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REPORT TO WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

OPTIONS FOR WV'S GENERAL STORMWATER PERMIT UNDER NPDES PHASE II

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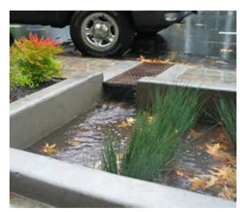


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I. INTRODUCTION

Polluted stormwater runoff is one of the nation's leading threats to clean water. Rain and snowmelt running over parking lots, roofs, over-fertilized lawns and open construction sites wash dirt, chemicals and bacteria into the water we drink. As our cities, towns and suburbs have grown, stormwater problems have increased.

Unlike pollution from industrial operations, stormwater comes from everywhere at once, which makes it challenging for regulated municipalities to effectively manage. As they struggle to find cost-effective solutions, some local water quality managers are turning to their colleagues in the transportation and land use planning fields, because the built environment has a tremendous impact on how much stormwater runs off a site, how fast it goes, and where it ends up. Shared solutions that integrate stormwater management into some development approaches can decrease impervious cover, save time and money, and better protect water resources.

For example, certain development strategies, such as brownfield and greyfield redevelopment, reuse of vacant properties, narrower streets, reduced parking, and low impact development approaches, can be used to effectively protect and restore water resources. Research indicates that these approaches can be used to prevent and minimize stormwater pollutants**,** reduce the volume and rate of stormwater runoff, promote ground water recharge, protect drinking water sources, and protect, or even reduce the need for, investments in water infrastructure.

Stormwater is currently regulated through the National Pollution Discharge Elimination System (NPDES) part of the Clean Water Act. In 1990, medium and large cities with populations over 100,000 people, were required to create a specific stormwater permit that detailed how the city was managing stormwater. Smaller cities, with municipal separate storm sewer systems, are regulated through a state general permit, which many states issued for the first time in 2003 and 2004. The state general permits laid out six minimum control measures required for each municipality:

1. Public Involvement and Participation
2. Illicit Discharge
3. Identification & Elimination
4. Construction Site Runoff
5. Post Construction Runoff Minimization
6. Pollution Prevention and Good Housekeeping Measures

Many states now are in the process of revising their general state stormwater permits and programs to reissue Phase II general permits in 2008 and 2009. The reissuance of state stormwater permits represents an opportunity to include permit language, particularly for post-construction runoff minimization requirements, that recognizes new approaches for managing stormwater that have been developed over the past five years, such as green infrastructure approaches that comprehensively manage stormwater water at three scales: regional, neighborhood, and the site level.

Incorporating green infrastructure approaches into the post-construction runoff minimization requirements of a state's general stormwater permit is an opportunity to recognize that the wide range of stormwater measures, including development patterns, have different environmental performance. The permit language can recognize these differences and reward practices that are better for the environment.

Recognizing the opportunity to incorporate new approaches to stormwater management into state general permits, several EPA programs, including the Office of Wastewater Management (OWM), Office of Policy, Economics, and Innovation (OPEI), Office of Wetlands, Oceans, and Watersheds (OWOW), the Office of Brownfields, Cleanup and Redevelopment (OBCR), and the Office of Ground Water and Drinking Water (OGWDW), offered support to state NPDES program and EPA regions.

West Virginia Department of Environmental Protection (DEP) requested this technical assistance from EPA and its contractors. Specifically, DEP requested assistance for possible permit and program language for the post-construction minimum measures that embraced a comprehensive green infrastructure approach, including, performance based design criteria, incentives for redevelopment of brownfield sites, site specific strategies for low impact development techniques, and policy development that promotes more effective stormwater management for roads and parking lots.

EPA, with its contractor Tetra Tech, completed a site visit June 26 and 27, 2007 to learn more about WVDEP's NPDES stormwater permits and programs and to better understand the opportunities and barriers to implementing a better stormwater program.

The purpose of this report is to explain the new stormwater management strategies that form the basis for the suggested permit language, summarize EPA's findings from the site visit, discuss some of the water quality advantages of the proposed approach, and offer ideas for potential next steps. Appendix A provides the proposed permit language for post-construction requirements and Appendix B provides the justification for that language. As noted in the application materials and during EPA's site visit, all suggested permit options described in this report are for WVDEP's consideration only as there is no regulatory or other requirement from EPA to implement any idea or information described here.

