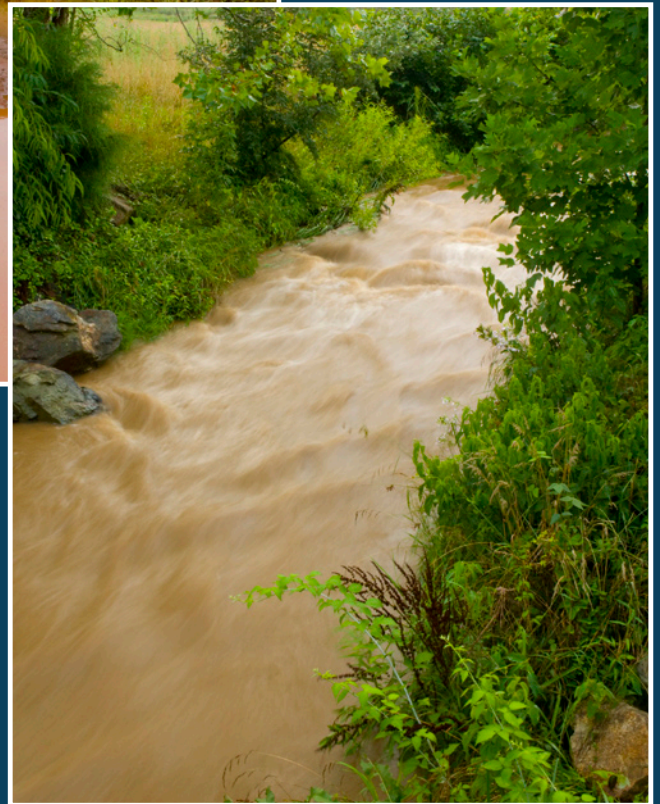


Before the Storm: Reducing the Damage from Polluted Stormwater Runoff



Recommendations for Albemarle County

Prepared by the Southern Environmental Law Center, the Rivanna Conservation Society,
and the University of Virginia School of Law's Environmental Law and
Conservation Clinic

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ENVIRONMENTAL LAW AND CONSERVATION CLINIC

The Environmental Law and Conservation Clinic is an academic program of the University of Virginia School of Law. The clinic and its students represent and counsel environmental nonprofits, citizen groups, and other community organizations seeking to protect and restore the environment of Virginia and other parts of the country.
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The Rivanna Conservation Society is a nonprofit organization located in Charlottesville. The mission of the RCS is to develop public support to safeguard the ecological, recreational, cultural, scenic, and historic resources of the Rivanna River Watershed.
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The Southern Environmental Law Center is a nonprofit, regional organization dedicated to protecting the South's environment and outstanding natural areas. Headquartered in Charlottesville, SELC works with local, state, and national groups, providing legal and policy expertise on issues relating to transportation and land use, forests, coasts and wetlands, and air and water quality. SELC's work on this report is part of its Charlottesville/Albemarle Project, which promotes smarter growth, more responsible development practices, and sensible transportation choices in our hometown.

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Acknowledgements

The University of Virginia School of Law's Environmental Law and Conservation Clinic, the Rivanna Conservation Society, and the Southern Environmental Law Center are grateful to the many people and organizations who contributed information to this report, including staff members of Albemarle County's Department of Community Development and the Thomas Jefferson Soil and Water Conservation District. The report was supported in part by funding SELC received from the Charlottesville Area Community Foundation and the Virginia Environmental Endowment.

Photographs: © Bill Sublette (cover, pages 4, 8, 9, 12); Charles Shoffner (pages 1, 13, 17); Albemarle County (pages 6, 10); Casey Williams (pages 9, 16); Lower Columbia River Estuary Partnership (page 7); Robert Llewellyn (page 14). The illustration on page 2 was adapted from an original obtained from the Maryland Department of the Environment.

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Introduction

Water has long been a defining feature of Albemarle County. The area's abundant supply of freshwater streams and rivers offers a wide range of health, recreational, economic, and environmental benefits, contributing significantly to the strong quality of life County residents enjoy. However, more than twenty stretches of waterways flowing within or along the County's borders are now included on the Virginia Department of Environmental Quality's (DEQ) list of "impaired waters."¹ While the causes of the damage to affected segments can vary considerably, stormwater runoff is an all-too-common denominator, acting as an underlying cause of many of the water pollution problems that are affecting the County's rural areas as well as its more suburbanized sections. Indeed, DEQ recently analyzed seven of Albemarle's impaired stretches of water, and the results show that stormwater runoff is a major contributor to the pollution problems in every single one.²

Recognizing that the stormwater problem is likely to increase in magnitude as the County's population continues to grow, Albemarle's Comprehensive Plan sets a goal of "minimizing the negative impacts of increased stormwater discharges from new land development."³ This report — a joint effort of the University of Virginia School of Law's Environmental Law and Conservation Clinic, the Rivanna Conservation Society, and the Southern Environmental Law Center — puts forward a set of recommendations to help the County achieve this critical goal. We identify a number of straightforward changes the County could make to different ordinances and policies to promote better choices about the way land is developed and managed. These choices, in turn, can help reduce the damage from polluted stormwater runoff and thereby ensure healthier streams and rivers throughout the County.

To be sure, these recommendations, if implemented, will not eliminate stormwater runoff in the County or solve all the myriad problems it poses. For one thing, our recommendations focus primarily on limiting runoff from new land development, but retrofitting some existing developments and land uses with better stormwater protections is an equally important piece of the larger stormwater puzzle. In addition, further scientific evaluation and research to be undertaken over the next several years by the Rivanna River Basin Commission may demonstrate that a wholesale shift in the way our region approaches stormwater runoff is necessary if we are ever to solve the problem fully. Our objective with this report is to highlight several near-term changes that could expediently be made to existing County provisions and programs.



Albemarle's Comprehensive Plan recognizes the County's responsibility to protect the beautiful water resources with which it is blessed.

The Challenges of Stormwater Runoff

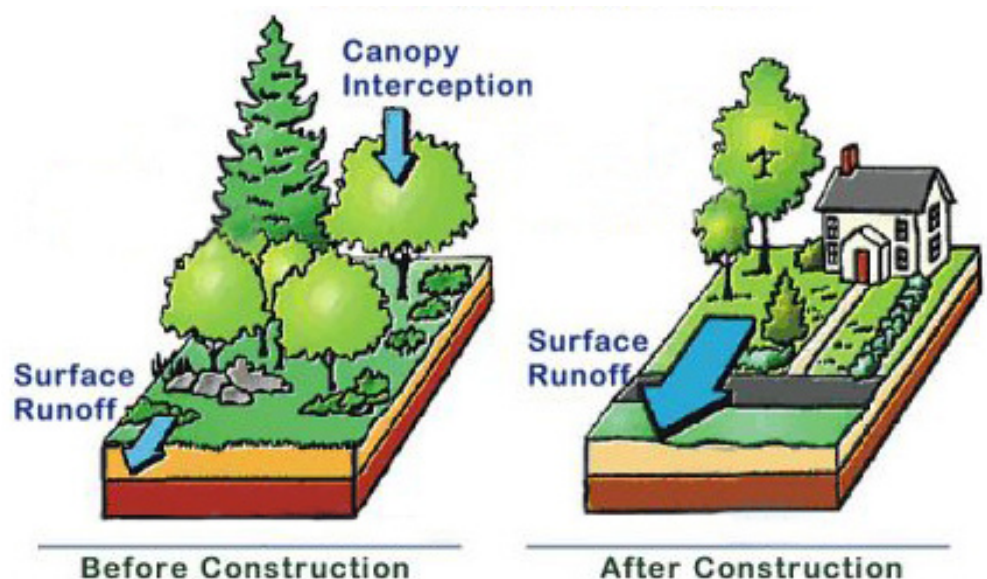
The Virginia Department of Environmental Quality has recognized stormwater runoff as a “primary contributor” to water quality impairments throughout the state.⁴ It affects urban as well as rural watersheds, inflicting damage in two principal ways. Both forms of damage result from changes humans make to the landscape, and both are occurring in Albemarle County.

