Reducing Runoff from New Development

Recommendations for the City of Charlottesville

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

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UNIVERSITY of VIRGINIA SCHOOL OF LAW
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 non-profit 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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Southern Environmental Law Center

The Southern Environmental Law Center is a non-profit, 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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Introduction

Charlottesville's residents consistently rank environmental protection as a top priority for the City. Our 2007 Comprehensive Plan recognizes that "[t]he city's commitment to environmental sustainability is a key component in ensuring that the community's high quality of living can be maintained for years to come."[1]

Protecting the quality of the City's streams and rivers is a large part of that environmental commitment. It is also a significant challenge. Stretches of the Rivanna River, Meadow Creek, and Moore's Creek that run through or near the City are included on the Virginia Department of Environmental Quality's list of "impaired waters."[2] In addition, a recent StreamWatch study of stream health in the Rivanna River Basin found that water quality was worst at the two monitoring sites located in or nearest to Charlottesville.[3]

The City's Comprehensive Plan acknowledges that one of the greatest ongoing threats to our local waterways is polluted stormwater runoff, pointing out that the streams within the Meadow Creek watershed "are impacted by the high level of associated impervious cover," while the Moore's Creek watershed "suffers degradation from contaminated stormwater runoff and aging stormwater infrastructure."[4]

Unfortunately, the magnitude of this threat is likely to increase in coming years as the City continues to develop, and more and more natural terrain is replaced with asphalt, pavement, and buildings. Charlottesville and surrounding localities must act now to minimize the effect that new development will have on our local waterways by reducing the runoff from future projects.

The City deserves much credit for actions it has already taken or that City staff has proposed to help address runoff, including the raingarden demonstration project built in Greenleaf Park[5] and City staff's recent stormwater fee proposal to help fund needed repairs to Charlottesville's stormwater infrastructure.[6] These are important steps, and we are encouraged that City Council appears to be pursuing the fee proposal. However, much more needs to be done.

This report—a joint effort of the University of Virginia Law School's Environmental Law and Conservation Clinic, the Rivanna Conservation Society, and the Southern Environmental Law Center—recommends a number of straightforward and common-sense changes the City could make to its development ordinances and policies to help reduce runoff from new development.

To be sure, these recommendations, if implemented, will not eliminate stormwater runoff in the City or solve the myriad problems it poses. For one thing, our recommendations focus primarily on limiting runoff from new development, but cutting back on the stormwater damage that existing development inflicts is also critical and will require a sustained effort over the long term. Moreover, 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.

In the meantime, this report offers a number of important near-term opportunities. Most of our recommendations could quickly be put into practice within the existing regulatory system to reduce the additional stormwater burden that future development in the City could otherwise impose. That burden is one that cannot be neglected if Charlottesville hopes to improve local water quality and make continued progress toward environmental sustainability.

The Challenges of Stormwater Runoff

The Virginia Department of Environmental Quality has identified stormwater runoff from urban landscapes as a primary contributor to water pollution throughout the state.[7] In natural and forested conditions, much of the precipitation from rainstorms is absorbed back into the ground close to where it falls. Typically, any excess rainwater will flow slowly over the terrain and eventually empty into nearby streams and rivers. But as the amount of developed land in an area increases, less of the precipitation is able to seep back into the soil. Instead, it collects on paved and compacted surfaces and then flows over the land at greatly increased velocities and volumes, even during small rainstorms. The intensified flows quickly make their way into surface waters, either rushing through overwhelmed natural channels that lead to larger creeks and streams, or by getting flushed into underground stormwater sewers that discharge the untreated runoff directly into waterways.[8]

Stormwater runoff can damage waterways in a number of ways. First, the heavy runoff causes flows to intensify in the streams and rivers into which it empties. The increased flows can erode a massive amount of sediment from the banks and beds of the streams, disrupting river and shoreline ecosystems. Further, the eroded sediment is swept downstream, smothering aquatic habitat as it settles to the streambed. Such stream sedimentation can also gradually fill in drinking water reservoirs, reducing their capacity and increasing water treatment costs.[9]

In addition, as rain washes off paved surfaces, lawns, and construction sites, it picks up oil, fertilizers, sediment, and numerous other contaminants on those surfaces. Natural ground cover normally helps to slow and filter the runoff, allowing sediment and other pollutants to settle out as the runoff flows over the land. But where natural ground cover is replaced with built surfaces and manicured lawns, runoff transports a much higher volume of pollutants directly into nearby waterways. This influx of pollutants often causes severe harm to fish and wildlife, and it can make rivers and streams unfit for recreation.[10]

The polluted runoff challenge tends to be greater in urban localities such as Charlottesville where buildings and pavement already dominate the landscape and where many of the remaining areas of green space are being covered by impervious surfaces. The problem is made worse by the high number of construction projects in the City over the past several years. Typically, construction activities remove the stabilizing layer of topsoil on a site, exposing the underlying soil layers directly to the elements. This in turn causes the soil to erode into smaller sediments that rainwater can then transport into nearby waterways. For example, recent construction of new developments such as the Huntley Planned Unit Development project near Moore's Creek and the Cherry Hill development adjacent to Lodge Creek have led to citizen concerns and complaints over the amount of sediment being washed into those waterways. Additionally, the Grand Lark student housing project (15th Street Apartments) has received numerous notices of violation and stop-work orders from the City for violations of erosion and sediment control requirements.