II. NEW STRATEGIES FOR STORMWATER MANAGEMENT

The last few decades of stormwater management have resulted in the current convention of control and treatment strategies that are largely hard infrastructure engineered, end-of-pipe, and site-focused practices concerned primarily with peak flow rate and suspended solids concentrations control. Conventional practices, however, fail to address the widespread and cumulative hydrologic modifications within the watershed that increase stormwater volumes and runoff rates, and cause excessive erosion and stream channel degradation. Existing practices also fail to adequately treat for other pollutants of concern such as nutrients, pathogens, and metals.

While this approach works to drain each site, continued expansion of dispersed, low-density developments over the past years means that too much water, carrying too much pollution, is running into drains. The results are poor water quality, especially at drain outlets, and a dramatic drop in the refill rate of aquifers and streams. The 20 regions in the country that developed the most land over the period 1982 to 1997 now lose between 300 and 690 billion gallons of water annually that would otherwise have filtered through the earth and been captured as groundwater.[1]

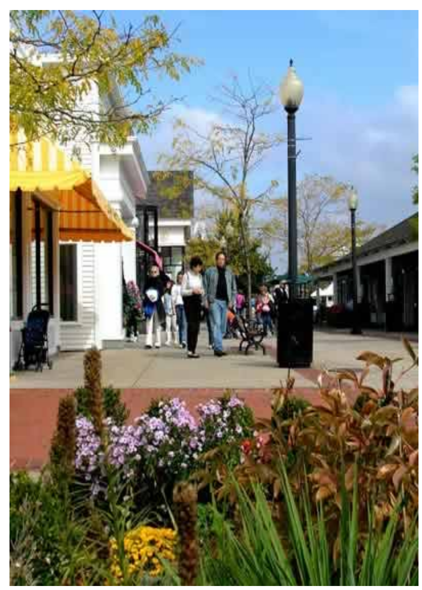
Today, the practice of stormwater management is evolving beyond engineered approaches applied at the site level to an approach that looks at managing stormwater at the regional, neighborhood, and site scales through natural approaches. These approaches, commonly referred to green infrastructure, represents a new approach to stormwater management that is cost-effective, sustainable, and environmentally friendly.

[1] American Rivers and Smart Growth America. 2002. Paving Our Way to Water Shortages: How Sprawl Aggravates The Effects of Drought. Smart Growth America: Washington, D.C.

Green infrastructure is the use of soil, trees, vegetation, and wetlands and open space (either preserved or created) in urban areas to capture rain while enhancing wastewater and stormwater treatment. A comprehensive green infrastructure approach to stormwater management seeks to:

- *Preserve*: Protect and enhance natural features, such as undisturbed forests, meadows, wetlands, and other natural areas that provide natural stormwater management.
- *Reduce*: Reduce land consumption and use land efficiently to reduce total watershed or regional impervious cover.
- *Recycle*: Recycle land by directing new development to already degraded land, e.g., parking lots, vacant buildings, abandoned malls.
- *Reuse*: Direct stormwater into the ground near where it fell through infiltration, evapotranspiration, or reuse techniques.

Regional Scale. Decisions about where and how to grow are the first, and perhaps most important decisions related to water quality. A green infrastructure approach supports an interconnected network of open spaces and natural areas (such as forested areas, floodplains and wetlands) that improve water quality while providing recreational opportunities and wildlife habitat. In addition, using land efficiently can better manage stormwater by putting development where it is most appropriate. For example, by directing and concentrating new development in areas targeted for growth, communities can reduce or remove development pressure on undeveloped parcels and protect sensitive natural lands and recharge areas. Another strategy is redeveloping already degraded sites such as abandoned shopping centers or



Redeveloping vacant properties has limited impact on water resources as there is limited or no net increase in runoff. Mashpee Commons, Massachusetts, before redevelopment (left) and after (right).

underutilized parking lots. In this case, the net increase in runoff from development would likely be zero—or it might even decrease, depending on the on-site infiltration practices used. Also, by allowing or encouraging denser development, less land is converted overall, and less total impervious area may be created.

Neighborhood Scale. Green infrastructure approaches at the neighborhood level include a range of planning measures, including techniques such as:

- Incorporating natural landscape features or natural functions into a neighborhood's streets and road network, buildings, and other developed areas;
- Connecting open space and recreation areas, and
- Narrowing street and roads, co-locate a range of land uses, such as retail, residential, civic, and schools to minimize impervious cover,

These strategies can be incorporated into existing buildings, streetscapes, and roadways or into new developments. For example, increasing densities, creating a gridded street network with narrower streets, and integrating retail opportunities into a neighborhood can reduce overall impervious surface and create more open spaces and landscape features for infiltration.