First, stormwater runoff can cause excessive erosion and sedimentation of the waterways into which it flows. In natural and forested conditions, much of the precipitation from rainstorms is absorbed back into the ground close to where it falls, nourishing plant life and helping to recharge groundwater aquifers. Typically, any excess rainwater will flow gradually over the terrain and slowly drain into nearby streams and rivers. But as we replace our forests with pavement, buildings, and manicured lawns, less of the precipitation is able to seep back into the soil. Instead, the rainwater quickly collects on these compacted surfaces and forms sheet runoff that flows off the site at a much higher volume and speed. It has been estimated, for example, that a one-acre parking lot creates 16 times more runoff than a meadow of the same size.⁵

Often, the accumulated runoff forms rivulets that pour directly into the nearest stream or tributary. Or it might first flow into a storm sewer that simply pipes it directly to a nearby waterway. The result is the same in either case: stream flows in the receiving waters increase significantly. As the higher flows rush through stream channels unaccustomed to such volumes and speeds of water, a massive amount of sediment is carved away from the streambanks.⁶ The eroded sediment eventually settles to the streambed, where it smothers aquatic habitat and alters the waterway’s ecology. The sediment can also be swept into drinking water reservoirs like the South Fork Rivanna Reservoir in Albemarle County, reducing capacity over time and increasing water treatment costs.

The second principal way in which stormwater runoff damages local waterways is by washing pollutants directly into rivers and streams. As rainfall collects on and washes over paved surfaces, construction sites, lawns, and pastures, it picks up some of the oil, sediment, fertilizers, and bacteria present on those surfaces.⁷ When the runoff then empties into nearby waters it can carry those pollutants along with it, often causing harm to fish and wildlife and even making rivers and streams unfit for recreation. In addition, pollutants contained in the runoff from areas like Albemarle County are significant contributors to water quality problems in the Chesapeake Bay.

These problems have been made worse by the high number of large construction projects in the County over the past several years. Typically, construction activities remove the stabilizing layer of topsoil on a site. When the underlying soil layers are exposed directly to the elements, the rate at which those soils erode accelerates dramatically. Stormwater runoff then captures the eroded sediment and can convey it directly into streams, polluting water in the immediate vicinity of the site and often miles downstream. The longer these construction sites leave large expanses of soil exposed, the greater the damage.



By replacing natural terrain with pavement and rooftops, new land development often limits the opportunities for precipitation to be absorbed by plants or infiltrate into the ground. As a result, a much higher percentage of precipitation becomes surface runoff after land is developed, posing significant threats to nearby waterways.

For example, many County residents have raised concerns about the extended period of time the earth around the Hollymead Town Center has been in some state of disturbance, and what impact that is having on nearby waterways. Two citizen groups recently commissioned a sediment survey of the bottom of Lake Hollymead, a man-made water body that lies a few thousand feet “downstream” of the Town Center. The survey found that the rate at which sediment has collected on the lakebed has increased dramatically in the past four to five years⁸ — a period that corresponds to intense construction activity at the Town Center and some other sites upstream of the lake.

Fortunately, making certain choices about how we develop and manage our land can reduce stormwater runoff and limit the damage it inflicts. Just as poor decisions can lead to serious pollution problems in our local waterways, the proper decisions can help protect them. By simply removing some unnecessary regulatory obstacles to smarter development patterns, encouraging more responsible site design and construction practices, and providing incentives for better land management strategies, Albemarle County can much more effectively promote the type of land use decisions that will lead to cleaner, healthier waters.

Background

The recommendations discussed below are the result of an extensive analysis of the County’s development ordinances and policies jointly conducted by the Rivanna Conservation Society, the Southern Environmental Law Center, and the University of Virginia School of Law’s Environmental Law and Conservation Clinic. The project was designed to build on a wider review the James River Association conducted in 2006 with guidance from the Center for Watershed Protection. Their review looked more broadly at the 45 major localities that make up the James River watershed.⁹

The Center for Watershed Protection has developed a Code and Ordinance Worksheet (“Worksheet”) that we used as the starting point for our analysis. The Worksheet contains a number of benchmarks that can be used to determine how well a locality’s ordinances promote development practices that reduce stormwater runoff.¹⁰ We used the Worksheet in combination with the collective stormwater knowledge and experience of our own organizations to identify certain County practices and specific provisions of the County Code that showed potential for improvement.

We then spent several months expanding and refining our preliminary findings based on numerous discussions with County staff and members of Albemarle’s development and environmental communities. The recommendations presented below are the culmination of this effort, and we believe they represent a manageable set of practical, common-sense steps the County could take to reduce the damage that polluted stormwater runoff is causing to our local waterways.

Category 1: Promote Better Design and Layout of New Development Sites

As described above, the amount of stormwater runoff that a certain area generates can increase considerably when its trees and meadows are replaced with buildings and pavement. In recent years, however, innovative approaches to the design and layout of new development sites have emerged that seek to minimize this effect. These approaches focus on two goals: (1) avoiding the construction of excessive impervious surfaces; and (2) using small-scale, natural landscape features to help absorb and treat rainwater close to where it falls and before it forms fast-moving sheets of runoff. (This usage of natural landscape features to minimize and treat runoff is commonly referred to as “low-impact development,” or “LID.”)

The first category of recommendations included in this report offers specific ways in which different County Code provisions can be improved, and the County’s development policies refined, to better advance both goals. The recommendations contained in Category 2 are related, but focus on ways to promote LID practices more generally.

A. Parking Lots

Large surface parking lots can generate massive volumes of stormwater runoff. For example, a one-acre paved parking lot (43,560 square feet) will produce roughly 27,000 gallons of runoff during a one-inch rain.¹¹ Some of the large commercial parking lots in the area are nearly 10 acres in size. With one inch of rain, that much pavement will generate over a quarter of a million gallons of runoff — enough to fill a swimming pool the size of the basketball court in the John Paul Jones Arena to a depth of 7.3 feet. Worse, the runoff collects many of the various pollutants that have accumulated on the parking lot and can flush them into local waterways.



