smart growth and the clean water act

BY JAMES M. MCELFISH, JR. & SUSAN CASEY-LEFKOWITZ

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executive summary

The Clean Water Act influences land use patterns and land use patterns influence the implementation of the Clean Water Act. The Act's programs have the potential to promote revitalization and development of areas with existing infrastructure.

This study investigates the relationship between three Clean Water Act programs and "smart growth," an approach to development that emphasizes greater density, mixed uses, redevelopment of underused areas, transportation choices, and open space protection. These programs can promote smart growth when federal, state, and local governments grasp opportunities to integrate water quality and smart growth goals. Some jurisdictions already have done so, resulting in efficiencies and environmental benefits.

Water quality has received relatively minor consideration in most development and planning decisions compared with road construction, tax liabilities and incentives, government subsidies, land costs, and political issues. Nevertheless, the three water quality programs examined in this report have an increasing effect at the margin. The strategies and techniques for improving water quality and fostering smart growth can be mutually reinforcing.

STORMWATER PERMIT PROGRAM

In 1987, Congress enacted Clean Water Act provisions establishing a schedule for the permitting of industrial and municipal discharges of stormwater. Phase 1 of the program regulates discharges from large municipal separate storm sewer systems (MS4s), industrial activities, and activities at large construction sites. Phase 2 will regulate discharges from MS4s in smaller urbanized areas and activities at smaller construction sites.

Currently, the stormwater permit program's relationship with development is largely site-specific and technical, with minimal influence on the location of new development. However, stormwater design and financing techniques offer some opportunities to promote smart growth, infill development, and green infrastructure such as the retention of open space and maintenance of natural drainage ways.

The stormwater program does not stimulate sprawl. The Phase 1 MS4 program increases operations and maintenance costs for some urban areas, but not to a degree that appears to disadvantage such areas in comparison with new development on the exurban fringe. The Phase 2 MS4 program provides so much flexibility and so few minimum requirements that it does not appear likely to promote a preference for development outside of the urbanized areas subject to the program. The construction site stormwater programs apply both inside and outside urbanized areas, and thus do not create a perverse incentive to construct in exurban areas to avoid regulation.

Recommendations

Regional Coordination. States could promote integrating multiple jurisdictions under general stormwater permit applications. This would provide efficiencies in planning and management of both growth and stormwater, while creating a forum for discussion of regional development issues.

EPA Flexibility. The U.S. Environmental Protection Agency (EPA) could support state and local governments in efforts to address the location of development by allowing them to link stormwater permits to water quality objectives.

Smart Growth Incentives. States and EPA could offer some relief from requirements to implement some stormwater control measures for municipalities that improve stormwater management on a watershed basis through smart growth measures, such as transferable development rights and mixed use, compact development.

Revised Development Regulations. State and local governments could revise land use ordinances to limit the creation of impervious surfaces that increase stormwater problems.

Resource Protection Zoning. Resource protection zoning could be more widely used to restrict incompatible land uses or limit the scale of development to prevent threats to water quality.

Integrating Stormwater Management with Site Reuse. State and local programs could incorporate stormwater controls into brownfield site redevelopment and urban retrofit programs to combine smart growth goals with water quality goals. EPA could encourage redevelopment of brownfields and other urban sites to help manage stormwater, and could promote stormwater management as a goal of its grant programs.

Linking Stormwater Fees to the Size of Impervious Surfaces. Local systems could assess fees based on the amount of impervious surface on a property and provide discounts for properties where stormwater is managed effectively on site.

States and EPA could provide funding and technical support for urban areas to reduce their level of impervious surfaces and change their infrastructure to comply with best management practices for stormwater runoff.

Technical Assistance. States and EPA could provide funding and technical support for urban areas to reduce their level of impervious surfaces and change their infrastructure to comply with best management practices for stormwater runoff — especially through addition of greenways, infiltration areas, and other green infrastructure.

Infill as a Best Management Practice. EPA and states could designate infill development as a best management practice and/or work with state permitting authorities to determine the criteria under which such development could qualify as a BMP.

Road Siting. Federal, state, and local transportation planning could link road siting with water quality, incorporating consideration of the direct impacts of runoff from roads and the indirect impacts of additional runoff from their attendant development.

COMBINED SEWER OVERFLOW AND SANITARY SEWER OVERFLOW PROGRAMS

Combined sewer overflows (CSOs) result from a technique used many years ago for the construction of municipal sewers in which sewer collection lines were designed to handle both sanitary sewage and stormwater runoff from streets, roofs, and buildings. During periods of rainfall, untreated sewage is discharged from the systems. Sanitary sewer overflows (SSOs) occur when sewer collection lines that are designed

In places where CSO/SSO repairs are coupled with waterfront revitalization and riparian restoration, they have made core urban areas more attractive to redevelopment and infill.

to handle only sanitary sewage become charged with stormwater, groundwater, and other waters entering the system from external sources. These sewer lines then discharge in a similar manner to CSOs.

CSOs and SSOs pose a threat to public health and safety and to the environment. EPA required systems with CSOs to implement nine minimum controls by January 1, 1997, and has brought high profile enforcement cases against a number of urban systems. SSOs are illegal under the Clean Water Act and are a focus of EPA enforcement and rulemaking activities.

The relationship of CSO/SSO rehabilitation with development is largely financial. In theory, the high cost of CSO/SSO repairs in aging neighborhoods might discourage investments in those neighborhoods and push development to outlying areas with no CSO/SSO liability. In practice, in many cities sprawl already was well advanced before CSO/SSO repairs caused fees and taxes to rise. Moreover, in places where CSO/SSO repairs are coupled with waterfront revitalization and riparian restoration, they have made core urban areas more attractive to redevelopment and infill.

The examination of the CSO/SSO programs reveals several opportunities to leverage the programs to support smart growth, while also ensuring that smart growth efforts reduce sewer related water pollution problems.

Recommendations

Linking CSO/SSO Rehabilitation with Waterfront Restoration. Expenditures to correct CSO/SSO problems could be used to target priority areas and help revive urban economic vitality, especially in cities that are restoring waterfronts as part of downtown revitalization efforts.

State Revolving Loan Fund Priority. In recognition of the water quality and development benefits of urban CSO/SSO rehabilitation, states could develop criteria to favor funding the rehabilitation of large-scale urban CSO/SSOs over the replacement of on-lot systems with new sewer systems.

Supplemental Environmental Projects. EPA could support further use of supplemental environmental projects in conjunction with CSO/SSO rehabilitation to improve water quality and revitalize waterfront areas and urban green space.

Directing Funding to Avoid Sprawl. To encourage infill development, which can offer important water quality benefits, federal funding and state revolving loan funds could target urban areas with an inadequate rate base to prevent a steep rate differential between urban and exurban areas.

Linking Planning and Permitting. State and local programs could link permits for new sewer system connections to the system's capacity to handle the extra load created by future development. They also could consider permits for sewage treatment plant expansion in the context of watershed assessments and land use planning.

Watershed-Based Strategies. Regional, watershed-based strategies could help target expenditures to cost-effectively control CSOs and eliminate SSOs. By addressing issues on a watershed basis, these efforts could promote integrated planning while cutting costs.

Promoting Regional Cooperation. EPA could use permitting and enforcement approaches and incentives that support collaboration among local governments in a common growth and service area, especially on a watershed basis.

TOTAL MAXIMUM DAILY LOAD PROGRAM

Section 303(d) of the Clean Water Act takes a quantitative water quality-based approach to regulation. It requires states to identify polluted waters and calculate the total maximum daily load (TMDL) of specific pollutants that each stream segment can absorb and still meet water quality standards. The TMDL sets allowable limits for these pollutants, and distributes pollutant loads among discharge sources. TMDLs are established for waters polluted by point sources, nonpoint sources, or a combination of the two.