The Belle Hall study, by the South Carolina Coastal Conservation League, supports this premise. The study examined the water quality impacts of two development alternatives for a 583-acre site in Mount Pleasant, South Carolina. The town planners used modeling to examine the potential water quality impacts of two site designs: one that used a conventional suburban pattern of large lots, wide roads, and separation of land uses; and one that incorporated traditional neighborhood patterns of higher densities, mixed uses, and narrower roads. In each scenario, the overall number of homes and the square feet of commercial and retail space were held constant. The results found that the conventional scenario consumed eight times more open space and generated 43 percent more runoff, four times more sediment, almost four times more nitrogen, and three times more phosphorous than the scenario that incorporated traditional neighborhood patterns.[2]

Site Scale. On the site scale, green infrastructure consists of site-specific management practices that are designed to maintain natural hydrologic functions by absorbing and infiltrating precipitation where it falls. These strategies are designed to be integrated within a particular development to reduce the on-site stormwater runoff volume and impacts. Techniques such as the use of rain gardens, green streets, and infiltration areas help reduce the amount of impervious cover and associated runoff, and naturally treat the runoff that does occur. Managing stormwater where it originates allows for local infiltration, groundwater recharge, and filtering of pollutants. It also decreases the amount of stormwater that enters the sewer system, thereby reducing the risk of overflows that impact streams and other outfalls through scouring and the addition of nutrients and pollutants.

Green infrastructure strategies reduce and locally manage stormwater through infiltration, reuse, and evapotranspiration. Each of these approaches is described below.

1. *Infiltration*

Infiltration practices are engineered structures or landscape features that are designed to capture and infiltrate runoff. They can be used to reduce both the volume of runoff discharged from the site and the infrastructure needed to convey, treat, or control runoff. Infiltration practices can also be used to recharge groundwater. This benefit is especially important in areas where maintaining drinking water supplies and stream baseflow is of special concern due to limited precipitation or a high ratio of withdrawal to recharge rates. Infiltration of runoff can also help to maintain stream temperatures because the infiltrated water that

[2] South Carolina Coastal Conservation League, Environmental Protection Agency, National Oceanic and Atmospheric Administration, South Carolina Department of Health and Environment; Town of Mount Pleasant. 1995. The Belle Hall Study: Sprawl vs. Traditional Town: Environmental Implications. South Miami, FL: Dover, Kohl, and Partners.

moves laterally to replenish stream base flow typically has a lower temperature than overland flows that may be subject to solar radiation.

2. Stormwater Reuse

Rainwater harvested in cisterns, rain barrels, or other devices, is a primary source of water in many parts of the world. In West Virginia, harvested stormwater may be used to reduce potable water used for landscape irrigation, fire suppression, toilet and urinal flushing, and custodial uses. Storage and reuse techniques range from small-scale systems (e.g., rain barrels) to underground cisterns that may hold large volumes of water.

3. Evapotranspiration

Neighborhoods are often defined by their trees, which perform a variety of functions that reduce runoff volumes and improve water quality. In addition to the infiltration benefits described above, leaf canopies intercept and hold large quantities of rainwater on the leaf surface, preventing it from reaching the ground and becoming runoff. On average, a single tree can intercept and absorb anywhere from 800 gallons to almost 2,400 gallons per year. Through the absorption process, trees also remove pollutants from stormwater and stabilize them. In addition, their root systems create spaces in the soil that allow the soil to hold more water.[3]

Root systems create voids in the soil that facilitate infiltration. Trees also absorb and transpire large quantities of ground water, making the soil less saturated, which allows more stormwater to infiltrate. Through the absorption process, trees remove pollutants from stormwater and stabilize them. Tree canopies shade and cool paved areas, which reduces the temperature of the runoff that flows across the paved surface.

Case Study: High Point Redevelopment- Stormwater Management at Three Scales

The High Point Redevelopment in Seattle, Washington demonstrates the interconnectivity, and the superior environmental performance, of regional, neighborhood, and site level stormwater design solutions. High Point, is a redevelopment project that includes 1,600 mixed-income housing units that replaced 716 subsidized housing units on 120 acres in a West Seattle neighborhood. The site's previous infrastructure directed polluted street, sidewalk, parking area, and building runoff through a series of underground pipes directly into the creek, damaging the ecosystem and reducing local salmon populations.