There are still many untapped opportunities for reducing polluted runoff from new parking lots built in the County.

The recommendations in this subsection focus on reducing the stormwater impact of new surface parking lots by reducing lot size and incorporating LID features into the design. However, it must be noted that one of the best ways to minimize the amount of runoff generated by a large surface lot is to build instead a structured or underground parking facility. Developers often dismiss these options because of their higher construction costs, but the economics are changing and the County is beginning to see large Development Area proposals include some structured parking. In addition to the recommendations below, we urge the County to seek a higher percentage of underground or structured parking in all appropriate rezoning proposals in the designated Development Areas.

1. Require that 20% of spaces within larger parking lots be designed to “compact car” dimensions (8 feet by 16 feet).

The amount of land paved to build a new surface parking lot depends on several factors. One is the size of the individual parking spaces within the lot. Regrettably, parking lots are often configured so that every parking space can accommodate the largest class of automobile, even though roughly 20% of the automobiles on the road today are smaller, “compact” cars,¹² and the percentage of large vehicles being sold is rapidly decreasing.

A requirement that an appropriate percentage of the parking spaces within large parking lots be designed to “compact” dimensions can reduce the size of the parking lot while accommodating the same number of vehicles. It can also increase the space available within the lot for LID stormwater management practices.

We recommend that section 18-4.12 of the Albemarle County Code be amended to require that 20% of the parking spaces within parking lots of 10 or more spaces be designed to a “compact car” set of dimensions (8 feet by 16 feet), and be marked for use by compact cars only.

2. Lower the minimum parking space requirement for professional office buildings.

Another major factor in the size of a surface parking lot is, of course, the overall number of parking spaces. Often, local ordinances specify a minimum number of parking spaces that must be built for various types of land uses, such as business offices and retail space. When these minimum parking requirements exceed what a new development is likely to require, it results in unnecessary pavement. Not only does this increase the amount of stormwater the site generates, but it can also increase construction costs for the developer. To help localities avoid these results, the Center for Watershed Protection (CWP) has developed a recommended minimum number of parking spaces for major uses such as professional office buildings and shopping centers.

Albemarle’s minimum parking space requirements are contained in section 18-4.12.6 of the Albemarle County Code. While the requirements for shopping centers and single family homes fall within the CWP’s recommendations for those classes of uses, the County’s parking requirement for professional office buildings exceeds the mark. The CWP recommends a minimum of 3 spaces per 1,000 square feet of gross floor area of office space. Albemarle requires, in effect, 4 parking spaces per 1,000 square feet of gross floor area.¹³

Not only does the County’s requirement exceed the CWP’s recommendation, but we understand that developers of professional office space in Albemarle frequently request permission to build fewer parking spaces because they feel the County’s minimum is set too high. Reducing the minimum parking space requirements for office space is an easy way for the County to allow developers to reduce unnecessary impervious surface in new commercial developments without jumping through extra hoops. Notably, this change would not require developers of office space to build fewer parking spaces; it would simply allow them to do so.

We recommend that section 18-4.12.6 of the County Code be amended to reduce the minimum parking ratio for professional office space to 3 spaces per 1,000 square feet of gross floor area (or, using net office floor area, 3.75 parking spaces for every 1,000 square feet of net office floor area).

3. Require a special use permit for exceeding the maximum limit on parking spaces.

In addition to requiring a *minimum* number of parking spaces for various uses, the County also limits the *maximum* number of spaces that may be built to accommodate each use. Under section 18-4.12.4(a) of the County Code, the number of parking spaces built for a particular use may not exceed the required minimum number of spaces for that use by more than 20%. Setting a reasonable maximum limit helps ensure that lots are not built to sizes that greatly exceed the anticipated demand for parking.

Although the County Code contains parking maximums, developers may ask County staff to increase or simply waive the limit, and the Code currently requires little in the way of justification or mitigation for such a request. If the Code were amended to require developers to obtain a special use permit before they may exceed the parking maximums, these shortcomings could be remedied.

As a starting point, the County could require developers to submit with their special use permit application an official parking study demonstrating the need for the additional spaces. When a developer requests permission to build fewer parking spaces than the County’s *minimum* requirement, the Code requires the developer to submit a parking study from a professional transportation planner or licensed engineer providing several categories of data that justify the request.¹⁴ Yet no such study is currently required when developers ask to exceed the maximum limit.

Beyond simply providing justification, developers should also be expected to install enhanced stormwater protections in return for permission to exceed the maximum parking requirements. For example, to be eligible to exceed the parking space limit, the County could require that a minimum percentage of the overall parking spaces within the lot must be incorporated into a “spillover” parking area in which pervious pavement options (as will be discussed in more detail later in this report) are required. Alternately, the County might require either a rainwater harvesting system or a “green” roof on the building(s) that will be served by the parking lot to reduce the runoff from those structures.

Requiring that a special use permit be obtained before parking maximums may be exceeded would give the County the necessary authority to both require parking studies and incorporate more progressive stormwater mitigation practices into approved permits.

We recommend that section 18-4.12 of the County Code be amended to require a special use permit before maximum parking requirements may be exceeded. We further recommend that a parking study be required as part of the special use permit application, and that the County require enhanced stormwater protections on the site as a necessary condition of any such special use permit.

4. Increase landscaping in new parking lots, and require the landscaped areas be designed to collect and filter runoff.

It is fairly common for local ordinances to require that some small percentage of the total area of a new surface parking lot be set aside for trees and shrubs. Albemarle has this type of requirement in its Zoning Ordinance: for parking lots of 5 or more spaces, an area equal to 5% of the total paved area must be set aside and landscaped with plants.¹⁵

Although parking lot landscaping requirements have traditionally been based on the desire to provide safe pedestrian havens as well as shade, the planted landscape areas also pose significant potential for treating stormwater. However, the plants are often contained in islands that are raised above adjacent portions of the parking lot and bordered by impenetrable curbs. With runoff from the paved portion of the parking lot thus unable to infiltrate the landscaped areas, the stormwater benefit they provide is limited to the rain that falls directly on top of them.

Better landscape design approaches exist and are already being used in a few projects in our area. For example, if landscaped areas are built at a slightly lower grade than the adjacent portions of the parking lot and are not completely surrounded by a curb, some runoff from the paved portion of the lot will drain into them where it can be filtered and absorbed. Incorporating back-up drainage systems into the landscaped areas, as the examples on the prior page illustrate, can address overflow and help ensure that the plants are not flooded during heavy rainstorms.



Stormwater that collects on these parking lots at Monticello High School and the Shoppers World Shopping Center flows into vegetated “biofilters” that absorb some of the runoff and help filter out pollutants. During large rainstorms, any excess runoff can spill into overflow drains that usually connect to the storm sewer network.

We recommend that section 18-32.7.9.7 of the County Code be amended to increase the parking lot landscaping requirement to 10%, and to require that the landscaped areas be designed to filter a portion of the runoff from the paved parking surface.