TMDLs present a significant opportunity to integrate planning for land uses across a watershed both spatially and temporally. Smart growth techniques can facilitate TMDL development and the long-term implementation of TMDL load allocations and wasteload allocations by better controlling stormwater discharges, reducing the quantity and peak flow of stormwater, and retaining more land in open space and

buffers. Moreover, allocations for future growth provide a mechanism to evaluate the patterns of development that will protect water quality and those that will not.

Recommendations

Incorporating Growth Management in Allowance for Future Loadings. By examining the water quality effects of potential development in a particular watershed or region, states and municipalities could create an opportunity to invest community resources wisely as pollutant loads were being allocated among present and future users. States and EPA could explicitly recognize smart growth techniques as providing reasonable assurances sufficient to satisfy allocations for future growth or to reduce the margin of safety needed to account for uncertainty.

Considering Redevelopment Potential in Determining TMDL Priorities. The process of TMDL priority ranking, at the discretion of the states and EPA, affords an opportunity for regulators to promote priority schemes that give preference to developing TMDLs that will serve a locally oriented smart growth agenda while improving water quality. EPA could strongly encourage states to consider prioritizing waterways where infill, redevelopment, and other smart growth techniques are in place or can be put into place relatively quickly.

Linking TMDL Allocations with Development Approvals. States and localities could connect permits that facilitate growth and development, such as wastewater facility expansion permits, site plan approvals, or water withdrawal permits, to the TMDL process in impaired watersheds.

Promoting Conservation Development Techniques. States could encourage incorporation of river corridor protection criteria, buffers, best management practices, operating standards, and other water quality requirements into local ordinances.

introduction

Land uses directly and indirectly affect the quality of our nation's waters. Various patterns of urban, suburban, exurban, and rural development can contribute either to improving water quality or to impairing it. At the same time, state and federal programs directed at controlling water pollution can influence development. The relationship between land use and water quality has been studied on a watershed scale in a number of settings, but there has never been a study of the relationship between the programs of the federal Clean Water Act (CWA) and state and local land uses.

This study examines the relationship of three CWA programs to patterns of land use and development. It addresses whether these programs encourage and enhance opportunities for "smart growth" or, conversely, lead to "sprawl." The study also identifies ways in which federal, state, and local governments can reduce compliance costs and increase environmental benefits through the mutually reinforcing components of smart growth strategies and CWA programs.

Two of the three programs analyzed in this study are usually described as the "wet weather" programs. These are the industrial and urban stormwater permitting program, and the combined sewer overflow/sanitary sewer overflow (CSO/SSO) program. They deal with the pollution effects resulting from precipitation running off urban and industrial land, and the lack of treatment for some sanitary sewage in wastewater treatment systems that also convey substantial stormwater. The third program is the Total Maximum Daily Load (TMDL) program under section 303(d) of the Clean Water Act, which requires states to establish wasteload allocations for point sources and load allocations for nonpoint sources that are contributing to the failure of identified waters to meet water quality standards.

These three Clean Water Act programs are intended to improve water quality through such techniques as reducing the amount and extent of impervious surfaces in order to reduce runoff quantity and improve runoff quality; providing new or rehabilitated infrastructure capacity sufficient to capture and treat untreated sewage discharges and to reduce rainwater inflow into older systems carrying sanitary sewage;

The three programs are intended to improve water quality through such techniques as reducing the amount and extent of impervious surfaces, providing new or rehabilitated infrastructure capacity, and reducing both point source and nonpoint source discharges of pollutants.

and reducing both point source and non-point source discharges into impaired waters on a watershed basis.

Smart growth is a new approach to development and redevelopment of land that includes characteristics such as more compact development and greater density, mixed uses, infill and re-development of previously developed areas, provision of transportation choices in addition to automobiles, and intentional protection of green space.[1] It is intended to be an alternative to sprawl development, which typically is characterized by rapid population growth outside metropolitan centers, construction of new roads and infrastructure on the exurban fringe, rapid development of agricultural and forested areas, leapfrog development bypassing nearer suburbs, segregated land uses, lengthy commute times and distances, and relatively low population density even in developed areas.

The following chapters illustrate when and where the goals of smart growth and the environmental goals of the three Clean Water Act programs are compatible and, more specifically, how they can be made mutually reinforcing.

stormwater permit program

The stormwater permit program is designed to manage the quality, and to a lesser extent the quantity, of stormwater discharges to the nation's waters. This program provides opportunities to promote smart growth, infill development, and green infrastructure. Many of the design techniques and local land use regulations that can improve stormwater management also serve smart growth goals. These techniques include the reduction of impervious surfaces, the preservation of open space, and the protection of watersheds and stream corridors.

PROVISIONS OF THE STORMWATER PERMIT PROGRAM

In 1987, Congress added provisions to the Clean Water Act to establish a schedule for permitting industrial and municipal discharges of stormwater to the waters of the United States.[2] The U.S. Environmental Protection Agency (EPA) subsequently issued regulations in two phases. The Phase 1 regulations, published in 1990, regulate discharges from municipal separate storm sewer systems (MS4s) serving populations over 100,000, industrial activities, and construction activities disturbing five or more acres. The Phase 2 regulations, adopted in December 1999, expand the program's scope by regulating discharges from MS4s in urbanized areas with populations of less than 100,000 and construction activities disturbing one to five acres.

Stormwater permitting is done primarily by the states, with some delegation of authority by states to local and regional governments. EPA issues stormwater permits in states that do not have approved programs. MS4 operators are responsible for some regulation of activities in their service areas as needed to comply with the terms of their stormwater permits.

Phase 1 Regulations

Medium and Large MS4s. Under the Phase 1 regulations, the Clean Water Act requires medium and large MS4s that serve populations of 100,000 or more to obtain

MS4 operators must propose a management program as part of the permit application, including a comprehensive planning process involving public participation and intergovernment coordination.

individual National Pollutant Discharge Elimination System (NPDES) permits from EPA or the authorized state permitting program. The program issued approximately 900 NPDES permits nationwide, covering many of the nation's major cities and urban counties. However, the program left adjacent areas unregulated, including urban MS4s in smaller jurisdictions and unincorporated areas. The program excluded systems serving smaller incorporated municipalities adjacent to regulated city systems, as well as incorporated municipalities in counties with regulated systems. Some of these unregulated areas contain sprawling development, but many others are older urban municipalities with populations that simply fell beneath the regulation's thresholds.

The Phase 1 MS4 permits must include a requirement to effectively prohibit non-stormwater discharges into storm sewers and controls to reduce the discharge of pollutants "to the *maximum extent practicable*." These controls include management practices, control techniques and systems, and design and engineering methods.[3] In general, MS4 permits do not specify numerical effluent limits, but rather indicate the practices to be employed. Permit litigation over the Phase 1 MS4 program resulted in a ruling that MS4 permits do not require numerical standards, and EPA only recently issued its first MS4 permit with a numerical effluent limit.[4]

The Phase 1 regulations require planning for future development in the areas served by the MS4. The regulations expressly require MS4 operators to provide "a description of the land use activities…indicating undeveloped, residential, commercial, agricultural and industrial uses accompanied with estimates of population densities *and projected growth for a ten-year period* within the drainage areas served by the separate storm sewer."[5] These projections are intended to make it possible to determine where controls and management activities may be needed to reduce the volume, speed, or pollution load of stormwater runoff entering and exiting the system. The same data also may make it possible to link stormwater controls to growth and development controls.