The choices we make now in how we develop our land will help determine the future health of our local waterways. By removing some unnecessary regulatory obstacles to smarter development patterns and by encouraging more responsible site design and construction practices, we can reduce the impact of new development and get a better handle on this growing problem.

Background

The recommendations discussed below are the result of an extensive analysis of the City's development ordinances and policies jointly conducted by the Rivanna Conservation Society, the Southern Environmental Law Center, and the University of Virginia Law School's Environmental Law and Conservation Clinic. The project was designed to build upon a broader review the James River Association conducted in 2006 of the forty-five major localities that make up the James River watershed, including Charlottesville.[11]

The Center for Watershed Protection has developed a Code and Ordinance Worksheet that was the starting point for our analysis. That document contains a number of benchmarks against which a locality's ordinances may be compared to determine how well they promote development practices and techniques that reduce stormwater runoff.[12] Working with several U.Va. law students, we used the Worksheet to identify a number of City practices and specific provisions of the City Code that showed some potential for improvement.

We then spent several months refining our preliminary findings based on numerous discussions with City staff and members of Charlottesville's development and environmental communities, as well as the collective experience and knowledge of our own organizations. The recommendations presented below are the culmination of this effort, and we believe they represent a manageable set of practical, common-sense steps the City could take to reduce runoff from new development and improve upon its current efforts to address the stormwater problem.

Recommendations

The recommendations are grouped into five broad categories:

1. Amend City Code provisions to reduce impervious surface.
2. Promote on-site infiltration and low-impact development features.
3. Limit erosion from construction sites.
4. Regularly update and expand the City's stormwater guidance manual.
5. Explore new initiatives to enhance stream buffers.

Category 1: Amend City Code provisions to reduce impervious surface

In recent years, many new techniques and practices have been advanced to reduce the impact of new development on streams and rivers. One common goal of these strategies is to reduce the amount of impervious surface that new development generates. Simply put, the less impervious surface created on a development site, the more rainwater can be slowed and filtered by natural surfaces or infiltrate back into the ground.

In addition to the water quality benefits, there is often an economic incentive to developers to limit the amount of impervious surface they create in a new development. Less pavement can often translate to reduced expenses for grading, materials, and construction.

Yet developers may often be forced to create more impervious surface than they otherwise would because local development ordinances include minimum size requirements for features such as parking spaces and road widths. When these mandated minimums exceed the size actually needed for the features to achieve their purposes effectively and safely, they result in unnecessary impervious surface.

It is therefore beneficial for local governments to update their ordinances periodically to reflect evolving standards and remove or amend requirements that result in excessive pavement. The recommendations outlined below reflect specific changes that could be made to existing provisions of the City Code to reduce certain pavement requirements without sacrificing other important goals, such as public safety.

A. Reduce the minimum allowable street width for low-volume residential streets.

Streets account for roughly half of the paved surfaces in many traditional neighborhoods and are often the largest single component of pavement in a residential subdivision.[13] Residential streets also account for a significant portion of a locality's overall impervious surface. At least part of the reason for this is that localities often incorporate standards into their ordinances requiring residential streets to be unnecessarily wide, even after safety considerations (such as sufficient access for emergency vehicles) are taken into account. By reviewing their standards and allowing developers to build new residential streets to lesser widths where appropriate, localities can reduce impervious surface in new developments and at the same time improve roadway safety by reducing traffic speeds.

City staff members are now reviewing and updating the City's subdivision design standards, and minimum residential road widths are one of the items they are considering. Currently, section 29-62 of the Charlottesville City Code requires a minimum paved surface of 30 feet for a "local street"—the lowest volume residential streets addressed in the Code. This significantly exceeds the Center for Watershed Protection's recommended minimum of 18 to 22 feet of pavement for streets in low-density residential developments. Moreover, the Virginia Statewide Fire Prevention Code states that 20 feet of unobstructed width will usually suffice to provide fire apparatus access.[14] Charlottesville's minimum pavement width of 30 feet for local streets would therefore seem to exceed appreciably what is necessary for low-volume residential streets where on-street parking is either unnecessary or can be limited to one side of the street. Indeed, for streets with average daily traffic of less than 1,500 vehicles, the City of Roanoke allows a minimum paved way of 26 feet, and this includes parking on both sides of the street.[15]

We recommend that section 29-62 be amended to reduce the minimum required pavement width for "local streets."[16]

B. Reduce the minimum required diameter for paved surface in a cul-de-sac to 70 feet, and require landscaped islands in the middle of large cul-de-sacs.