B. Streets and Driveways

Streets and driveways are major contributors to the impervious surfaces generated by residential development. Streets are often the largest single component of pavement in a residential subdivision, accounting for roughly half of the impervious cover in the overall road network in traditional neighborhoods.¹⁶ Driveways are usually responsible for another 20% to 30%, and cul-de-sacs and other turn-arounds represent approximately 7%.¹⁷ Because these features can be such major sources of impervious surface, it is important to encourage developers to build street networks that incorporate LID measures into their design.

Most counties in Virginia, including Albemarle, have fairly limited discretion over the design of streets in new developments if they want the Virginia Department of Transportation (VDOT) to bear the expense of maintaining them. This is because the state has prescribed a set of design standards that new streets must meet before VDOT can agree to maintain them. However, the Virginia General Assembly recently passed legislation requiring that these “secondary street acceptance requirements” be updated, specifically requiring that “provisions to minimize stormwater runoff” from the secondary streets be included in the revised requirements.

Although the new regulations have not yet been finalized, recent drafts indicate that localities will be granted increased flexibility to promote new street designs that incorporate LID measures into the right-of-ways and within cul-de-sacs.¹⁸ Once the new regulations have been finalized and adopted, it will be important for the County to respond by more actively promoting such roadway designs in its Subdivision Ordinance and by providing guidance on acceptable approaches. The recommendations below offer some specific design suggestions.

1. Explicitly allow perforated curbs along roadsides in the Development Areas, and publish guidance demonstrating acceptable designs.

Under the County Code, all new streets in the Development Areas must be constructed with either curbs or curbs and gutter (although an applicant may ask the Planning Commission to waive the curb and gutter requirement altogether).¹⁹ Conventional curb and gutter systems simply collect all the stormwater runoff from the roadbed and channel it directly to the storm sewer system. This approach is often advocated in areas of dense development because there is typically less natural terrain on adjacent lots to help absorb the runoff. However, a few simple design changes to the traditional roadside curb and gutter system can safely allow for the treatment and on-site absorption of some portion of the stormwater the street generates.

Specifically, instead of being designed as one long, uninterrupted channel, roadside curbs can be “perforated” with periodic curb cuts. These breaks in the curb allow some runoff from the road to spill into the planting strips that are already required along new streets in the Development Areas and that offer a natural opportunity for slowing, filtering, and absorbing runoff. As



Periodic curb cuts allow some street runoff to drain into planting areas like the ones pictured in the example above.

with landscaped areas in parking lots, back-up drainage features can be utilized to address potential overflow in the planting areas during heavy rainstorms.

In step with the adoption of the new secondary street acceptance requirements, a new sentence could be added to the County's Subdivision Ordinance to make clear that properly designed perforated curb systems that allow runoff to drain into adjacent planting strips or other areas of natural terrain are acceptable along new streets in the Development Areas. To further encourage the practice, the County could publish a guidance document demonstrating designs that are acceptable to both the County and VDOT.

We recommend that the Subdivision Ordinance be amended to expressly allow perforated curb designs for both public and private streets, and that the County publish a guidance document demonstrating acceptable designs.

2. Explicitly allow landscaped islands in the middle of cul-de-sacs, and publish guidance demonstrating how the islands can be equipped with LID stormwater practices.

For a variety of reasons, cul-de-sacs are generally not a preferred street design element in new neighborhoods and developments. Where they must be used, however, these large circles of pavement can be designed in ways that help reduce their stormwater impact. Fortunately, this appears to be another area in which the revised version of the state's secondary street regulations will grant localities increased flexibility.

For example, creating landscaped islands in the middle of cul-de-sacs, rather than paving the entire surface, can help cut down on pavement. A 40-foot-diameter island in the middle of an 80-foot-diameter cul-de-sac will reduce the impervious surface of the cul-de-sac by 25%. Further, if the island is built at a lower elevation than the sur-



Building landscaped islands in the middle of new cul-de-sacs can help reduce pavement, as seen in this photo of the new Brookwood development currently under construction on Raymond Avenue in Charlottesville. Additional stormwater benefits can be provided if the islands are designed to absorb some runoff from the surrounding street.

rounding roadway and surrounded by a perforated curb rather than an impenetrable one, it can capture and treat runoff from the adjacent roadway. Installing other LID stormwater features in the island can increase the amount of runoff that can be efficiently treated without overflow.

We recommend that the Subdivision Ordinance be amended to expressly allow landscaped islands in the middle of cul-de-sacs, and that the County publish a guidance document demonstrating how LID stormwater features can be installed within the islands.

3. Promote the use of pervious pavements for residential driveways.

Driveways can account for approximately 20% to 30% of the impervious cover in traditional residential street networks.²⁰ However, there are many options available for creating driveways with pervious materials that allow stormwater to be absorbed into the ground. One option increasingly being used in our region is porous pavers. These are usually interlocking blocks of concrete that are designed to create small “voids,” or empty spaces within and between the blocks. Stormwater is able to flow through the voids into grass, soil, or some other underlying material that can absorb and filter it.

We recommend that a sentence be added to the County's Zoning Ordinance to make clear that pervious materials may be used for driveways, and that guidance on using the different types of pervious pavement that have proved successful in this region be published and made easily available.

C. Site Layout

Our recommendations to this point have focused on standards and designs that mitigate the stormwater impact of two major sources of pavement in new developments: parking lots and roads. Runoff can also be reduced by promoting a more thoughtful layout of the development on the overall site — one that avoids valuable natural resources and limits disturbance to soils. This is the focus of the recommendations outlined in this subsection.



Porous pavers allow rainwater to percolate be absorbed into the ground below. A few recent projects in our area have incorporated them for parking areas and driveways, like the RiverBluff development in Charlottesville.

1. Explore incentives to developers to preserve existing trees at development sites.

In addition to the aesthetic, economic, and air quality benefits that healthy trees provide to a development site, they also help protect nearby waterways. Specifically, a leafy tree canopy provides an initial barrier to rainfall, reducing the erosive force with which raindrops hit the earth. In addition, the leaves and the roots of trees absorb and filter some of the rainwater that falls on and around them, decreasing the amount of rainfall that becomes stormwater runoff. These services of slowing rainfall and reducing runoff are especially valuable during the critical stages of high erosion that occur during and after construction.

Albemarle County has a tree canopy provision in its Zoning Ordinance requiring that new development sites have at least a few trees on them within ten years of the completion of construction on the site.²¹ In accordance with the state enabling legislation, however, the County's tree canopy requirement may be met entirely by planting new trees. This means developers can satisfy the requirement even if they completely strip a new development site of all vegetation during the construction process.

Although the County currently allows mature trees that are preserved on a site throughout the construction process to count "extra" toward the canopy requirement,²² it is unclear how often developers take advantage of this bonus. If most developers are ignoring the bonus and primarily using newly planted trees to fulfill the canopy requirement, additional incentives for preserving existing trees on development sites should be explored. These incentives should incorporate measures to ensure that the designated trees are adequately protected during the entire construction process.