MS4 operators must propose a management program as part of the permit application, including a comprehensive planning process involving public participation and

intergovernment coordination; identification and implementation of management practices, control techniques, and system design and engineering methods intended to meet the maximum extent practicable standard; and a description of the staff and equipment needed to implement the program and assess program performance.[6] The program must control stormwater entering the system from commercial and residential areas, construction sites, and industrial facilities. It also must provide measures to detect and remove illicit discharges and control and prevent improper disposal of materials into the MS4.[7]

Several MS4 management program requirements are specifically relevant to growth and development patterns. The requirements call for planning procedures to reduce discharges from areas of new development and major redevelopment after construction is complete.[8] The program also must implement and maintain best management practices to reduce pollutants in stormwater runoff from construction sites, including site planning that considers potential water quality impacts.[9] Finally, the program must describe practices for operating and maintaining public streets, roads and highways and procedures for reducing the impact of discharges from their stormwater structures on receiving waters.[10]

Construction Sites. Phase 1 regulates stormwater from construction activities that disturb five or more acres of land under a common plan of development. EPA issued a general permit for the states and the areas for which it serves as the permitting authority; authorized states issued similar permits. The EPA general permit, most recently reissued in 1998, requires construction site operators to submit a notice of intent to be covered by the permit and a stormwater pollution prevention plan.[11] Operators must implement erosion and sediment controls, including stabilization practices, such as seeding, mulching, and tree preservation, and structural practices, such as silt fences, check dams, and drainage swales. The permit also requires the use of stormwater management measures, including on-site infiltration, flow attenuation, outfall velocity dissipation, retention structures, water quality detention structures, and best management practices intended to keep pollutants out of stormwater.

Phase 1 also covers stormwater discharges from industrial facilities through sector permitting and general permits, as well as some individual National Pollutant Discharge Elimination System (NPDES) permits.

Phase 2 Regulations

Small MS4s. The final Phase 2 regulations, published in December 1999, will regulate all MS4s serving populations of less than 100,000 in "urbanized areas," capturing most areas in and around the Phase 1 MS4s and many in smaller towns, cities, and counties. As defined by the U.S. Census Bureau, an urbanized area is a land area comprising one or more central places and the adjacent densely settled surrounding area, which together have a residential population of at least 50,000 and an overall population density of at least 1,000 per square mile. The Phase 2 regulations will bring under MS4 regulation approximately 5,040 additional local government jurisdictions in the nation's 405 urbanized areas.[12] The Phase 2 regulations also apply to any state, tribal, and federal MS4 facility (including highway stormwater conveyances) located in an urbanized area.

The regulations allow permitting authorities to require coverage of additional MS4s outside of urbanized areas where needed for water quality purposes. The state or federal permitting authority must develop criteria for assessing the need to include additional areas. These criteria must be applied, at a minimum, to places with a population of 10,000 and population density of at least 1,000 per square mile.[13]

Permitting authorities may waive permit requirements for small MS4s in urbanized areas that serve jurisdictions with populations of less than 1,000, such as small incorporated towns in a larger urbanized area, provided they do not contribute substantially to loadings of a physically interconnected MS4. Such waivers are not available if the small MS4 discharges pollutants identified as impairing the water body into which it discharges, unless a total maximum daily load (TMDL) analysis for the water body determines that stormwater controls are not needed.[14]

A permitting authority also may grant a waiver to a small MS4 serving a population of between 1,000 and 10,000. To grant the waiver, the authority must evaluate all waters that receive a discharge from the MS4 and determine as part of a TMDL "or equivalent analysis" that stormwater controls are not needed to address the pollutants in question, and that future discharges from the MS4 do not have the potential to result in exceedances of water quality standards.[15]

Unlike the larger Phase 1 MS4s, the Phase 2 MS4s are expected to be regulated primarily by general permits, but the rules also allow the discharger to seek an individual permit.[16] Permitting authorities have up to three years to issue general permits, and MS4s

have up to three years and 90 days to apply for coverage under such permits. States are authorized to phase in permit coverage of MS4s serving populations of less than 10,000 on a schedule consistent with a watershed permitting approach. Under this option, all regulated small MS4s will be permitted by March 8, 2007.[17] Permitting authorities must specify a time period of up to five years from the date of permit issuance for operators of MS4s to fully develop and implement their stormwater program.[18]

In its proposed Phase 2 rule, EPA requested comment on smart growth approaches that would provide incentives for limiting adverse water quality impacts…However, the final rule did not include such provisions.

Generally, the Phase 2 MS4 permits will rely on best management practices (BMPs). EPA considers "narrative effluent limitations requiring implementation of BMPs," rather than numerical measures, to be the "most appropriate form" of effluent limitations for MS4s.[19] Permit authorities may use more specific or numerical requirements only if necessary to protect water quality — provided that an approved TMDL or equivalent analysis supports such requirements.[20] The MS4 must identify BMPs and "measurable goals" for implementing them and a timetable with milestones for implementation.[21] The BMPs are to be selected from a menu provided by EPA or the state permitting authority, or from those otherwise available.

The regulations prescribe six minimum control measures for Phase 2 MS4 permittees, including public education, public involvement, elimination of illicit discharges, construction site controls, post-construction runoff controls, and pollution prevention and maintenance measures.[22]

The MS4 permittee will be required to evaluate the effectiveness of the chosen BMPs and assess progress in meeting measurable goals.[23] But the evaluation pertains to progress in implementing the selected measures and BMPs rather than in actual water quality, because permittees are expected to meet narrative rather than numeric effluent limits.[24] According to the final rule, "EPA recommends that, in general, NPDES permits for small MS4s should not require the conduct of any additional monitoring beyond monitoring that the small MS4 *may already be performing*."[25] EPA said that after ten years of experience under the permit program, "some limited ambient monitoring" might be required of perhaps half of regulated small MS4s, but only for "identified locations for relatively few pollutants of concern."[26] EPA also stated

that it did not anticipate permitting authorities imposing "end-of-pipe" monitoring requirements for Phase 2 MS4s.[27]

In its proposed Phase 2 rule, EPA requested comment on smart growth approaches that would provide incentives for limiting the adverse water quality impacts associated with uncontrolled growth in a watershed. According to the proposed rule, "In situations where there are special controls or incentives (e.g., transferable development rights, traditional neighborhood development ordinances) in place directing development toward compact/mixed use development and away from wetlands, open space, or other protected lands, it may be possible to provide some relief to municipalities in terms of implementation of the proposed minimum control measures[.] [I]n areas of infill, or compact mixed use, the relief would pertain to minimum control measures concerning construction and new infill development or redevelopment."[28] However, the final rule did not include such provisions. Instead, the final preamble merely recommends infill development and notes that permitting authorities can include regulation of MS4s outside urbanized areas, as noted above, if necessary to avoid effects that might encourage development beyond designated growth areas.[29]

The final (Phase 2) rule allows permitting authorities to regulate operations disturbing less than one acre where watershed plans, TMDL determinations, or other local water quality assessments identify the need to control such sources.

Construction Sites. Phase 2 also will regulate construction sites of one to five acres, wherever located. In addition, the final rule allows permitting authorities to regulate operations disturbing less than one acre where watershed plans, TMDL determinations, or other local water quality assessments identify the need to control such sources.[30] The regulatory approach is to be a general permit. EPA will not require operators to file a notice of intent, but will allow the permitting authority discretion to require such notice.[31]

The Phase 2 rule allows waiver of the stormwater regulation for construction when climate records indicate that the construction activity occurs during a period of negligible rainfall (and hence "low predicted rainfall erosivity"), or when a watershed plan

or TMDL allocation sufficiently addresses the pollutants of concern and demonstrates that controls for small construction sites are not needed in the watershed.[32]

In the proposed rule, EPA requested comment on providing some regulatory relief for construction sites under certain circumstances. These circumstances could include the existence of special controls or incentives to direct growth toward compact/mixed use development and away from wetlands, open space, or other protected lands, provided the average development densities were less than one unit per 25 acres; or in situations in which redevelopment construction replaced existing development and resulted in a net water quality benefit.[33] EPA did not pursue this approach in the final rule, possibly because the development densities that are believed to be low enough to justify potential relief from the program would contribute to sprawl.