Similar to excessive street widths, oversized cul-de-sacs unnecessarily generate stormwater runoff. Allowing developers to build cul-de-sacs at the minimum radius necessary that still accommodates emergency and maintenance vehicles helps reduce unnecessary impervious cover. For example, a cul-de-sac with a paved diameter of 70 feet results in nearly 1,200 fewer square feet of impervious surface than a cul-de-sac with a paved diameter of 80 feet.

This is a good example of a landscaped island in the middle of a cul-de-sac, located in the new Brookwood development currently under construction on Raymond Avenue in Charlottesville. Additional stormwater benefits could be provided if it were designed so that runoff from the street drained into it.

Further, creating landscaped islands in the middle of cul-de-sacs rather than paving the entire surface

helps cut back on pavement. For example, a 40-foot diameter island in an 80-foot diameter cul-de-sac will reduce the impervious surface of the cul-de-sac by 25%. If the island is designed and built to capture runoff from the surrounding roadway—rather than being raised above the surrounding roadway and surrounded by impermeable curbs—the landscaped center can have an even larger stormwater benefit.

As with street widths, cul-de-sacs are one of the items being reviewed as the City updates its subdivision design standards. Section 29-62 of the City Code currently requires a minimum diameter of 80 feet of paved surface in a cul-de-sac. There is no explicit mention that landscaped islands are required or even allowed. The Center for Watershed Protection recommends a minimum radius of paved surface of 35 feet (70-foot diameter) and encourages the creation of landscaped islands within cul-de-sacs.

We recommend that section 29-62 be amended to reduce the required minimum diameter of paved surface in a cul-de-sac to 70 feet. For cul-de-sacs built to an 80-foot diameter or larger, we recommend that the Code be amended to require landscaped islands in the middle.

C. Review City Code's required minimum and maximum driveway widths and reduce the current requirements to the greatest extent possible without compromising safety.

Driveways are another large source of impervious pavement; roughly 30% of the pavement in traditional residential subdivisions consists of driveways.[17] As with streets and cul-de-sacs, ensuring that minimum and maximum driveway width requirements are not overly broad can help reduce the amount of unnecessary impervious surface that new development generates. It is also helpful if local ordinances explicitly allow two-track designs and permeable surfaces for driveways serving single-family homes.

The City Code's requirements for driveway widths vary considerably depending on the type of dwelling unit the driveway would serve and the part of the yard in which the driveway would be located. Specifically, section 34-972 appears to establish a few maximum driveway width requirements, while section 34-976 establishes minimum widths for all driveways except those serving single- and two-family dwellings.

The Center for Watershed Protection recommends a minimum driveway width of 9 feet or less for one-lane driveways, and 18 feet for two-lane driveways. As a relevant example, the City of Lexington's zoning ordinance contains a minimum driveway width of 8 feet.[18]

We recommend that the City review its required minimum and maximum driveway widths and reduce the current requirements to the greatest extent possible without compromising safety.

D. Require at least 20% of the parking spaces within large parking lots be designed to "compact car" dimensions.

Approximately 20% of automobiles on the road today constitute "compact cars."[19] However, many large parking lots are configured so that every parking space can accommodate the largest class of automobile on the road. Requiring instead that an appropriate percentage of the parking spaces within large parking lots be designed to "compact car" dimensions can reduce the amount of impervious pavement in the parking lot while accommodating the same number of vehicles. It can also increase the opportunities and area available for incorporating stormwater best management practices into the parking lot design.

Section 34-977 of the City Code gives City staff or the Planning Commission the ability to allow up to 30% of the spaces within parking lots of 10 or more spaces to be designed to "compact car" dimensions. This provision would be improved if it also contained a requirement that at least 20% of the spaces in these parking lots must be designed to "compact car" dimensions.

We recommend that section 34-977 be amended to require 20% of the parking spaces within large parking lots be designed to the City's "compact car" parking space dimensions.

Category 2: Promote on-site infiltration and low-impact development features

Another key strategy to reducing stormwater runoff and the damage it causes to local waterways is to absorb and manage more rainwater on the development site using natural landscape features. This strategy has recently been embodied in a set of stormwater management practices collectively known as "low-impact development" (LID). These practices focus on preserving or incorporating natural features into development sites that emulate the way the site absorbs and filters stormwater in its predevelopment state. This is in contrast to the more traditional management approach which aims to "dispose" of stormwater by channeling it into the storm sewer system or large holding ponds as quickly as possible.