At the regional level, High Point redeveloped an underused site rather than creating new impervious cover across a previously undisturbed greenfield site. The development also increased the site density; efficiently using the space to accommodate more people without consuming additional land. At the neighborhood level, narrow streets, sidewalks, and a traditional gridded street system reduce stormwater runoff and pollution through site design. At the site level, water-specific strategies are actively incorporated to further mitigate runoff. In place of curbs and gutters, swales and check dams are shaped into the land alongside the street. These wide, landscaped swales slow, filter, and direct street runoff into a detention pond that doubles as a park area. Parking areas are constructed with pervious gravel cover, and sidewalks with porous pavement. Together, these features create a comprehensive system to manage and reduce stormwater runoff from all 120 acres of the site.

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[3] Belan, Gary and Betsy Otto. 2004. Catching the Rain: A Great Lakes Resource Guide for Natural Stormwater Management. Washington, D.C.: American Rivers.

III. SITE FINDINGS

The team met with staff from DEP's municipal stormwater program and other DEP programs, including the State Revolving Fund for Clean Water, NPDES, Chesapeake Bay, and the Total Maximum Daily Load programs. Meetings were also held with representatives from WV Department of Transportation and the state's Office of Economic Development. Finally, the team met with representatives from several non-governmental organizations including the Greater Kanawha Valley Foundation, Charleston Area Alliance, West Virginia Water Research Institute, and the WV Local Technical Assistance Program. All of these organizations work with communities on different aspects of growth and development.

The purpose of these meetings was to discuss opportunities, barriers, and other program and state goals for post-construction requirements in the state's Phase II general stormwater permit. This information would help provide context and details to any suggested permit language for DEP's post construction requirements. Based on these discussions, the following information was used to help craft the proposed permit language:

- *Existing requirements.* WV DEP issued the state's general permit for stormwater discharges from Phase II small municipal separate storm sewer systems (MS4s) on March 7, 2003, with an expiration date of March 6, 2008. This Phase II general permit addressed 30 different municipalities or non-traditional MS4s throughout the state. The post-construction requirements in the general permit were largely similar to the post-construction minimum measure requirements in the stormwater Phase II regulations.

  In addition, WV DEP includes post-construction requirements in their construction general permit, which was issued March 7, 2003 and expires on March 6, 2008. However, during the meeting, DEP stated that the post-construction requirements will be removed when the permit is reissued.

- *Reissuance Schedule.* WV DEP management indicated they will begin drafting the next Phase II general permit in January 2008 and are hoping to have a finalized permit by autumn of 2008. Given that the current permit expires in March 2008, DEP is expecting to administratively continue the existing permit. Given this timeframe, DEP wanted any proposed permit language suggestions sent to them by early fall, 2007.

- *Impaired Water Bodies.* All of the MS4s permitted under the Phase II general permit discharge to at least one impaired water body. Some TMDLs for these impaired waters have already been developed. West Virginia DEP staff are currently undecided about exactly how to implement the relevant waste load allocations in the MS4 permits.

- *Underground Injection Control Requirements*. Several of the participants from the NPDES program and DOT believed that the underground injection control (UIC) program requirements significantly limit infiltration as a possible stormwater management strategy because of the registration requirements for Class V wells. DOT currently monitors and reports on a significant number of these types of practices, and is not interested in additional responsibility for more.

- *Combined Sewer Overflows*. Like most states, many WV MS4s have CSO issues. For example, there are 649 combined sewer outfalls in the state and 57 entities permitted for CSO, of which all have their nine minimum controls (NMCs) developed and implemented and 26 have approved Long Term Control Plans. The team heard from several DEP staff that they would be interested in any stormwater strategies or policies that reduced stormwater inflow into sewers.

- *State Revolving Loan Fund*. The SRF program in West Virginia has not, to date, funded stormwater projects, but seems open to doing so if a project that met the relevant criteria applied for funding. The greatest potential for funding seemed to be linked to the CSO issue, e.g., a stormwater project that could reduce flows into sewers.

- *Outreach and Education*. Like other states, WV's Phase II program is relatively new and while they have made great progress working with MS4s to identify barriers and opportunities within the state's and municipalities' stormwater programs, additional assistance was requested for outreach and education. Specifically, DEP requested from EPA a model presentation that summarized some innovative strategies for stormwater management. EPA sent this presentation to DEP in July, 2007.

- *Additional Permit Language Suggestions.* In addition to suggested permit language for post-construction requirements, DEP requested additional suggested permit language for several other areas of the permit, including TMDLs, evaluations, and education. EPA will offer suggested permit language in these areas where it complements the proposed post-construction provisions.