Instead, the final rule promotes a general permit approach similar to that of Phase 1, with stormwater pollution prevention planning and the use of BMPs on all sites. It further allows the regulatory authority to incorporate equivalent existing state, tribal, or local erosion and sediment control programs.[34] The Phase 2 rule also adjusts regulation of industrial stormwater dischargers under Phase 1. It authorizes any regulated industrial stormwater entity to claim a "no exposure" exemption from the permitting program in cases where "all industrial materials or activities are protected by a storm resistant shelter so that they are not exposed to rain, snow, snowmelt, or runoff."[35] The exemption is invoked by submitting a certification to the permitting authority every five years with a checklist, providing a copy of the checklist to the local municipality on request, and allowing inspection by the permitting or MS4 authority.[36]

EFFECTS OF COMPACT DEVELOPMENT ON STORMWATER MANAGEMENT

There is no fundamental conflict between the stormwater management program and smart growth. Smart growth characteristics can be compatible with, and potentially foster, the reduction of polluted stormwater discharges.

Stormwater controls and smart growth also can be mutually reinforcing if new development and redevelopment activities focus on preventing stormwater pollution rather than solely on the construction of collection and retention structures. Use of infiltration areas, drainage swales, reduced amounts of impervious surface, improved

Stormwater management programs need to ensure that construction and operation of compact, mixed use, and infill development do not produce net increases in stormwater discharges.

management of road rights-of-way, and similar techniques may increase the compatibility of the two goals.

However, the dense development associated with smart growth does raise an issue for stormwater management. Particularly where there is a high percentage of impervious surface, dense development can diminish water quality by increasing total stormwater discharge flow, stormwater peak discharges, and pollutant loads.[37] Therefore, stormwater management programs need to ensure that construction and operation of compact development, mixed use development, and infill development do not produce net increases in these discharges in comparison with either baseline conditions or lower density sprawling development. This requires attention to the creation of impervious surfaces and the location and management of green space and stormwater infiltration areas.

Imperviousness is a central issue for stormwater management because it increases runoff speed and peak volume of stormwater discharges to surface waters; limits areas where natural infiltration may occur; and reduces areas of vegetation that can slow water flow, promote infiltration and evapotranspiration, and capture sediments and other pollutants. The total imperviousness of a small watershed can increase if development is more dense. Thus, in isolation increased density of development can diminish stormwater quality.[38]

Although higher density smart growth development may increase the percentage of impervious surface within the developed area, it also may reduce the total amount of impervious surface in comparison with other development types by reducing the length and width of streets, the length of driveways, and the amount of infrastructure required to serve a given population.[39] In contrast, new exurban developments generally construct wider roads and more hard infrastructure. In fact, many suburban land use ordinances, building codes, minimum facilities requirements, and even conventional stormwater ordinances require a large amount of impervious surface for driveways, wide roads, cul de sacs, drainage gutters and retention basins, and the like.[40] Lower density development may produce as much stormwater runoff as higher

density development occupying a similar area because of the larger areas occupied by streets, driveways, and other hardened infrastructure.

Moreover, higher density development has the advantage of allowing preservation of larger areas of open space, forest, and farmland in a metropolitan area, thus reducing imperviousness in the entire watershed. Smart growth development also may stem increases in stormwater runoff by concentrating growth where impervious surfaces already exist. By reclaiming underused buildings and roads, compact infill development can stem the spread of "sprawl without growth," a phenomenon in many areas of the country where exurban development occurs even as the urban core population declines. This development abandons the old inventory of impervious surfaces, leaving fewer taxpayers and ratepayers to assure maintenance and runoff controls, while constructing a large inventory of new impervious surfaces on the exurban periphery that typically further impairs the same waterways that are affected by the urban core.[41]

INFLUENCE OF THE STORMWATER MANAGEMENT PROGRAM ON DEVELOPMENT

On close examination, the federal stormwater regulations appear to have no significant influence on patterns of development. EPA chose to regulate construction sites both inside and outside urbanized areas in order to meet water quality needs and avoid "creating a perverse incentive for building only outside urbanized areas."[42] Implementation of the Phase 2 regulations for small MS4s will further balance the degree of control between urban and exurban areas. In addition, the regulations focus far more on how development occurs than on where it is located.

Equalized Program Coverage

If there were sprawl development pressures resulting from differential regulation of Phase 1 and Phase 2 communities, these should be alleviated by the scope of Phase 2 regulation. The Phase 2 stormwater program for urbanized areas will bring under regulation most of the areas of sprawl that surround major metropolitan areas.[43] Phase 2 encompasses approximately 5,040 additional local government jurisdictions in the nation's 405 urbanized areas.[44] In addition, the regulations require permitting authorities to assess the need to regulate jurisdictions outside of urbanized areas with

populations of at least 10,000 and population densities of 1,000 per square mile or greater.[45] This includes approximately 600 additional jurisdictions.[46]

This expansion of the stormwater program is an important step. Phase 1 regulation of MS4s excluded many areas of sprawling development surrounding the nation's larger cities and incorporated municipalities. For example, Pittsburgh, Pennsylvania, (with a 1990 population of 370,000) was covered by the Phase 1 regulations, but the surrounding area (with a population of nearly 2 million) was not. Although Pittsburgh and Allegheny County unified their stormwater management activities, other surrounding counties posed management problems. For example, stormwater impacts caused by communities bordering Turtle Creek in neighboring Westmoreland County, which were not subject to Phase 1, adversely affected Allegheny County's ability to maintain water quality and prevent flooding on the lower reaches of the creek. Similarly, Charlotte, North Carolina, experienced adverse stormwater effects from surrounding Mecklenburg County until the city and county began to collaborate in advance of the Phase 2 regulations.

The construction regulations, and the many state and local erosion control laws operating independently of the federal stormwater program, also would mitigate any regulatory advantage of exurban construction over urban construction.

With adoption of the Phase 2 regulations, a remaining question is whether their implementation may lead to strategic behavior by some nonurban jurisdictions still seeking to remain outside the stormwater regulatory universe. In theory, the prospect of avoiding stormwater regulation could provide a disincentive for these local governments to zone and permit higher density development. However, this is unlikely. Even zoning for one-acre lots (a typical recipe for sprawl) would allow up to 400 homes per square mile. The population at this density would exceed the population threshold of 1,000 per square mile that triggers examination for stormwater control programs. Only areas with much lower population densities, which likely would have no MS4s, would avoid Phase 1 and 2 regulation.

In addition, runoff from construction sites is regulated both in areas served by MS4s (through the MS4 stormwater management plan requirements) and in other areas (through the industrial stormwater requirements applicable to construction sites of

one to five acres and sites of five or more acres). Thus, most construction of any sizable scale is regulated. The construction regulations, and the many state and local erosion control laws operating independently of the federal stormwater program, also would mitigate any regulatory advantage of exurban construction over urban construction.[47] For example, near Atlanta, Georgia, in fast-growing Cherokee County, the construction stormwater program is fully integrated with other permitting, and the state erosion control permit program is linked with issuance of local building permits in a way that apparently has improved compliance in recent years.[48] The implementation and enforcement of such stormwater controls on construction has had no apparent effect on the rate of sprawling development in the county.

Based on a sample of rates charged by individual stormwater utilities, it seems unlikely that stormwater regulation creates an economic incentive for exurban sprawling development.

The economic impact of current Phase 1 stormwater regulation on development patterns is difficult to evaluate because little information exists on the rates charged by utilities for stormwater management. Moreover, fees for stormwater management often are not separated from other charges. Many jurisdictions manage stormwater using general revenues, some roll the costs into general utility bills, and others assess fixed charges for an array of services including garbage disposal and stormwater management. Because the available information on costs generally is not consistent enough to support comparison, no comprehensive comparison of stormwater management rates exists.

Based on a sample of rates charged by individual stormwater utilities, it seems unlikely that stormwater regulation creates an economic incentive for exurban sprawling development. Residential stormwater rates reviewed in the course of this research for communities under Phase 1 regulation were in the range of $2 to $9 per month. Although this is not an insignificant cost, an annual charge of $24 to $100 does not seem to translate into a differential that would alter individual choices about where to purchase and hold property.