Increasing the amount of rainwater that is absorbed or filtered close to where it falls helps reduce the amount of pollutants in runoff, cut down on streambank erosion caused by peak stormwater flows, and promote groundwater recharge. This approach can also enhance aesthetics on development sites and reduce long-term stormwater management costs.[20]

It is therefore beneficial for local governments to update their ordinances and policies periodically to promote practices that allow more stormwater to infiltrate and be naturally managed on development sites. The recommendations outlined below reflect specific changes that could be made to the City Code to promote such practices.

A. Increase on-site infiltration of stormwater in new parking lots.

Surface parking lots generate high volumes of stormwater runoff. For example, a one-acre paved parking lot (43,560 square feet) will produce over 27,000 gallons of runoff during a one-inch rain.[21] Further, the runoff will collect many of the various pollutants that have accumulated on the parking lot surface since the last rainstorm. Landscaped areas of trees and shrubs within parking lots can help reduce and also filter runoff, while creating a more attractive, safe and shaded parking area.

- **Expand the scope of the City's parking lot landscaping ordinance to apply to smaller parking lots, and increase the percentage of parking lot area that must be landscaped with trees or shrubs.**

Section 34-873 of the City Code includes an interior landscaping requirement for parking lots of 20 or more spaces. 5% of the gross area of these parking lots must be landscaped with trees or shrubs. By strengthening these requirements, the City could reduce the stormwater impact of new parking lots. For purposes of comparison, the City of Norfolk requires interior landscaped planting areas be 10% of the parking lot area, and the requirement applies to parking lots of 10 or more spaces.[22]

We recommend that section 34-873 be amended to increase to 10% the percentage of the parking lot area that must be landscaped with trees or shrubs, and to apply the current landscaping requirement to parking lots of 10 or more spaces.

Even relatively small parking lots can produce a high volume of runoff.

- **Require interior landscaped areas to be designed to filter runoff from the paved portion of the parking lot.**

The water quality benefit of increasing the size of the landscaped portions of parking lots could be augmented by requiring that these landscaped areas be designed to filter some of the stormwater runoff generated by the paved portion of the parking lot. Traditionally, most landscaped portions of parking lots are contained in raised islands that are bordered by impenetrable curbs. With runoff from the paved portion of the parking lot unable to infiltrate the landscaped areas, the stormwater benefit the landscaped areas provide is limited to the rain that falls directly on them. If the landscaped portions were instead designed at a slightly lower grade than the adjacent portions of the parking lot and surrounded by a perforated curb, it would allow some runoff from those adjacent portions to drain into and be filtered by the landscaped areas.

The City Code currently does not require that interior landscaped areas of parking lots be designed to accept any runoff from the paved portion of the lot. However, the Code does require such design for the thinner landscaped buffers that are sometimes required along the edges of a parking lot.[23] By extending this design requirement to the interior landscaped areas, more of the parking lot runoff could be managed on-site. Incorporating other design practices into the landscaped areas, such as bioretention areas or biofilters with underdrain filters, could increase their stormwater benefits even further.

We recommend that section 34-873 of the City Code be amended to require that interior parking lot landscaping areas be designed to filter a portion of the runoff from the paved areas of the parking lot.

B. Offer incentives to developers to exceed the tree canopy requirements set forth in the City Code and to preserve existing trees at development sites.

In naturally forested conditions, a leafy tree canopy provides an initial barrier to rainfall, reducing the erosive force with which raindrops hit the earth. The tree canopy also helps to catch and absorb some of the rainwater, decreasing the amount that reaches the ground. A portion of the rain that does make it to the ground is then absorbed and filtered by the root structures of the trees and the natural terrain that surrounds them.

Requiring that a percentage of new development sites be covered in tree canopy within a certain number of years of the completion of construction means there will eventually be some number of trees on the site that will be able to provide these valuable stormwater benefits. This is in addition to the obvious aesthetic, economic, and air quality benefits that trees provide to a development site.

Currently, section 29-43 of the City's subdivision ordinance and section 34-869 of the City's zoning ordinance include certain tree canopy percentage requirements for new developments within different zoning districts. These percentages are set at the highest level that the state enabling legislation permits localities to require. However, the City could still encourage developers to exceed these canopy requirements voluntarily, including offering possible incentives such as density bonuses or an accelerated approval process.[24]

In addition, because newly planted trees take time to grow, protecting and preserving existing trees during construction and site development leaves mature trees on the site that can provide a stormwater benefit both during and immediately after construction. Although the City currently awards a "bonus" in the canopy calculation formula for each existing tree preserved on the site, additional incentives could be explored to encourage developers to preserve existing trees when they are creating their development plans. These incentives should incorporate measures to ensure that the designated trees are adequately protected during the entire construction process.

We recommend that the City explore incentives for exceeding the tree canopy requirements set forth in the City's subdivision and zoning ordinances, and that it explore additional incentives to encourage developers to preserve existing trees and adequately protect them during construction.