These issues, as well as the Team's background and experience with stormwater management permits and programs across the country, formed the basis for the suggested permit language for WV's post construction requirements.

In addition, it is important to note that EPA Region 3 will review the proposed permit, including the post-construction requirements, to ensure that it meets the federal requirements and is consistent with the federal NPDES stormwater permitting iterative approach, e.g., that there are strong provisions for stormwater programs to move beyond planning provisions, which are more typical of 1st round permits, to implementation of measures that will be protective of water quality.

IV. OVERVIEW OF SUGGESTED PERMIT LANGUAGE

Stormwater outcomes are affected by development decisions at every level: regional, neighborhood, and site. As the examples above begin to illustrate, certain types of development are more protective at each level. Past stormwater permits have not done a good job of recognizing these inherent performance differences. They have not recognized, for example, the difference between redeveloping an already degraded site, such as a parking lot, and paving over forestland for new development. Neighborhoods that are planned with narrower streets have not received credit for the added runoff they avoid as compared to developments with wide roads. Past permits have also not generally recognized the difference between sites that reduce and infiltrate stormwater onsite versus those that increase impervious area and direct all runoff off-site to storm drains and streams. This new permit language seeks to recognize the difference between these practices that improve stormwater outcomes and those that do not perform well, and treat them accordingly – rewarding or incentivizing practices with better environmental performance.

The proposed permit language seeks to recognize the different performance of different development patterns/practices with respect to stormwater outcomes, and treat them accordingly. In addition, the proposed permit language requires onsite stormwater management through various site design approaches that infiltrate, evaportranspirate, or reuse runoff. The major elements of the proposed permit language are described below:

- The permit seeks to protect the physical, chemical and biological integrity of receiving waters, and their designated uses, from the impacts of stormwater discharges through the implementation of watershed protection elements and site and neighborhood design elements. The primary purpose of watershed protection elements is to manage the impacts of stormwater on receiving waters that occur because of regional or watershed-scale management decisions. The primary purpose of site and neighborhood design elements is to manage the impacts of stormwater on receiving waters that occur because of site and neighborhood design management decisions.

- All development is required to have site design standards for all new and redevelopment that require, in combination or alone, management measures that infiltrate, evapotranspire and reuse, at a minimum, the first 1 inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation. This first 1 inch of rainfall must be 100% managed with no discharge to surface waters. The permit also specifies alternatives if the 100% standard cannot be met.

- Stormwater management incentives will be given for certain types of development can either reduce existing impervious surfaces, or at least create less associated imperviousness. Incentive standards may be applied to these types of projects. A reduction of 0.1 inches from the 1 inch infiltration/evapotranspiration/reuse standard may be applied to any of the following types of development, for a maximum reduction of 0.5 inches for any project that meets any of the following criteria.
    1. Redevelopment
    2. Brownfield redevelopment
    3. High density (>7 units per acre)
    4. Vertical Density, (Floor to Area Ratio (FAR) of 2 or >18 units per acre)
    5. Mixed use and Transit Oriented Development (within ½ mile of transit)

- Municipalities are required to assess current street design guidelines and parking requirements, which should include recommendations to minimize impervious cover attributable to parking and street designs. The local planning commission, transportation commission and the public works department should be involved in the assessment and shall be given copies of the completed assessment and recommendations.

- Municipalities are required to assess subwatersheds for stream hydromodification impacts, for the purpose of developing hydromodification control strategies. In many urban watersheds, protecting receiving waters for all designated uses will require not just controls on new and redevelopment. Remedial activities such as stormwater retrofits to reduce the extent of effective impervious surfaces, and/or stream channel restoration will be necessary.

1. Advantages of this Approach

Pollution abatement: On-site stormwater management practices can reduce both the volume of runoff and the pollutant loadings discharged into receiving waters. These practices result in pollutant removal through settling, filtration, adsorption, and biological uptake. Reducing pollutant loadings can decrease stormwater and drinking water treatment costs by decreasing the need for regional stormwater management systems and expansions in drinking water treatment systems.

Protection of downstream water resources: The use of on-site stormwater management practices can help prevent or reduce hydrologic impacts to receiving waters, reduce stream channel degradation from erosion and sedimentation, improve water quality, and increase water supply.