Program Emphasis on How, Not Where, Development Occurs

The location of development on the land is as important to stormwater management as the techniques it uses, but the CWA's stormwater rules and state laws do not

address this issue. Current stormwater rules have a minimal effect on development location and more influence over design. The stormwater rules call for structural best management practices (BMPs), such as ponds, swales, retention and detention structures, and nonstructural practices, such as zoning, buffers, pollution prevention programs, and operation and maintenance programs. These tools address how development is done on a site already chosen, not whether development should occur there at all or how land use can be regulated in a watershed context.

An expert panel observed that "without strict land use planning, aggressive land acquisition programs, and integrated watershed management, our erosion, sediment, and stormwater control programs cannot do the job."

Nor do the rules regulate development in the context of watersheds. Indeed, the absence of numerical limits in stormwater permits and the lack of explicit links to water quality objectives may lead to missed opportunities to address the location of development. In addition, prescribing performance standards on a site-by-site basis may not do enough to successfully manage stormwater. An expert panel that studied stormwater management programs across the United States observed that "without strict land use planning, aggressive land acquisition programs, and integrated watershed management, our erosion, sediment, and stormwater control programs cannot do the job."[49] In other words, mere BMPs are not enough. It matters *where* the development occurs in the watershed as well as *how* it is designed.

"Conservation development" — a technique of clustering development on a small portion of a parcel and preserving the rest as open space — is not a panacea for the stormwater impacts of sprawling development.[50] It can reduce stormwater impacts by providing areas for stormwater infiltration, often buffering stream corridors and other sensitive lands. However, conservation development still tends to occupy large parcels of land on the exurban fringe, which may require just as much highway construction and creation of other impervious surfaces as more conventional sprawling development.

Smart growth techniques can reduce the construction footprint of developments and thus reduce the impacts that need control. In the long term this can be quite important, for while structural practices such as silt fences and sediment ponds can maintain technical compliance at a construction site, the creation of impervious surfaces

and drainage structures can cause substantial post-construction erosion (which is not regulated except in urban MS4 settings). For example, state inspectors recently examined erosion effects at a housing development in sprawling Loudoun County, Virginia, and determined that the erosion was caused by stormwater exiting the completed portions of the development (and not in violation of regulations). The portion of the development still under active construction was properly controlling erosion in accordance with the construction stormwater permit rule requirements.[51]

STATE, REGIONAL, AND LOCAL INNOVATIONS

Innovative state and local laws and ordinances can promote better development siting and design — both from a smart growth and stormwater management perspective. Unfortunately, some of the better site designs may be prohibited by cookie-cutter zoning and subdivision ordinances. However, there are numerous opportunities for states and municipalities that are implementing the stormwater program to improve the links between preventing stormwater impacts and encouraging smart growth. Local innovations include regional coordination, resource protection zoning, and linking utility fees to the size of impervious surfaces.

Regional Planning and Coordination

Local governments can use stormwater management as a springboard for regional cooperation. For example, the Rouge River National Wet Weather Demonstration Project, near Detroit, Michigan, has used the stormwater program's water quality objectives as a catalyst for intergovernmental cooperation. Established in 1992, the project has created a forum for discussing road and highway construction, location, and management — all key issues for both smart growth and stormwater management.

The project focuses on subwatersheds and integrates multiple communities under general stormwater permit applications. This provides efficiencies in planning and management and fosters the intermunicipal coordination required for smart growth and development to occur. The project led to new uses for some older legal tools, such as the Michigan Drain Code, to handle intergovernmental issues and financing. The project also created a "Roads and Watersheds Roundtable" for community and county government representatives, which engaged road commissioners in examining watershed protection.

PORTLAND, OREGON: LINKING SMART GROWTH AND A REGIONAL MS4 PERMIT

Long a national leader in implementing smart growth policies, Portland, Oregon, is using a regional approach to link its smart growth and redevelopment incentives with stormwater regulation. Subject to Phase 1 MS4 permitting, Portland submitted a co-application for the permit with Multnomah County, the Port of Portland, the Oregon Department of Transportation, Multnomah Drainage District 1, and Peninsula Drainage Districts 1 and 2. This collaborative approach recognized the interconnection of the stormwater systems and the need for a common approach to stormwater. The permit, granted in 1995, specifies a broad array of practices and approaches.

Under the permit, new development and redevelopment falls under one of four management levels, based on the amount of impervious area resulting from the project. These tiers of regulation provide both incentives to use mitigation measures to reduce impervious surface (and thus stay below thresholds), and ways to deal with the special needs of development versus redevelopment projects. The management level determines the measures the applicant must take to reduce pollution and control the offsite discharge of stormwater. Management level one applies to new development or redevelopment creating impervious area of less than 500 square feet (after any mitigation measures have been applied). Level one does not require management measures, but does require use of some BMPs depending on site uses and characteristics.

The other levels require both specific flow control and pollution reduction measures, and certain design requirements and/or specified total suspended solid removal rates. Level two applies to new development with new impervious area greater than 500 square feet (after mitigation), and to residential redevelopment if the result is 500 to 5,000 square feet of additional impervious area. Levels three and four apply to other forms of redevelopment. Level four in particular covers "significant redevelopment" where the project area is 38,000 square feet or greater, the project includes demolition of 75 percent or more of the previous development, and the total impervious area after redevelopment covers 50 percent or more of the project area after any mitigation measures have been applied.

The Portland metropolitan area urban growth boundary is strictly enforced, and prevents sprawl development while increasing the density of development and redevelopment within the boundary. Apparently rising stormwater rates have not produced greater sprawl or pressure for sprawl, in part because of the substantial strength of the applicable land use controls. However, the rising costs have led to work on restructuring the whole suite of water, sewer, and stormwater rates applied to city residents and businesses.

Sources: Portland Stormwater Management Manual (1999); Memorandum from E. Sten and D. Saltzman to Mayor Katz, "Analysis and Recommendations for Water and Sewer Rate Reform," Oct. 21, 1999; Bureau of Env. Services, Portland, www.enviro.ci.portland.or.us; American Planning Association, *Planning Communities for the 21st Century* (Dec. 1999).

Stormwater controls and smart growth can be mutually reinforcing if new development and redevelopment activities focus on preventing stormwater pollution rather than solely on the construction of collection and retention structures. Use of infiltration areas, drainage swales, reduction of the amount of impervious surface, improved management of road rights-of-way, and similar techniques may increase compatibility of the two goals. Similarly, identification of stream corridors and buffers can help meet both smart growth and water quality goals.

Portland, Oregon, is using a regional approach to link its smart growth and redevelopment incentives with stormwater regulation. (See Portland box, previous page.) This collaboration recognized the interconnection of the stormwater systems and the need for a common approach to stormwater. The permit, granted in 1995, specifies a broad array of practices and approaches to reduce impervious surfaces.

In the Charlotte-Mecklenburg metropolitan area of North Carolina, a program to protect stream corridors is integrating smart growth techniques with stormwater management. (See Charlotte box, next page.) Stormwater measures have assisted the jurisdictions in adopting measures that are consistent with smarter growth.

Resource Protection Zoning

Resource protection zoning limits incompatible land uses or scales of development that may threaten water quality, thus controlling stormwater and promoting smart growth. Such zones typically include stream buffers, limits on building on steep slopes, and restricted building in or around wetlands and groundwater recharge areas. The terms of resource protection may be specified outright under permitted, conditionally permitted, or prohibited land uses, or they may be achieved through performance-based zoning.

Overlay zones commonly are used to implement resource protection zoning, adding requirements targeted to protecting a specific resource, such as a waterway. The overlay zone is superimposed over the traditional land use zoning, which may specify residential, multifamily, commercial, or other uses. Overlays have been used to protect groundwater recharge areas, stream corridors, wetlands, wildlife corridors, and historic preservation districts, and for many other purposes authorized under state law.