Development sites in the County too often resemble barren "moonscapes," completely stripped of trees and plants that could help slow and filter runoff.

We recommend that the County explore additional incentives to preserve existing trees on new development sites.

2. Adopt a tree conservation ordinance and designate specific trees for protection.

Another option at the County's disposal for preserving existing trees on development sites is to adopt a tree conservation ordinance pursuant to the enabling authority provided in the Code of Virginia.²³ Although the County has adopted other ordinance provisions that relate to the preservation of trees,²⁴ there is no firm requirement that exceptional trees or wooded areas on a development site be avoided. As discussed in the previous recommendation, entire sites can be razed with no mature trees left standing — trees that would have helped to slow and filter runoff during and after construction.

Although its reach would be limited to specific trees the County designates, a tree protection ordinance would provide those trees with a strong layer of protection. It would help ensure that the stormwater benefit provided by the County's most outstanding trees would be insulated against future development activity. Notably, other Virginia localities, including Fairfax City²⁵ and Arlington County²⁶ have adopted tree conservation ordinances to protect the trees those localities have deemed worthy of protection.

We recommend the County adopt a tree protection ordinance and designate specific trees deemed worthy of preservation.

Category 2: Actively Encourage Low-Impact Development Stormwater Practices

As discussed throughout this report, a new approach to stormwater management has emerged in recent years. It uses a set of techniques collectively known as “low impact development” (LID) that manage rainwater close to where it falls. The LID approach incorporates small-scale natural landscape features into the designs for new development sites. These features emulate the way the site naturally absorbs and filters runoff in its predevelopment state. This is in contrast to traditional stormwater strategies that convey runoff away from the site and into large holding basins, the storm sewer system, or directly into local waterways as quickly as possible. Because LID practices use natural systems to filter out pollutants and allow runoff to be absorbed into the ground, they can reduce the overall volume of runoff that flows off a development site, as well as the amount of pollutants in that runoff.

The County is to be commended for incorporating many LID stormwater features into its own public construction projects over the past several years, such as the rain gardens installed in the Monticello High School parking lot, and the green roof and porous pavers at the County office building on McIntire Road. These projects help to demonstrate to the public the feasibility, effectiveness, and aesthetic benefits of these practices. In addition, the Board of Supervisors has recently increased its efforts to obtain better stormwater and erosion control measures from developers proposing rezonings, and we urge the Board to continue to raise the bar with each new proposal that comes before it. Below we discuss two additional strategies the County could adopt to actively encourage LID stormwater techniques.



An excellent example of a green roof can be found on the Albemarle County office building located on McIntire Road.

1. Offer incentives to utilize low-impact development features.

An abundance of recent research demonstrates that incorporating LID practices usually reduces the overall cost of a development project while increasing environmental performance.²⁷ Nonetheless, fears about the amount of time it could take to get these features approved, as well as the potential for higher costs incurred in installing and maintaining them, appear to be limiting their use.

The County can help address these barriers and jump-start the use of these new practices by offering incentives to incorporate certain LID features into new and existing developments. For example, inducements to developers such as height or density bonuses and reduced or waived application fees could provide the necessary enticement to build green roofs or use porous pavers for driveways in lieu of asphalt. In addition, the Charlottesville City Council has recently endorsed the idea of a real estate tax reduction for owners of energy efficient homes and businesses; the County could pursue enabling authority to create similar incentives for homeowners and developers who install LID features such as rainwater harvesting systems.

We recommend the County explore incentives to utilize green roofs, porous pavers, rainwater harvesting systems, and other low-impact development practices.

2. Develop and publish guidance on low-impact development options.

While some landowners and developers might be waiting for the type of short-term economic incentive discussed in the above recommendation before they consider installing LID features, others likely have the desire already and simply lack the requisite knowledge. It is therefore important to have written guidance available explaining when certain LID practices may be appropriate, as well as instructions on how to design and implement those practices.

Many types of stormwater practices are already detailed in the *Virginia Stormwater Management Handbook* and associated technical bulletins, but the County could supplement these materials by publishing its own guidance materials that detail some of the specific LID practices we discuss in this report. These materials could be appended to the County's *Design Standards Manual* or form the basis of the County's own stormwater guidance document, which could be made readily available to interested landowners and developers. By educating not only the public about new LID options but also the County staff members responsible for putting the guidance documents together, this effort would help ensure that Albemarle County remains at the forefront of innovation in stormwater management.

We recommend that the County make guidance available that details the acceptable design and installation of some of the LID stormwater management practices we recommend in this report, including:

- Periodic curb cuts along roadsides so that stormwater drains into adjacent vegetated areas
- Landscaped areas in parking lots and cul-de-sacs that filter and absorb runoff from the surrounding pavement
- Porous pavers for parking lots and driveways
- Rainwater harvesting systems on new and existing buildings

Category 3: Limit Sediment-Laden Runoff from Construction Sites

When clearing, grading, and other construction activities expose bare earth and soil to the elements, the rate at which the soil is broken down into smaller, erodible sediments increases dramatically. According to the Virginia Department of Conservation and Recreation, erosion associated with construction activities can be 200 times greater than that from cropland and 2,000 times greater than that naturally occurring in woodlands.²⁸ Similarly, a guidance document published by the United States Environmental Protection Agency notes that erosion rates from natural areas such as undisturbed forested lands are typically less than 1 ton per acre per year, whereas erosion rates from construction sites range from 7 to 500 tons per acre per year.²⁹

Stormwater runoff can then sweep much of the eroded sediment from construction sites into nearby waterways. For example, in just one week in 2002, monitoring stations showed that rainfall washed 1.4 million pounds (or 700 tons) of sediment off of construction sites for Route 288 into the Swift Creek Reservoir, a primary drinking water source for Chesterfield County.³⁰

The primary regulatory mechanism in Virginia for dealing with this problem is the Erosion and Sediment Control program (“E&S program”). The E&S program requires developers to submit and implement a plan (“E&S plan”) containing the sediment-reduction measures they will undertake on a construction site. At the heart of the E&S program regulations are nineteen guidelines — the state law refers to them as “minimum standards” — that all E&S plans must meet.³¹ As their name implies, the state’s minimum standards act only as a “baseline” set of protections. A significant amount of sediment-laden runoff can still escape a construction site even when an E&S plan fully complies with the state’s standards and is properly implemented by the contractors on the site. Further, some of the minimum standards are vaguely worded and contain loopholes that can be easily exploited, minimizing what protection they are meant to offer.

Fortunately, local governments have the explicit authority to require stronger erosion protections than those contained in the minimum standards,³² and below we identify several upgrades Albemarle County could make to its local erosion control program to limit the amount of sediment that gets washed from construction sites into local waterways.

1. Require all erosion and sediment control plans to include a time limit by which denuded terrain must be permanently revegetated.

Erosion occurs much less rapidly when soil is protected by a permanent vegetative cover than when it is left bare and exposed to the elements. As a result, a key factor in reducing the amount of sediment that gets washed from a development site into nearby waterways is limiting the amount of time that the site is denuded.