C. Adopt a tree conservation ordinance to safeguard heritage, specimen, memorial, and street trees worthy of protection.

Section 34-866 of the City's zoning ordinance encourages developers to preserve trees of outstanding size, age, or historical value when they design new developments, but there is no firm requirement that these exceptional trees be saved. Instead, entire sites can be razed with no mature trees left standing to help slow and filter runoff during and immediately after construction.

A tree protection ordinance adopted pursuant to the enabling authority provided in section 10.1-1127.1 of the Virginia Code would provide a needed layer of additional protection from development activity for the City's most remarkable trees. It would help ensure that the stormwater benefit provided by at least a few of the City's most outstanding trees would be insulated against future development activity.

For purposes of comparison, Fairfax City[25] and Arlington County[26] have adopted tree conservation ordinances to protect specific heritage, memorial, specimen, and street trees those localities have deemed worthy of preservation.

We recommend the City adopt a tree protection ordinance and designate specific heritage, specimen, memorial, and street trees deemed worthy of preservation.

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

In addition to expanding the opportunities for on-site infiltration, the City should also explore possible incentives to developers and homeowners to utilize significant LID features such as green roofs, permeable pavers, and rainwater harvesting systems. An abundance of recent research demonstrates that many low-impact development practices can be installed and maintained over the long run at a lower cost than traditional stormwater management practices.[27] However, 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.

A good example of a green roof can be found on the Albemarle County office building located on McIntire Road in the City.

The City could help address these barriers and "jump-start" the use of these new practices by offering incentives to developers who incorporate them into their projects. For example, inducements such as density bonuses and reduced or waived application fees could provide the necessary enticement to developers and homeowners to employ some of these larger stormwater practices. City Council has recently endorsed the idea of a real estate tax reduction for owners of energy-efficient homes and businesses. Similar incentives should also be explored for developers and homeowners who effectively incorporate LID features.

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

Category 3: Limit erosion from construction sites

When 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] 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]

Reducing the amount of time that disturbed soil is left denuded and exposed is key to limiting the amount of sediment that rain washes off construction sites.

Even with a valid erosion and sediment control plan in place, a significant amount of the eroded sediment from construction sites is carried into nearby waterways during rainstorms. For example, in just one week in 2002, monitoring stations showed that rainfall washed 1.4 million pounds (or 700 tons) of sediment and 400 pounds of phosphorous off of construction sites for Route 288 into the Swift Creek Reservoir, a primary drinking water source for Chesterfield County.[30] And a recent sediment survey of Hollymead Lake in northern Albemarle County suggests that upstream portions of the lake bottom are covered in up to six feet of "recent sediment"—sediment that has likely been deposited in the past four years.[31] This corresponds with a period of intense development and construction activity upstream of the lake.

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

Limiting the time during which soil on construction sites is left in a denuded and destabilized condition is key to reducing the amount of sediment from the site that ends up in nearby waterways. 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.

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,[32] 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 evade the requirement and leave large portions of construction sites in a denuded and exposed condition indefinitely.

An approach that reduces the potential for this type of abuse has recently been undertaken by Albemarle County and some developers proposing rezonings there. Developers are proffering that within nine months after the start of grading under an erosion and sediment control permit, permanent vegetation must be installed on all denuded areas covered by the permit (except for any areas of the site where construction of structures is already underway at that time).[33]

The City could borrow from the County's approach and amend its water protection ordinance to require that all erosion and sediment control plans include a time limit by which all denuded and destabilized terrain on the site must be permanently revegetated. The particular time limit incorporated into each individual erosion and sediment control plan would be determined with City staff based on the specific characteristics of that site. In addition, the ordinance could also make clear that in no case shall the time

limit for revegetation in any erosion and sediment control plan exceed a specified number of months (as determined by the City). These changes would help plug the loophole in the state erosion control regulations and ensure that construction sites will not be left denuded for excessive periods of time.

We recommend the City amend its erosion and sediment control ordinance to require that all erosion and sediment control plans include a time limit by which all denuded and destabilized terrain in the area covered by the plan must be permanently revegetated. In addition, the ordinance should set an overarching time limit that may not be exceeded in any individual erosion and sediment control plan.

B. Expand the list of erosion control measures explicitly referenced in the form contract the City 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 City's erosion and sediment control ordinance allow the property owner to enter into an "agreement-in-lieu-of-a-plan" rather than submit a full erosion and sediment control plan. The purpose is to facilitate the permitting process for landowners proposing a relatively small land disturbance. Although it makes the process faster and easier, the agreement-in-lieu-of-a-plan does not exempt these landowners from complying with the erosion and sediment control ordinance; they must still put adequate erosion and sediment controls in place.

With relatively little guidance from the state as to the form that agreements-in-lieu-of-a-plan should take, localities have come up with "form contracts" that they enter into with qualifying landowners. Those contracts typically include a broad statement about the landowner's agreement to comply with the applicable erosion control requirements and any additional requirements that the locality may deem necessary. Specifics, however, are often lacking.