CHARLOTTE-MECKLENBURG, NORTH CAROLINA: LINKING SMART GROWTH AND STREAM CORRIDORS

The Charlotte-Mecklenburg metropolitan area has embraced smart growth to cope with the impacts of rapid population growth, which has led to both sprawl and the degradation of surface water quality from stormwater runoff. The city itself is one of the fastest growing in the nation, with a population burgeoning from 419,000 in 1990 to more than 500,000 by a recent census bureau estimate. The county has more than 660,000 residents in total, and its 1997 State of the Environment Report projected an addition of 200,000 people and 120,000 homes in the next twenty years. This growth rate is projected to cause increased pollutant loading into the county's creeks, turning all of them into "mere urban conduits for stormwater runoff and waste assimilation."

In 1993, Charlotte received its Phase 1 NPDES stormwater permit, which required institution of a management plan and additional actions to reduce pollution from its MS4. The parts of Mecklenburg County outside Charlotte, including six towns in the county, are not required to obtain NPDES stormwater permits until the implementation of Phase 2. Nevertheless, the city and county have coordinated their stormwater management activities through an agreement under which the county's department of environmental protection manages stormwater under contract with the city.

In 1995, Charlotte-Mecklenburg established the Surface Water Improvement and Management (SWIM) program to protect surface waters in the region by focusing on a basin approach. SWIM began with an educational campaign and then established a "creek use policy" designed to restore surface waters. The creek use policy has led to erosion control and stream buffer requirements for development activities.

Next the county moved to adopt measures to implement the creek policy, including aggressively seeking to protect greenways and buffers along waterways and supporting stricter permit limits for discharges. In 1999, both the county and city adopted a buffer plan and implementing ordinance. The plan set aside buffer zones and established mitigation requirements to be used in development and to affect public infrastructure in streamside areas. In addition to goals and limits, the plan created development incentives such as recognizing the use of dedicated open space in development and reducing setback requirements to accommodate encroachment of the buffer on the buildable parcel.

Sources: Mecklenburg County, "Surface Water Improvement and Management,"1999 (www.co.mecklenburg.nc.us/coenv/Water/swim_background.htm); Mecklenburg County, State of the Environment Report -1997; Mecklenburg County, State of the Environment Report - 2000; Mecklenburg County, "SWIM Stream Buffer Consensus Document," Jan. 7, 1999; Natural Resources Defense Council, Stormwater Strategies (May 1999).

Performance-based zoning ordinances do not specify the particular permitted use in detail, but instead establish performance criteria that can be met in a number of ways. Performance-based zoning gives developers design flexibility as long as the local government's planning objectives are met. For example, a performance-based zoning ordinance might limit the percentage of impervious surface but be silent as to the building type or use. Another type of ordinance might award points for various project characteristics, such as the percentage of pervious surface, types and extent of vegetation, monitoring and maintenance programs, or pollution traps, and require a minimum score for approval.

Other approaches include cluster development, conservation development, and related designs that site structures closer together on a smaller portion of the tract. Usually this preserves more open space, makes it possible to separate impervious surfaces from natural waterways, and reduces the total impervious surface.[52] Many of these techniques are compatible with technical recommendations for improving stormwater management. These include zoning, subdivision, and site plan approval requirements largely aimed at reducing the amount of impervious surface associated with new development. Specific practices include relaxing/reducing side yard requirements to reduce street length, reducing front setbacks to shorten driveways, minimizing cul de sacs, and reducing street widths.[53] Many of these benefits also are consistent with smart growth approaches — placing houses closer together to reduce transportation demand and to preserve larger areas of open space, connecting streets in a grid pattern to facilitate traffic flows and mixed uses, and saving infrastructure expenses for water, sewer, and utilities.[54]

Queen Anne's County, Maryland, applies performance-based zoning county-wide but uses different standards in different resource areas. When combined with greater densities in urban areas, this approach can serve a smart growth objective. The county uses performance-based zoning to calculate residential site capacity. This technique helps assure that development takes into account natural features, including (indirectly) the protection of water quality, and lowers density in areas with features important for watershed protection, such as forests and buffer areas.

Under the ordinance, the county first calculates the total "resource protection area" for a tract proposed for development, including 100 percent of the acreage that is in rivers, floodplains, and wetlands. The area also includes 100 percent of any woodland acres in the Chesapeake Bay critical area (lands within 1000 feet of the bay or its im-

mediate tributaries), 60 percent in other upland areas, and 50 percent in agricultural areas. The total resource protection area is compared with the county's "open space" ratio and the greater of these two numbers is subtracted from the gross tract area to determine the "net buildable area" for the tract. The net buildable area is then multiplied by the net density prescribed by the zoning ordinance to determine how many dwelling units to authorize. This net result is compared with the number of dwelling units derived by multiplying the gross area by the applicable gross density also from the zoning ordinance. The lesser of these numbers is the number of units that may be constructed. Similar procedures are used to determine the maximum amount of floor area, impervious area, and minimum landscape surface area for nonresidential development in the county.[55]

Some interesting approaches link the performance standards to the amount of impervious area in the development, recognizing that more stringent controls are needed when impervious area is increased.

The town of Lacey, Washington, has pioneered a performance-based approach through an ordinance that allows approval of "zero effective impervious surface projects" as an alternative to prescribed stormwater controls such as drainage basins, stormwater ponds, and maintenance regimes. The ordinance allows the waiver of these requirements when the project design uses alternative techniques to eliminate stormwater collection and discharge impacts. Possible design approaches allowed under the ordinance include replacing all driveway and parking areas with pervious materials; native landscaping and planting with greater capacity to slow runoff and take up and transpire the water; smaller rooftop exposures and/or rooftop gardens; or narrow roadways with substantial vegetative berms.[56]

Many of the more progressive MS4 phase 1 jurisdictions apply a performance standard "to assure that post-development peak discharge rate, volume, and pollutant loadings" do not exceed the pre-development levels."[57] Some require even more. For example, Kitsap County, Washington, requires that the post-development peak discharge rate not exceed 50 percent of the pre-development rate for the two-year, 24-hour storm; and that the rate not exceed the pre-development rate for the ten-year and 100-year storms.[58]

Some interesting approaches link the performance standards to the amount of impervious area in the development. This provides incentives to reduce the amount of impervious area in new development designs, as well as recognizing that more stringent controls are needed when impervious area is increased. Austin, Texas, for example, has a standard that requires sedimentation/filtration stormwater management systems to have a capacity to handle 0.5 inches of precipitation *plus* an additional 0.1 inches for each 10 percent increment in impervious area above 20 percent of the site.[59]

Linking Stormwater Fees to the Size of Impervious Surfaces

The financing of stormwater controls also can relate to development. Several hundred U.S. stormwater utilities derive funding for stormwater management from a system of user fees that directly links stormwater controls to development choices. For example, Takoma Park, Maryland, links stormwater generation with financing of the public improvements needed to address it. The town created a stormwater utility in 1996 to provide a funding mechanism for stormwater controls, operations, and maintenance. The utility assesses an annual fee of $24 on single family residences, with all other property assessments sliding upward based on the amount of impervious surface on the property.[60] Boulder, Colorado, has taken a similar approach, with a utility that assesses residential fees based not on land area but on the amount of impervious surface; it exempts undeveloped parcels altogether.[61]

In Portland, Oregon, stormwater fees are linked to land use by assessing all nonresidential properties at a rate of about $4 per 1,000 square feet of impervious area. In 2000 the city is considering revisions to the water, sewer, and stormwater rates that may further strengthen this connection. For example, one proposal would provide discounts for properties that manage stormwater effectively on site, and another would create a separate line item for stormwater costs created by the city's transportation system, which is responsible for about 70 percent of the volume of stormwater the city manages. Portland officials hope to build support for proposals that will finance transportation-related stormwater management costs through transportation-based fees or charges. Some proposals also might make it possible to support transportation retrofits and choices that will improve transportation options and alleviate stormwater concerns at the same time, providing some direct linkage as

Portland promotes alternative forms of transportation, and as highways and roads are right-sized, retrofitted, or removed.