Although Virginia regulations require that denuded terrain at construction sites be revegetated once grading is complete or if grading will not occur for a specified amount of time,³³ those regulations have a built-in loophole: by simply doing some marginal grading work on the site whenever the deadline for revegetation approaches, developers are able to “restart the clock” and leave large portions of construction sites in a denuded condition almost indefinitely. The most noticeable manifestations of this regulatory loophole in our area are the muddy moonscapes that sometimes persist for years at a time along the Route 29 corridor.

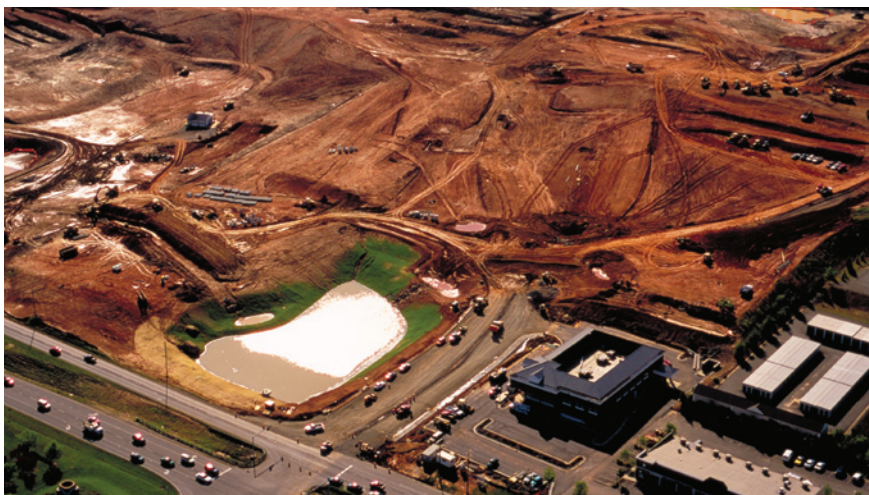
In a few recent rezonings, the County has begun accepting a proffer from developers that reduces the potential for this type of abuse. The proffer requires that permanent vegetation must be in place on all



Stormwater runoff can sweep significant amounts of sediment from construction sites into local waterways.

denuded areas of a construction site within a certain number of months after grading begins (except for any areas of the site where construction of roads or structures is already under way at that time).³⁴ This requirement provides needed clarity in determining the deadline for revegetation of a construction site.

Rather than limit this important safeguard to a few rezonings, we urge the County to codify the requirement in its Water Protection Ordinance so that it applies to all new construction activities covered by the County's E&S program. This change would help limit one way the existing erosion protections can be severely abused.



Limiting the amount of time that construction sites leave the terrain denuded and exposed to the elements is critical to protecting nearby streams and rivers.

We recommend the County amend its Water Protection Ordinance to require that all erosion and sediment control plans include a time limit by which denuded terrain must be permanently revegetated.

2. Expand the list of erosion control measures explicitly referenced in the form contract the County uses for agreements-in-lieu-of-a-plan.

When a land-disturbing activity results from the construction of a single-family residence, Virginia law and the County's E&S program allow the property owner to enter into an "agreement-in-lieu-of-a-plan" rather than submit a full erosion and sediment control plan.³⁵ In contrast to a detailed, site-specific E&S plan, an agreement-in-lieu-of-a-plan is usually just a short form contract in which the landowner pledges to comply with any applicable erosion control requirements. The option is meant to streamline the construction planning and permitting process for landowners or developers proposing only to build a single house (as opposed to the larger disturbance necessary for a new subdivision or shopping center).

Because the agreements are broadly worded and often lack detail, their effectiveness and enforceability can be hampered. However, some localities append to the agreements a list of specific erosion protections that must be undertaken on any site covered by an agreement-in-lieu-of-a-plan. The City of Norfolk, for example, expressly incorporates twelve of the state's minimum standards into its agreements. These conditions include, among other things, a requirement to stabilize all stockpiles of soil on the site during construction and a reminder that the contractor must inspect all erosion control measures after rainstorms to make sure they are working properly.³⁶ By explicitly spelling out the most critical requirements, Norfolk helps ensure that property owners and contractors know the specific erosion control requirements to which they must adhere. This, in turn, likely leads to more consistent compliance with those requirements.

The form contract Albemarle County uses for agreements-in-lieu-of-a-plan lists only three specific conditions. At a minimum, some of the other erosion control requirements that Norfolk spells out could be added to the County's form contract. Further, the overarching time limit by which all denuded areas of construction sites must be permanently revegetated, as recommended above, could also be added to the list.

We recommend that the County expand the list of erosion control measures explicitly referenced in the form contract it uses for agreements-in-lieu-of-a-plan. We further recommend that one of the measures referenced be the overarching time limit for permanent revegetation discussed in our previous recommendation.

3. Lower the threshold for compliance with the County’s erosion and sediment control program to 2,500 square feet of land disturbance in the Development Areas.

Under the County’s Water Protection Ordinance, most land disturbances of less than 10,000 square feet in size are exempt from the erosion and sediment control requirements. As a result, no E&S plan or even an agreement-in-lieu-of-a-plan is required for these disturbances.

While most land disturbances for new houses in the County’s Rural Areas exceed 10,000 square feet and therefore fall under the E&S program, there will occasionally be smaller “infill” projects in the County’s denser Development Areas that do not meet the threshold. As a result, these projects are not required to put erosion controls in place during construction. Because sedimentation tends to be a larger problem in waterways that flow through more urban zones, there is a water quality benefit to ensuring that smaller land disturbances in the Development Areas are brought within the purview of the County’s erosion control program.

Notably, Virginia already requires 46 of the localities in the Chesapeake Bay watershed to use a 2,500-square-foot threshold for their E&S programs. If the County adopted the more protective 2,500-square-foot threshold for land disturbances in its Development Areas, it could help reduce the adverse water quality impact that future infill construction projects will have in these areas.

We recommend the County lower the threshold for compliance with the erosion and sediment control program to 2,500 square feet of land disturbance in the Development Areas.

4. Prepare and publish guidance on effectively preserving topsoil during construction.



Healthy topsoil is an extremely valuable resource and should be preserved during construction whenever possible.

Establishing a robust vegetative cover on denuded soil helps limit the amount of sediment that erodes from a development site during and after construction, and a healthy layer of topsoil is crucial to establishing that vegetative cover quickly. Topsoil is a biologically active system that contains the necessary combination of minerals, organic matter, air, water, and microorganisms that allows plants to grow and flourish. It can take thousands of years for a rich layer of topsoil to form.

During construction disturbances, the topsoil is frequently damaged or removed and discarded, and subsoils emerge to form the new surface of the development site. The subsoils lack the ideal mixture of components that nourishes plant growth. As a result, it often becomes necessary to supplement

or “amend” these subsoils with fertilizers in areas of the site that are to be revegetated once construction is complete, and this process can be an expensive undertaking for developers. It can also increase environmental damage, as runoff often collects some of the nutrients and other harmful pollutants that are contained in the fertilizers and washes them into nearby waterways.