Groundwater recharge: On-site stormwater management practices can also be used to infiltrate runoff to recharge groundwater. Development pressures typically result in increases in impervious surfaces and runoff volumes, and corresponding decreases in groundwater recharge rates and volumes. When more water runs off than infiltrates, groundwater and stream baseflow levels can drop. Growing water shortages nationwide increasingly point out the need to effectively manage our water resources, including groundwater.

Water quality improvements/reduced treatment costs: It is almost always less expensive to keep water clean than it is to clean it up. The Trust for Public Land[4] noted Atlanta's tree cover has saved more than $883 million by preventing the need for stormwater retention facilities. A study of 27 water suppliers conducted by the Trust for Public Land and the American Water Works Association in 2002 found that a direct relationship exists between forest cover in a watershed and water supply treatment costs. In other words, communities with higher percentages of forest cover had lower treatment costs.

Reduced downstream flooding: On-site stormwater management practices can be used to reduce downstream flooding through the reduction of peak flows and the total amount or volume of runoff. The use of these techniques also can help protect or restore floodplains which also play a role in maintaining water quality.

Community Fiscal Impacts. Communities across the U.S. are finding that development that is more compact, walkable, and mixed use can save local governments money. For example, a 2000 analysis found that by directing development to existing communities, the state of New Jersey's state plan found that directing development to existing communities would save the state $1.45 billion in sewer and water infrastructure.[5] Nationwide, a 2004 Brookings study[6] found that more compact development saves money over single-use low density development. With more compact development, local governments could save:

- 6 percent, or $12.6 billion, from water and sewer costs over 25 years; and
- roughly 3 percent, or $4 billion, for annual operations and service delivery.

Reduced incidence of CSOs: Many municipalities have problems with Combined Sewer Overflows (CSOs), especially in areas with older infrastructure. Combined sewer systems discharge sanitary waste water during storm events. While EPA acknowledges that the Phase II general permit does not apply in CSO areas, by retaining and infiltrating runoff, the on-site stormwater management approaches described in the permit can reduce the frequency and amount of CSO discharges to receiving waters.

NEXT STEPS

In addition to considering and discussing the permit language suggestions laid out in this report, there are a number of additional activities in which DEP could engage as it begins the process of reissuing its general permit for stormwater. These activities include:

1. *Determine what outcomes DEP is seeking from its general permit*. With five years of program experience under its belt, the Department is in a unique position to step back from the

[4] Trust for Public Land. 1999. *The Economic Benefits of Open Space*. http://www.tpl.org/tier3_cd.cfm?content_item_id=1195&folder_id=727. Accessed March 29, 2006.

[5] Rutgers University. 2000. Cost and Benefits of Alternative Growth Patterns.

[6] Mark Muro and Robert Puentes. 2004. "Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns." Brookings Institution: Washington, D.C.

administrative details associated with running the program and re-issuing the permit, to determine what it wants to achieve with the permit. During the site visit, the Team heard from several DEP staff, other state departments, and stakeholder groups that they want to protect and enhance the qualities that make West Virginia a special place: its natural resources, its downtown areas, and its people. While a stormwater permit cannot address all of these issues, it can help lay the foundation for how West Virginia communities grow and develop.

For example, managing stormwater on-site through design solutions allows downtown areas to grow and redevelop without adding more runoff to the sewer system or to the many natural water bodies found throughout the state. In addition, providing stormwater credits to developers who redevelop already degraded areas can also allow West Virginia communities to enjoy the benefits associated with growth while not increasing overall impervious cover, which helps protect the area's water quality.

2. *Look for program efficiencies*. The state's stormwater permit could be crafted to assist other program goals for DEP. For example, the stormwater permit could help meet any brownfield clean up goals DEP may have. Structuring the stormwater permit in a way that meets multiple DEP goals is one way to increase DEP effectiveness and resources.

3. *Gather community input.* Communities that have made investments in public participation have found that they have recovered these extra costs in the form of more attractive, livable, sustainable, and valuable development and communities. DEP could consider holding a series of workshops or outreach meetings to get feedback from residents and other stakeholders about some of the stormwater strategies discussed in this report.

As stressed during the Team's site visit in June, WV DEP is not required to accept or implement the proposed permit language for post-construction requirements as outlined in this report. However, DEP does have to meet federal requirements of the NPDES stormwater program and any provision set forth by EPA Region 3. It is the Team's intention that if implemented, the proposed permit language would allow the state to meet the federal requirements and program goals for the stormwater program. It is our hope that DEP will consider the opportunities identified in this report as it moves ahead with re-issuing the state's general stormwater permit.