The City of Griffin, Georgia, has made stormwater management implementation a high priority, establishing a consensus early and adopting a funding mechanism that reflects user demand. With a population of 24,000 and encompassing about 15.5 square miles, the city is subject to Phase 2 regulations, and in advance of the regulations it established a stormwater utility as part of its management program. The utility provides funding for the development of BMPs and implementation of the other requirements through a monthly user fee for each property. The "equivalent runoff unit" is the basis for the monthly charge of $2.95 per residence or per 2,200 square feet of impervious surface for nonresidential properties (including paved roads).

> The federal stormwater management program could enhance water quality while promoting smart growth by emphasizing site reuse, recognizing infill development as a stormwater BMP, and focusing on the water quality impacts of road siting.

The city used its innovation and financial commitment as selling points to obtain additional funding from other sources, including the Federal Emergency Management Agency, the Spalding County sales tax program for infrastructure, EPA nonpoint source water pollution control funding, and a state revolving loan fund loan from the Georgia Environmental Facilities Authority. These funds will provide a substantial portion of the capital expenses, while the user fee will support staffing, planning and design of infrastructure, program development, and implementation activities. The user fees also are being used to design the capital construction program, which also can affect development and redevelopment.[62]

OPPORTUNITIES

State, regional, and local innovations, and general experience in implementing the stormwater management program point to important opportunities to leverage land use policies to protect water quality. Although the stormwater regulations do not appear to promote sprawl, neither do they include explicit recognition that the location

of development is as important to water quality as the manner in which the development is constructed and maintained. The federal stormwater management program could enhance water quality while promoting smart growth by emphasizing site reuse, recognizing infill development as a stormwater BMP, and focusing on the water quality impacts of road siting.

Site Reuse

Brownfield redevelopment may present an important opportunity for combining smart growth with stormwater controls. Many brownfield sites (abandoned or underused land areas with actual or perceived contamination) are substantially covered with impervious surfaces that produce stormwater runoff. Even when this runoff is collected, it is rapidly discharged from the site — along with any contamination. The reuse of such sites can improve stormwater controls by increasing the integrity of the new impervious surfaces (some of which are used to prevent stormwater contact with residual contamination) and replacing some impervious surfaces with landscaping or buffer areas. Although stormwater infiltration is undesirable at some brownfield sites, particularly industrial areas with residual contamination, on-site stormwater management is highly desirable at many sites.

For example, in Wilkinsburg, an aging suburb of Pittsburgh, an abandoned outdoor shopping mall currently occupies about 70 acres at the head of an urban watershed. The impervious surface contributes huge volumes of runoff to the municipal storm sewers. A redevelopment proposal would convert part of the site to residential use and another portion to commercial development, while reducing impervious surface.[63] If stormwater reduction were a goal of the project, a contemplated mixed use redevelopment in an older, low-income neighborhood could significantly improve stormwater quality. However, the federal Phase 2 stormwater program provides no meaningful incentives to do the project in this way instead of simply channeling the huge volume of stormwater on the site more efficiently into the storm sewers, or worse, leaving the site in its current condition.[64] In this and other cases, stormwater management likely would improve if regulators considered the water quality benefits of redevelopment that reduces the volume of stormwater discharges, especially from contaminated sites.

Infill as a Best Management Practice

An unresolved issue under stormwater management programs is whether compact development can itself be a BMP. EPA sought comment on the issue in the Phase 2 proposed rule but did not adopt a formal position in the final rule, instead simply noting that such techniques could be good for water quality. Until the final Phase 2 permits are developed, it may not be possible to determine the viability of such an approach. A key question will be whether compact or infill development must be formally linked to the protection of open space (or a reduction in impervious surface elsewhere) in order to be credited as a BMP. The preamble of the regulations suggest such a link in references to programs for the transfer of development rights.

Federal regulators could designate infill development as a BMP and specify the criteria it must meet to qualify. Furthermore, EPA and the states could offer municipalities some relief from implementation of stormwater control measures when the municipalities implemented infill development, transferable development rights, traditional neighborhood development, mixed use development, and other smart growth measures on a watershed basis.

Road Siting

The expansion and siting of paved roads can be a major contributor to both sprawl and water quality impairment. The Phase 2 rule regulates roads as MS4s whenever they enter urban locations, even when they are operated and maintained by the state or another entity.[65] Nevertheless, the regulations do not explicitly link road siting with water quality objectives, even though roads directly contribute to stormwater runoff from paved surfaces and can further increase runoff by inducing development and additional paving on private lands adjacent to and surrounding the roads. A study in Portland, Oregon, found that roads and associated transportation infrastructure were responsible for 70 percent of all the stormwater handled by the city's MS4.[66]

Although stormwater regulation can begin to address some of the issues relating to operation and maintenance of roads and road drainage systems, the currrent approaches do not integrate analysis of the sprawl-inducing effects of road location with stormwater implications. The stormwater permit program could incorporate the direct impacts of runoff from roads and the indirect impacts of additional runoff from their potential attendant development.

combined sewer overflow and sanitary sewer overflow programs

The Clean Water Act's program to rehabilitate combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) will require an enormous investment, particularly in urban areas with aging sewer infrastructure. Some approaches to CSO and SSO rehabilitation may reinforce opportunities for smart growth and urban infill development. If state and local governments adopt watershed- and sewershed-based approaches, the resulting intermunicipal cooperation in land use planning and infrastructure funding can lay the groundwork for smart growth strategies. In addition, CSO and SSO investments can help revive urban waterfronts and strengthen the urban core, thus making further residential and commercial development possible.

PROVISIONS OF CSO AND SSO PROGRAMS

Two kinds of stormwater problems beset sewage collection and treatment systems in older communities throughout the nation. They are *combined sewer overflows* (CSOs) and *sanitary sewer overflows* (SSOs). Both can release raw sewage into waters of the United States, posing a threat to public health and safety and the environment. Such wet weather discharges impair stream quality, raise the possibility of disease, threaten aquatic habitat for fish and other wildlife, and necessitate warnings for recreational, swimming, and boating uses.

Combined Sewer Overflows

Combined sewer overflows result from a design technique used for the construction of municipal sewers many years ago. Sewer collection lines often were designed to handle

both sanitary sewage and stormwater runoff from streets, roofs, and buildings. These combined systems in many cases were built prior to municipal, state, or federal requirements for sewage treatment. When wastewater treatment plants were constructed, the plants and their collector sewers were provided with bypasses to prevent them from being overwhelmed with large volumes of mixed sewage and stormwater during periods of rainfall. Combined sewer overflows (CSOs) are the discharge of mixtures of stormwater and untreated sewage from these combined systems.

The U.S. Environmental Protection Agency (EPA) reports that, nationwide, combined sewer systems serve about 950 communities housing about 40 million people. CSOs are not prohibited outright by federal or state law, but they must be identified and authorized in the National Pollutant Discharge Elimination System (NPDES) permits that apply to the wastewater treatment plants with which they are associated. EPA has brought a number of high profile cases against cities and municipalities to abate CSOs, requiring the expenditure of hundreds of millions of dollars and payments of civil penalties.