It is therefore important to minimize damage to a site’s topsoil during construction. On those areas of the site that will be disturbed, the topsoil should be removed, stockpiled, and stored in a protective way whenever possible. Once grading of the area is complete, the topsoil should be replaced quickly to areas that are to be revegetated to provide the necessary foundation for plant growth.

By educating citizens and developers on the ecological value of topsoil and by explaining effective ways to preserve it, the County could encourage these valuable practices and reduce the amount of topsoil lost during construction.

We recommend that the County publish a guidance document explaining the importance of preserving topsoil and detailing ways of safely removing and preserving it so that it can be replaced after construction.

5. Support County staff's efforts to administer and enforce the Water Protection Ordinance.

The County's recent budget challenges are making it even harder for a stretched Community Development staff to administer and enforce the stormwater runoff and erosion control provisions in the County's Water Protection Ordinance. Specifically, there are seven positions currently frozen within the Department of Community Development, including two inspectors and one engineer. These empty staff positions make it extremely difficult for the County to adequately review and ensure proper implementation of the stormwater and erosion control plans that developers must submit.

Community Development staff recently presented to the Board of Supervisors a proposed revision of the fees the County charges to administer certain programs under the Water Protection Ordinance. The proposal was necessitated in part by the fact that the fees the County currently charges are well below the cost of providing the services the fees are supposed to cover. The new proposal would adjust the fee amounts to levels that are comparable to the fees that many neighboring localities charge, providing a more adequate recovery of County costs. What is even more important, the proposed fee increases would generate enough revenue to support two of the positions within the Community Development department that are currently frozen. With no funding coming from the County budget to fill any of the frozen positions in the near future, the fee increases are an essential step toward better implementation and stronger enforcement of the County's water protections.

We recommend that the Board of Supervisors adopt County staff's proposal for updating the fees the County charges to administer the Water Protection Ordinance.

Category 4: Support Riparian Protection on Pasture Land

Reducing impervious surfaces, encouraging LID stormwater management practices, and reducing erosion from construction sites are all essential to limiting the sedimentation problems affecting a number of local waterways. However, several of the County's impaired stream and river segments are failing to meet federal clean water standards because of high levels of a different pollutant — *E. coli* bacteria. Stormwater runoff is one of the primary ways that *E. coli* gets washed into our local waterways, and below we discuss ways the County could augment its efforts to address this threat.

1. Provide supplemental funding for the Virginia Agricultural Best Management Practices Cost-Share program, and urge the General Assembly to provide a dedicated source of funding for the program.

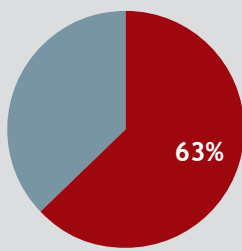
The *E. coli* bacterium is commonly found in the intestinal tracts of many warm-blooded animals. While rare variations of the bacteria can be harmful or even lethal to humans if ingested, finding high levels of *E. coli* in a waterway is more of a concern because it often indicates the presence of other disease-causing bacteria that are much more difficult to detect on their own. Elevated levels of *E. coli* are not uncommon in waterways flowing through agricultural areas because two main sources of the bacteria are manure-based fertilizer applications and livestock waste. However, several rural streams and rivers in Albemarle County have such high concentrations of the bacteria that they are generally deemed unsafe for swimming and qualify as "impaired" under state and federal standards.

As part of a study required by the Clean Water Act, the Virginia Department of Environmental Quality recently examined five stretches of rivers and streams in Albemarle that are impaired by high levels of *E. coli*. In all five, pasture land for livestock grazing was determined to be — by far — the largest source.³⁷ This means that

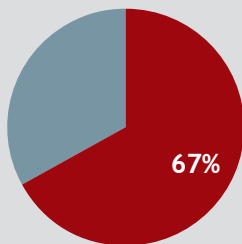
SOURCES OF *E. COLI* BACTERIA IN COUNTY WATERWAYS

■ Pasture Lands ■ Other

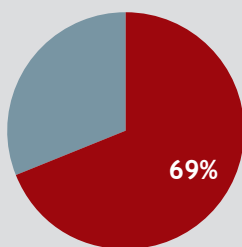
Rivanna River



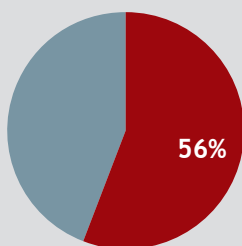
North Fork Rivanna



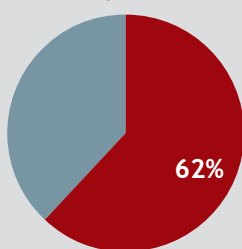
Beaver Creek



Mechums River



Preddy Creek



Pasture lands are by far the predominant source of bacteria in several impaired river and stream segments in the county.

Source: Virginia Department of Environmental Quality. (See Note 37.)

stormwater runoff is collecting the bacteria when it flows over the pasture land and then washing it into these waterways.

Livestock farming is an important component of the area's strong rural heritage, and Albemarle's farmers are often some of the County's best land stewards. It is therefore important to ensure that the local agricultural industry is not subject to unreasonable constraints that threaten its viability. At the same time, more clearly needs to be done to reduce the damage that runoff inflicts on local rivers and streams when it flows across pastures.

Encouraging livestock farmers to plant and maintain vegetated buffers along rural streams and tributaries is one area where current efforts can be strengthened. Establishing an effective riparian buffer on land used for livestock grazing is both difficult and costly, and this helps explain why the County's stream buffer requirements specifically exempt livestock farmers. First, establishing a buffer requires the installation of fencing to keep livestock from trampling the vegetation that would otherwise grow to establish the buffer. At the same time, alternative drinking water systems must be installed for the animals because they will no longer be able to access the stream. However, fencing and new water systems can be an expensive proposition for many local farmers. While the state has created a cost-share program that can pay up to 75% of the cost of fencing and undertaking other land management practices on pasture land, it is often the case that the remaining expenses are still too high for many farmers to afford.



More must be done to encourage livestock farmers to establish stream buffers and other effective riparian protections.

The County could help by supplementing the state's cost-share program with the County's own dedicated source of funding, focusing attention on those local waterways that are impaired by *E. coli*. The supplemental funding could be used to cover the remaining share of the costs of taking needed land management steps on pasture lands located near impaired waterways.

In addition to setting aside some of its own funding, the County could include among the annual legislative priorities it sends to the General Assembly a request for increased state monies to support the cost-share program and the administrative and technical staff members who implement it. Although a new state law creates a specific fund that can only be used for the cost-share program, no money has yet been set aside for the fund. The County could voice its support to the state for establishing a dedicated revenue source for the new fund.³⁸

We recommend the County set aside funding to supplement the state cost-share program for undertaking protective agricultural land management practices in watersheds impaired by *E. coli*. We further recommend that the County request the General Assembly to establish a dedicated source of revenue for the new Virginia Natural Resources Commitment Fund.

