and allows conservation programs to adapt to trends in landscape changes.

CITATIONS:

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