Notably, some localities append a list of requirements that set forth specific erosion protections that must be undertaken on any site for which there is an agreement-in-lieu-of-a-plan. The City of Norfolk, for example, expressly incorporates twelve conditions into the agreements. These conditions include, among other things, a requirement to install erosion and sediment control measures before construction begins, a mandate to remove sediment from paved areas on a daily basis, and a requirement to stabilize stockpiles of soil.[34]

By explicitly spelling out the most critical requirements rather than relying on a broad statement that makes only a vague reference to "the applicable rules and regulations," Norfolk helps ensure property owners and contractors are more familiar with the required practices for limiting erosion. This, in turn, likely leads to more consistent compliance with those requirements. Additionally, Norfolk can more easily enforce those specific requirements when it becomes clear they are being ignored.

Charlottesville's form contract for agreements-in-lieu-of-a-plan includes only one specific condition, and that condition is the same loose requirement from the state regulations that relates to revegetating denuded areas (discussed in the recommendation above). At a minimum, it seems Charlottesville could incorporate into its agreement-in-lieu-of-a-plan a more complete list of explicit requirements similar to the list Norfolk includes. Further, the new requirements could include the overarching time limit by which all denuded and destabilized terrain covered by the plan must be permanently revegetated, as discussed above.

We recommend that the City 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 explicitly referenced be the overarching time limit for permanent revegetation discussed in the prior recommendation.

C. Lower the threshold for compliance with the City's erosion and sediment control ordinance to 2,500 square feet.

The City's water protection ordinance requires compliance with the erosion and sediment control provi-

sions for most land disturbances of 6,000 square feet or greater in size. Most disturbances less than 6,000 square feet are exempt from the requirements of the erosion and sediment control program and are not required to put protections in place to reduce erosion and sediment-laden runoff during construction. While the City's 6,000-square-foot threshold is more protective than the 10,000-square-foot threshold that state law currently requires, individual land disturbances in the City will usually be relatively small because of the City's urban character. As such, there are many land disturbances in the City that fall below the current 6,000-square-foot threshold and therefore go unregulated. These unregulated disturbances can be a significant contributor of sediment to local waterways, especially when viewed in the aggregate. If these unregulated disturbances were brought within the purview of the City's erosion and sediment control program, the amount of eroded sediment leaving these sites and ending up in local waterways could be reduced.

It is worth noting that Virginia requires forty-six localities located closer to the Chesapeake Bay to use a 2,500-square-foot threshold. Therefore, many other localities in the state are already successfully employing the smaller and more protective 2,500-square-foot threshold.

We recommend that the City reduce its threshold for land disturbances that must comply with the City's erosion and sediment control provisions to 2,500 square feet.

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

While quickly establishing a robust vegetative cover on denuded soil helps limit the amount of sediment that erodes from a development site during and after construction, a healthy layer of topsoil is crucial to establishing that vegetative cover. 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 to form.

During construction disturbances, the topsoil is frequently damaged or removed and discarded, and subsoils emerge to form the new surface of a development site. The subsoils lack the rich mixture of components in topsoil that nourish plant growth. It often becomes necessary to supplement or "amend" these subsoils in areas that are to be revegetated once construction is complete, and this process can be an expensive undertaking for developers.

It is therefore important to avoid disturbances and damage to topsoil as much as possible during construction. On those areas of the site that will be disturbed, the topsoil should be removed, stockpiled and stored in a protective way. Once grading of the area is complete, the topsoil should be replaced as soon as possible to areas that are to be revegetated in order to provide the necessary foundation for plant growth. Unfortunately, many developers today either are not aware of the importance of topsoil or simply opt not to preserve it. By educating citizens and developers on the value of topsoil and the importance of preserving it during construction, the City could increase the likelihood that topsoil at future construction sites will be preserved.

We recommend that the City 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.

E. Hire additional staff members to review erosion and sediment control plans and enforce the water protection ordinance.

Localities have primary responsibility for implementing a local erosion and sediment control program. Among other things, this includes reviewing and approving erosion and sediment control plans, inspecting construction sites on a routine basis, and enforcement. This places a significant burden on City staff members, many of whom only spend a portion of their day working within the erosion and sediment control program. Implementing the recommendations outlined above would almost certainly increase the

number of plans that staff must review and the number of site inspections staff must perform. It is also likely to lead to an increase in enforcement activity. An additional staff member or members will probably be needed to carry out these recommendations effectively.

We recommend that the City hire an additional staff person or persons to assist with plan reviews, inspection, and enforcement of the City's erosion and sediment control program.