Making Better Choices

Albemarle County is experiencing firsthand the harm that stormwater runoff can cause to rivers and streams in rapidly developing areas as well as more rural locations. One of the most promising ways we can effectively respond to this threat is by making better choices about how we manage and develop our land. This report highlights a number of ways in which the County's ordinances and policies can be refined to foster management and development decisions that go further to protect our local waterways. By removing unnecessary regulatory obstacles to smarter development patterns, strengthening water protections where there are currently loopholes, and providing stronger incentives for more sensitive land stewardship, we can ensure cleaner and healthier rivers and streams throughout the County.



Endnotes

¹ Virginia Department of Environmental Quality, *Final 2006 305(b)/303(d) Water Quality Assessment Integrated Report* (approved by the Environmental Protection Agency on Oct. 16, 2006).

² Virginia Department of Environmental Quality, *Results of the Rivanna River Total Maximum Daily Load Study*, PowerPoint presentation delivered at February 11, 2008 public meeting (<http://www.deq.state.va.us/export/sites/default/tmdl/pptpdf/rivp2deq.pdf>).

³ Albemarle County, Va. *1996-2016 Comprehensive Plan* (Natural Resources and Cultural Assets Component), p. 28 (adopted March 3, 1999) (<http://www.albemarle.org/departments.asp?department=planning&relpage=3000>).

⁴ Virginia Department of Environmental Quality, note 1, p. 3.1-3.

⁵ Chesapeake Bay Foundation, *A Better Way to Grow: For More Livable Communities and a Healthier Chesapeake Bay* (1996), p. 4.

⁶ Virginia Department of Conservation and Recreation, *Virginia Stormwater Management Program* (http://www.dcr.virginia.gov/soil_&_water/stormwat.shtml).

⁷ *Ibid.*

⁸ TEC Inc., *Hollymead Lake Sediment Survey*, prepared for Forest Lakes Community Association and Hollymead Citizens Association (Aug. 2007) (http://www.hollymead.org/sediment_survey.pdf).

⁹ Working with students from the University of Virginia, Virginia Tech and Virginia Commonwealth University, the James River Association published its findings in an informative report entitled *Building a Cleaner James River: Improving Local Building Codes & Ordinances to Protect the James River & Its Tributaries* (January 2007) (http://www.jamesriverassociation.org/watershed_scores.html).

¹⁰ Further information on the Code and Ordinance Worksheet, the model development principles on which it is based, and the process used to develop those principles may be found on The Center for Watershed Protection's *Site Planning and Model Development Principles* webpage: (http://www.cwp.org/22_principles.htm).

¹¹ Calculation available at North Carolina Clean Water Education Partnership web site: (<http://www.nccwep.org/involvement/kids/slobber.php>).

¹² Mary Smith, *Vehicle Sizes Inch Down . . . Literally!*, Walker Parking Consultants (2007) (copy available from author).

¹³ Albemarle requires 1 space per 200 ft of "net office floor area," which section 18-4.12.6 of the County Code defines as 80% of the gross office floor area. This translates to 4 spaces per 1,000 square feet of gross floor area.

¹⁴ Albemarle County Code § 18-4.12.2(c)(1) (2008).

¹⁵ Albemarle County Code § 18-32.7.9.7 (2008).

¹⁶ Thomas R. Schueler, *Site Planning for Urban Stream Protection* (Ch. 6, Headwater Streets), p. 147 (1995).

¹⁷ *Ibid.*

¹⁸ More information on the proposed regulations, including the most recent draft, is available on the Virginia Department of Transportation's web site (<http://www.virginiadot.org/projects/ssar/default.asp>).

¹⁹ Albemarle County Code § 14-410(H) (2008).

²⁰ Schueler, note 16.

²¹ Albemarle County Code § 18-32.7.9.9 (2008).

²² Albemarle County Code § 18-32.7.9.9(d) (2008).

²³ Specifically, § 10.1-1127.1 of the Virginia Code gives localities the authority to adopt tree conservation ordinances.

²⁴ See, for instance, section 18-32.7.9.4(c) of the County Code, which gives the County the authority to require that site development plans spare small groups of trees or individual trees that contribute significantly to the character of Albemarle County. See also section 18-4.3 for the County's tree cutting ordinance, which limits the cutting of trees of a certain size but does not apply outside the County's Rural Areas and is largely inapplicable during the development of land.

²⁵ Fairfax City Code § 110-257 (2008).

²⁶ Arlington County Code § 67-3 (2008).

²⁷ For example, a recent U.S. Environmental Protection Agency report analyzes seventeen case studies of developments and compares the costs of applying LID stormwater controls to the costs of traditional stormwater controls on the same developments. The report concludes that in the vast majority of cases, significant savings were realized and environmental performance was improved when LID methods were used. U.S. Environmental Protection Agency, *Reducing Stormwater Costs through Low Impact Development Strategies and Practices*, Publication Number EPA 841-F-07-006 (December 2007) (<http://www.epa.gov/owow/nps/lid/costs07/>).

²⁸ Virginia Department of Conservation and Recreation, *Virginia's Erosion and Sediment Control Program* (http://www.dcr.virginia.gov/soil_&_water/e&s.shtml).

²⁹ U.S. Environmental Protection Agency, *National Management Measures to Control Nonpoint Source Pollution from Urban Areas, Management Measure 8: Construction Site Erosion, Sediment, and Chemical Control*, Publication Number EPA 841-B-05-004 (Nov. 2005) (available for download at <http://www.epa.gov/owow/nps.urbanmm>).

³⁰ Tom Pakurar, Hands Across the Lake, *Impact of Runoff Pollution 8/25/02-9/2/02 on Swift Creek Reservoir*, November 12, 2002.

³¹ 4 Va. Admin. Code 50-30-40 (2008).

³² Va. Code Ann. § 10.1-570 (2008).

³³ 4 Va. Admin. Code 50-30-40(1) (2008).

³⁴ For example, the developers of the Biscuit Run project recently proffered the following as part of the rezoning for that project: “Within nine (9) months after the start of grading under any erosion and sediment control permit, permanent vegetation shall be installed on all denuded areas, except for areas the Program Authority determines are otherwise permanently stabilized or are under construction with an approved building permit. A three (3) month extension for installation of permanent vegetation may be granted by the Program Authority due to special circumstances including but not limited to weather conditions.”

³⁵ Va. Code Ann. § 10.1-563 (2008); Albemarle County Code § 17-205 (2008).

³⁶ A copy of Norfolk’s agreement-in-lieu-of-a-plan is available at http://norfolk.gov/Planning/Applications/Erosion_Sediment.pdf.

³⁷ Virginia Department of Environmental Quality, *Results of the Rivanna River Total Maximum Daily Load Study*, PowerPoint presentation delivered at February 11, 2008 public meeting (<http://www.deq.state.va.us/export/sites/default/tmdl/pptpdf/rivp2deq.pdf>).

³⁸ For example, ten Virginia environmental and agricultural groups co-authored a letter to Governor Kaine dated August 29, 2007, requesting that 1/10th of 1 cent of the state sales tax revenue be dedicated to the fund.