APPENDIX A: ADDITIONAL RESOURCES

WV DEP could refer to any of the additional stormwater, transportation, and land use resources as they consider the options discussed in this report.

STORMWATER

The following resources can help communities implement innovative stormwater management approaches at the regional, community, and site level.

The City of Emeryville created *Stormwater Guidelines for Green, Dense Redevelopment* in 2006. The guidelines, and an accompanying spreadsheet model, were developed to manage stormwater on –site during redevelopment activities. Available at: < http://www.epa.gov/dced/emeryville.htm>.

In 2006, EPA published *Protecting Water Resources with Higher-Density Development*. This report helps communities better understand the impacts of higher and lower density development on water resources. The findings indicate that low-density development may not always be the preferred strategy for protecting water resources. Available at: <http://www.epa.gov/dced/water_density.htm>.

In 2006, EPA published *Using Smart Growth Techniques as Stormwater Best Management Practices*. This report reviews nine common smart growth techniques and examines how they can be used to prevent or manage stormwater runoff. Available at: < http://www.epa.gov/dced/stormwater.htm>.

In 2004, EPA published *Protecting Water Resources with Smart Growth*. This report is intended for audiences already familiar with smart growth concepts who seek specific ideas on how techniques for smarter growth can be used to protect water resources. The report describes 75 policies that communities can use to grow in the way that they want while protecting their water quality. Available at: <http://www.epa.gov/dced/water_resource.htm>.

In 2006, the Local Government Commission published *The Ahwahnee Water Principles: A Blueprint for Regional Sustainability*. This report provides a practical blueprint for sustainable land-use practices that can improve the reliability and quality of water resources and reduce some of the financial liabilities that new development places on local government. Available at: <http://water.lgc.org/announcements/water-guidebook>.

In 2006, NRDC published *Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows*. This report is a policy guide for decision makers looking to implement green strategies in their own area, including nine case studies of cities that have successfully used green techniques to create a healthier urban environment. Available at: <http://www.nrdc.org/water/pollution/rooftops/contents.asp>.

In 2004, American Rivers published *Catching the Rain: A Great Lakes Resource Guide for Natural Stormwater Management*. The publication describes a wide range of low impact development strategies that can be implemented in a wide range of built environments. Available at: <http://www.americanrivers.org/site/DocServer/CatchingTheRain.pdf?docID=163>.

Portland Metro (Oregon) created *Green Streets: Innovative Solutions for Stormwater and Stream Crossings* in 2002. The handbook describes stormwater management strategies and includes detailed illustrations of "green" street designs that allow infiltration and limit stormwater runoff. Available at: <http://www.metro-region.org/article.cfm?articleID=262.>.

Portland also published *Trees for Green Streets: An Illustrated Guide* in 2002. The guidebook helps communities select street trees that reduce stormwater runoff from streets and improve water quality. Available at: < http://www.metro-region.org/article.cfm?articleID=263>.

Seattle's pilot Street Edge Alternatives Project (SEA Streets) is designed to provide drainage that more closely mimics the natural landscape prior to development than traditional piped systems. Good information can be found at: <http://www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/Natural_Drainage_Systems/Street_Edge_Alternatives/index.asp>.

TRANSPORTATION

In 2006, the Institute of Transportation Engineers published *Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*. This working draft document provides engineers and planners guidance on designing major urban streets in a way that supports walkability and livability. Available at: http://www.ite.org/bookstore/RP036.pdf.

In 2006, EPA published *Parking Spaces / Community Places: Finding the Balance Through Smart Growth Solutions***.** This document highlights proven approaches that balance parking with broader community goals. Communities have found that combinations of parking pricing, shared parking, demand management, and other techniques have helped them create vibrant places while protecting environmental quality. Available at: <http://www.epa.gov/dced/parking.htm>.

In 1999, ICMA and Reid Ewing published *Pedestrian- and Transit-Friendly Design: A Primer for Smart Growth*. This report suggests design elements that make walking and transit use easier and more comfortable. Available at: <http://www.epa.gov/dced/pdf/ptfd_primer.pdf>.

Portland Metro published *Creating Livable Streets*. This handbook describes how communities can design streets to be people friendly and includes detailed illustrations of designs that integrate streets with nearby land uses. Available at: <http://www.metro-region.org/article.cfm?articleID=261>.