Category 4: Regularly update and expand the City's stormwater guidance manual

It is often the case in the City that residents and developers coming forward with site plans and building proposals are environmentally minded citizens willing to go the extra mile to minimize stormwater runoff and promote on-site infiltration. However, citizens may need guidance explaining when certain practices may be appropriate, as well as instructions on how to design and implement those practices. Recognizing this, the City has published an extensive stormwater guidance manual that outlines a number of good stormwater management practices and includes design guidelines detailing how certain practices may be implemented.[35]

While the manual effectively describes a number of low-impact stormwater techniques, we recommend that the manual be updated to incorporate a few additional best management practices. The City's stormwater guidance manual serves the dual purpose of educating those submitting stormwater plans, as well as the City staff members responsible for reviewing and approving them. As new approaches for managing stormwater on site are developed and demonstrated to be effective, incorporating those approaches into the manual helps ensure that City staff becomes familiar with the practices, can determine where they may be appropriate, and can instruct applicants on their implementation.

We recommend that the City's stormwater guidance manual be regularly updated, and that it be made more usable to the public by separating the various chapters on the City's website.

We further recommend that technical guidance for the best management practices described below be incorporated into the City's stormwater management manual as soon as possible.

- **Develop technical specifications demonstrating the use of periodic curb cuts along roadsides.**

Conventionally designed curbs and gutters concentrate stormwater runoff from roads and channel it directly to the stormwater piping system, eliminating opportunities for treatment and infiltration into the ground. If periodic curb cuts (or "perforated curbs") are used instead, opportunities are created for stormwater to access vegetated channels and other areas of natural ground cover adjacent to the roadsides where it can be slowed, filtered, and absorbed. By developing technical specifications for using perforated curbs, the City would make it easier for developers to employ this practice.

Periodic curb cuts allow for streetside infiltration of stormwater, reducing the amount of runoff that enters storm sewers.

- **Develop technical specifications demonstrating how landscaped areas can be designed to manage and filter runoff from the paved portions of parking lots.**

In a recommendation included in Category 2, we propose that interior parking lot landscaping areas be designed to filter some of the runoff from the paved portions of the parking lot. In addition to the information the City's stormwater guidance manual already provides on infiltration and bioretention techniques, some specific guidance describing how these devices can be used in place of traditional "raised" landscaped islands would help ensure that the interior parking lot landscaping areas are appropriately designed to filter and manage runoff more effectively.

- **Provide information on the benefits of rainwater harvesting and instructions on appropriately utilizing harvested rainwater.**

The density of some development and redevelopment projects in the City will be so great that the opportunities for on-site infiltration of stormwater will be severely limited. In these cases, one of the best remaining options is to capture the runoff from the built surfaces and use it as non-potable water. While the City stormwater guidance manual does include design detail schematics of a rainwater harvesting system and a household cistern design, we think it would be useful to also include some text that describes the benefits of rainwater harvesting and provides information on appropriate ways to utilize harvested rainwater.

Category 5: Explore new initiatives to enhance stream buffers

Reducing impervious surface and promoting on-site management of stormwater are essential strategies for decreasing the amount, velocity, and polluted content of runoff that leaves a developed site and reaches nearby waterways. While these are very important pieces of the larger stormwater puzzle, it is also necessary to take steps to slow and filter runoff closer to the waterways we are seeking to protect. One commonly accepted strategy for doing so is to protect and enhance riparian buffers.

Riparian buffers work in many ways to reduce the potential damage of stormwater generated from both new and existing development. First, the root structures of buffer vegetation help stabilize streambanks so they can better withstand the erosive effect of streamflows that have been increased by runoff. Buffers can also reduce the speed and volume of runoff before it reaches the streams by allowing it to infiltrate back into the soil where it recharges groundwater aquifers. Further, the vegetation, roots, and natural debris in buffers can trap sediment and help filter out other pollutants in runoff before they are swept into waterways.

The City's water protection ordinance currently requires a 100-foot buffer on each side of the portions of the Rivanna River, Moore's Creek, and Meadow Creek that flow through the City.[36] City staff is in the midst of exploring whether buffer protections could also be applied to other streams where vegetated buffers are still intact. Because of the many vital roles vegetated stream buffers play, we think this is a very important effort and encourage the City to pursue options that would preserve an existing vegetated buffer around as many City stream segments as reasonably possible.

In addition to preserving existing buffers, the City should continually explore ways it can encourage and help bring about the establishment and reestablishment of stream buffers on both public and private land. For example, working with Albemarle County, the City successfully restored the streambank and reestablished buffers along a 1,200-foot stretch of Moores Creek by Azalea Park.[37] This will help insulate that stretch from runoff and cut down on erosion from the creek's flow. By coordinating public outreach and education efforts with local watershed protection groups, and by leveraging City and state funds to help pay for buffer enhancement programs, the City could raise the bar for buffer reestablishment and even adopt an annual goal of a certain number of linear feet to be restored each year.