Congress for the New Urbanism published *Traditional Neighborhoods: Street Design and Connectivity*. This image-filled document shows how land use practices and street design can create walkable environments. Available at: <http://www.contextsensitivesolutions.org/content/reading/traditional-neighborhoods-street-design/>.

In 2003, Maryland State Highway Administration published *When Main Street is a State Highway*. This step-by-step guide shows designers and engineers how to retrofit state highways so that they can serve the dual functions of downtown economic development and mobility. Available at: <http://www.sha.state.md.us/businesswithSHA/projects/ohd/mainstreet/MainStreet.pdf>.

New Jersey Department of Transportation published *Flexible Design of New Jersey's Main Streets*. This document provides policy and practice changes that add flexibility and context sensitivity to DOT's design process for main streets. Available at: <http://www.contextsensitivesolutions.org/content/reading/flexible-design-new-jersey/resources/flexible-design-new-jersey/>.

Oregon Departments of Transportation and Land Conservation and Development published *Main Street…When a Highway Runs Through It: A Handbook for Oregon Communities.* This document provides strategies to make state highways more context sensitive as they travel through towns as the main street. Available at: http://www.contextsensitivesolutions.org/content/reading/main-street/resources/main-street-when-a-highway/>.

Project for Public Spaces wrote *Balancing Street Space for Pedestrians and Vehicles.* This article discusses how to balance pedestrian needs and creating lively public spaces while at the same time maintaining appropriate space for vehicles. Available at: <http://www.pps.org/civic_centers/info/how_to/transit_tool/balancing_peds_and_vehicles>.

The organization, Context Sensitive Solutions, has a web site that includes hundreds of resources about designing transportation projects in a way that fits the physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility. Check it out at: <www.contextsensitivesolutions.org>.

The organization, Walkable Communities, offers a variety of publications and photos on its website, <http://walkable.org/>.

LAND USE

In 2003, the National Association of Realtors and the Local Government Commission published *Creating Great Neighborhoods: Density in Your Community.* The document highlights nine community-led efforts to create vibrant neighborhoods through density, discusses the connections between smart growth and density, and introduces design principles to ensure that density becomes a community. Available at: http://www.epa.gov/dced/density.htm.

In 2005, Smart Growth America published *Choosing Our Community's Future: A Citizen's Guide to Getting the Most Out of New Development*. This document focuses on the visioning and planning efforts that set the stage for smarter growth and how citizens can engage and make suggestions for better growth and development through collaborative stakeholder meetings and workshops. Available at: <http://sgusa.convio.net/site/PageServer?pagename=guidebook .

The American Planning Association has model smart growth codes. These codes encourage mixing land uses, preserving open space and environmentally sensitive areas, providing choices in housing and transportation, and making the development process more predictable. Available at: <www.planning.org/smartgrowthcodes>.

The Local Government Commission's *Smart Growth Zoning Codes: A Resource Guide* studies codes that have been implemented in communities around the country. Its main areas include "traditional neighborhood design," which encourages walkable, mixed-use neighborhoods; mixed-use and live/work codes, which help diversify land uses; street and block design that makes it easy and comfortable for people to walk, bike, or drive; parking guidelines that use land more efficiently; and design regulations that help maintain or create attractive, distinctive, safe places. Available at: <www.lgc.org>.

Some communities have found a form-based code to be useful. Form-based codes emphasize the appearance and qualities of buildings and blocks rather than their uses. They encourage great public participation because they are more visual than traditional zoning codes, making it easier to understand what type of buildings they will allow. They encourage a mix of uses and a mix of housing types. A good introduction to form-based codes is available at: <www.lgc.org/freepub/PDF/Land_Use/fact_sheets/form_based_codes.pdf>.

One example of a form-based code is the Smart Code, developed by urban-design firm Duany Plater-Zyberk. The Smart Code combines zoning, subdivision regulations, urban design, and basic architectural standards. It is intended to be customized to local needs. Available at: <www.dpz.com/pdf/SmartCodeV7.0-6-06-05.pdf>.

The state of Colorado has a model code for small communities. Available at: <www.dola.state.co.us/smartgrowth/resources.htm>.

Nashville, Tennessee, recently revamped its subdivision regulations. Available at: at:<www.nashville.gov/mpc/expanded_subdiv_regs_doc.htm>. In addition, they have an Urban Design Overlay for a specific area. The site includes example overlay codes. Available at: <http://www.nashville.org/mpc/urban.htm>.

Model TND ordinance prepared for Wisconsin is available at: <http://www.wisc.edu/urpl/people/ohm/projects/tndord.pdf>.