We recommend the City:

- **Continue efforts to increase the number of City streams around which vegetated buffers must be preserved.**
- **Work with local watershed protection groups such as the Rivanna Conservation Society to coordinate public education and outreach programs on the importance of establishing and protecting buffers and removing invasive species from them.**
- **Encourage stream buffer enhancement efforts by, for example, providing trees and other plants for private buffer plantings and applying for state grants to implement stream buffer enhancement programs on public lands and within urban areas.**
- **Consider creating at least a small natural stream buffer along the portions of the various streams that run through the City's parks.**

Conclusion

The City of Charlottesville is experiencing firsthand the harm that increased stormwater runoff can inflict on rivers and streams. While the City has already adopted some important measures to lessen the damage caused by runoff, the recommendations included in this report are straightforward actions the City could take to ease the additional stormwater burden that new development in the City could otherwise impose. In addition, some of these recommendations will also help reduce the stormwater impact of existing development. Both objectives are essential if Charlottesville hopes to improve local water quality and make continued progress toward environmental sustainability

Stormwater runoff flows directly into Schenks Branch near the intersection of McIntire Road and Harris Street.

Endnotes

[1] City of Charlottesville, Va. *2007 Comprehensive Plan* (Ch. 8), p. 173 (adopted Aug. 6, 2007) (http://www.charlottesville.org/Index.aspx?page=1745).

[2] 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).

[3] StreamWatch, *Correlates of Biological Condition in Streams and Rivers of the Rivanna Basin—Winter 2003/04 through Fall 2005*. (Oct. 11, 2006) (http://www.streamwatch.org/Data/Reports/index.php).

[4] City of Charlottesville, note 1, p. 178.

[5] Information on the raingarden project is available on the City of Charlottesville's website at http://www.charlottesville.org/Index.aspx?page=563.

[6] Information on the proposed Water Resources Protection Program is available on the City of Charlottesville's website. It is included in the information packet for City Council's Sept. 17, 2007, meeting, available at http://www.charlottesville.org/index.aspx?page=1791.

[7] Virginia Department of Environmental Quality, note 2, p. 3.1-3.

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

[9] Thomas R. Schueler, *Why Stormwater Matters*, The Practice of Watershed Protection (Thomas R. Schueler and Heather K. Holland eds., 2000) (http://www.stormwatercenter.net/Library/Practice/63.pdf).

[10] *Ibid*.

[11] Working in conjunction with the Center for Watershed Protection and students from the University of Virginia, Virginia Tech, and Virginia Commonwealth University, the James River Association's review culminated in the publication of an informative report entitled *Building a Cleaner James River: Improving Local Building Codes & Ordinances to Protect the James River & Its Tributaries* (January 2007). The report can be accessed at http://www.jamesriverassociation.org/watershed_scores.html.

[12] 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 and the worksheet may be found on the Center for Watershed Protection's *Site Planning and Model Development Principles* webpage (http://www.cwp.org/22_principles.htm).

[13] Thomas R. Schueler, "Headwater Streets" (Ch. 6), *Site Planning for Urban Stream Protection* (1995) (http://www.cwp.org/SPSP/TOC.htm).

[14] Virginia Statewide Fire Prevention Code § 503.2.1 (2003).

[15] City of Roanoke, Va., Code § 31.1-400, Table 400-2 (2007).

[16] It should be noted that setting a lower minimum width does not mean that developers could not build the streets wider if they desired; it simply means they would be *permitted* to build to the narrower width.

[17] Schueler, note 13.

[18] City of Lexington, Va., Zoning Ordinance § 28-133(e) (2007).

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

[20] 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 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/).

[21] Calculation available at North Carolina Clean Water Education Partnership website at http://www.nccwep.org/involvement/kids/slobber.php.

[22] City of Norfolk, Va., Zoning Ordinance § 17-5.1 (2007).

[23] City of Charlottesville, Va., Code § 34-873(e).

[24] Offering such incentives would also promote the Comprehensive Plan goal of increasing the urban tree canopy level in the City to forty percent. City of Charlottesville, note 1, p. 187.

[25] City of Fairfax, Va., Code § 110-257 (2007).

[26] Arlington County, Va., Code § 67-3 (2007).

[27] See note 20 for a recent U.S. Environmental Protection Agency report summarizing several examples.

[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) (http://www.epa.gov/owow/nps.urbanmm/index.html).

[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] 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).

[32] 4 Va. Admin. Code 50-30-40 (2007).

[33] 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."

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

[35] City of Charlottesville, *Stormwater Guidance Manual for the City Water Protection Ordinance* (Oct. 2005) (http://www.charlottesville.org/Index.aspx?page=1371).

[36] City of Charlottesville, Code § 10-71 (2007).

[37] Further information on the streambank restoration project is available on the City of Charlottesville's website at http://www.charlottesville.org/Index.aspx?page=570.