In order to gain further control over CSO discharges and to eliminate and reduce them, EPA required systems with CSOs to implement "nine minimum controls" by January 1, 1997.[67] Under existing EPA policy, NPDES permits may be issued if the nine

NINE MINIMUM CONTROLS FOR CSOS

1. Proper operation and maintenance programs for the sewer system and the combined sewer overflows.
2. Maximum use of the collection system for storage of combined stormwater and sewage for later treatment.
3. Review and modification of industrial wastewater pretreatment requirements to assure that adverse CSO impacts are minimized.
4. Maximizing flow to the wastewater treatment plant for treatment.
5. Prohibition of CSO discharges during dry weather.
6. Control of solid and floatable materials in CSOs.
7. Pollution prevention measures.
8. Adequate notification to the public about CSO occurrences and impacts.
9. Monitoring to characterize CSO impacts and the effectiveness of CSO controls.

minimum control measures are implemented and the discharger develops and submits a long-term control plan. In 1998, EPA determined that only about 52 percent of CSO dischargers were implementing the nine minimum controls.[68]

Sanitary Sewer Overflows

Sanitary sewer overflows occur when sewer collection lines that are designed to handle only sanitary sewage become overcharged with stormwater entering the system from a variety of external sources. These sewer lines then either back up and discharge from manholes or other outlets, into homeowners' basements, or through designed diversion structures which are intended to limit the amount of flow into large interceptor sewers. These discharges are sanitary sewer overflows (SSOs).

Sources of the stormwater entering these sanitary sewer systems include *inflow* and *infiltration*. Inflow comes from such design defects as locating manholes and other features below grade so that they serve as a conduit for stormwater into the sanitary sewer system. Other sources of inflow include breaks or gaps in collectors that admit stream flows and hookups of residential roof drains and foundation drains to the sanitary sewer system. Infiltration comes from the deterioration of collectors and house laterals (the homeowner-owned portion of the system that conveys wastewater to the municipal collector), allowing stormwater to enter the lines. EPA cites informal studies that suggest as many as one-third of sanitary sewer systems have SSO problems.[69]

SSOs are illegal under the federal Clean Water Act. EPA regards them as unlawful discharges for which a permit cannot be issued, although a federal advisory committee is examining whether there should be a way to permit some unavoidable SSO discharges under limited circumstances in which abatement or total elimination is not feasible. EPA has developed a graduated hierarchy of enforcement actions to be taken in response to SSOs and has taken enforcement actions against a number of systems with SSOs.[70]

Some problems are hybrid CSO/SSOs. In many communities, especially where early suburban systems tied into existing city combined systems, a separate sanitary sewer system discharges into a large combined sewer interceptor. At the point of the first connection, there may be an overflow structure, which is an SSO. Thereafter, however, the discharge points are CSOs. Interestingly, sometimes the SSO discharge may be occasioned by the mixed stormwater and sewage volume carried by the combined system interceptor, which makes it unable to carry the entire flow from the sanitary sewer lines.[71]

CSO and SSO Rehabilitation

In April 2000, EPA released a new compliance strategy for CSOs and SSOs. The strategy calls for the development of regional response plans by all EPA regions by July 2000. The strategy also promotes the "Capacity, Management, Operation and Maintenance" (CMOM) and the municipal self-audit program for sanitary sewers, first tested by Region 4.[72] A proposed rule will require CMOM approaches and may include a watershed-based approach.[73]

The regional compliance plans will describe an approach and timetable to assure that all CSO communities have a NPDES permit or administrative order requiring implementation of the nine minimum controls and development of the Long-Term Control Plan, where this does not already exist. The plans must assess the implementation status of existing long-term control plans. The plans also must describe the approach the region and states will use to develop an inventory of systems with SSO violations and identify how the inventory will be addressed. The regions are to assure that 20 percent of the priority systems will be addressed each year.

The removal of inflow and infiltration from SSOs can require excavation and replacement of house laterals, disconnection of roof and foundation drains, and other investments. Poor maintenance and lack of regular inspection and replacement of municipal collector sewers mean that many lines are functioning like perforated pipes — like French drains for groundwater, stormwater, and wastewater, conveying all of them to the point of connection or to a leak or unauthorized discharge. House laterals deteriorate; they are seldom maintained or replaced by homeowners unless a serious failure occurs, resulting in visible sewage on the street or in the homeowner's basement. Few municipalities engage in regular inspection or maintenance checks with respect to these connections.[74] CSO abatement may require constructing a new separate sanitary sewer system, or building retention basins to hold the mixed water for later treatment.

Technical solutions and alternatives may include:

- reducing the amount of inflow and infiltration from house laterals and other private sources such as roof and foundation drains;
- reducing the amount of stormwater in separate sanitary sewers through substantial repair/replacement of municipal collectors and better municipal maintenance

programs that schedule inspections and replacement of deteriorated lines and clean-outs of obstructions;

- conveying more or all of the mixed stormwater and wastewater to the wastewater treatment plant and providing additional treatment capacity for this volume; and
- constructing storage tanks and retention basins in individual municipalities, multi-municipal sewersheds, and other locations, to contain wet weather volumes for later treatment during lower flow periods.[75]

Legal responsibilities for these solutions may fall to different entities, including the regional wastewater treatment authority; municipalities or other entities that may own and maintain the collector sewers and interceptor sewers, which may not be owned or serviced by the wastewater treatment authority; and homeowners and business operators who handle retrofits and repairs. Their choices have sharply differing financial and political implications.

Difficulties in imposing direct costs on homeowners may lead municipalities to greater reliance on constructed storage facilities, which can be financed and paid for over time from ratepayer revenues and surcharges, even though a homeowner-based solution (or combined solution) might produce technically superior results.

Solutions that address municipal collectors or that require construction of storage basins might be financed by the municipalities, municipal authorities, or the sewer authority. Funding (either outright or to service debt) may come either out of general tax revenues or through surcharges on water/wastewater bills. Financial issues may arise if the problem needs to be solved at the homeowner/house lateral level, because costs to individual homeowners may be high and meet with either a voter backlash or an inability to pay for repairs. Difficulties in imposing direct costs on homeowners may lead municipalities to greater reliance on constructed storage facilities, which can be financed and paid for over time from ratepayer revenues and surcharges, even though a homeowner-based solution (or combined solution) might produce technically superior results.

Particular municipalities or homeowners also may have some reasons to prefer solutions that rely more heavily on the regional treatment authority. For example, al-

In some areas, it may be environmentally and economically beneficial to tailor some loan and grant funding toward CSO/SSO rehabilitation to reduce the rate differential between older urban and newer suburban areas.

though construction of additional treatment capacity by the regional wastewater treatment authority can be extremely expensive, such a solution may be more attractive to some municipalities than requiring their residents to expend $5,000 each to rehabilitate house laterals, or spending municipal funds to rehabilitate local collector sewers or construct storage basins. In many cases, the selection of a solution will be a function of which entity EPA or a state enforcement authority pursues, or the political success of particular actors in shifting costs to others.

INFLUENCE OF CSO AND SSO REHABILITATION ON DEVELOPMENT

In general it appears that CSO and SSO rehabilitation costs will be quite high, but not uniformly higher than the cost of building new sewer systems to service construction in exurban areas. Thus, it is difficult to conclude that development in cities and older suburbs will be significantly disadvantaged by a difference in utility rates to cover these costs. However, urban areas may be disadvantaged vis-a-vis exurban development that relies on septic tanks and other on-lot sewage disposal methods. In some areas, it may be environmentally and economically beneficial to tailor some loan and grant funding toward CSO/SSO rehabilitation to reduce the rate differential between older urban and newer suburban areas.

In addition, some approaches to CSO and SSO rehabilitation may reinforce opportunities for smart growth, particularly urban infill development. This linkage is particularly strong in urban areas like Atlanta, Georgia, and Richmond, Virginia, that are rehabilitating riverfronts as part of their downtown revitalization efforts. In addition, watershed- and sewershed-based approaches to CSO and SSO rehabilitation may help promote intermunicipal cooperation in land use planning and infrastructure funding that can support smart growth while correcting wet weather flows. Compared to enforcement focused on individual municipalities, a regional approach can identify less expensive solutions and promote more community redevelopment opportunities.

Differences Between Urban and Exurban Sewer System Costs

The chief impact of CSO and SSO rehabilitation on development patterns may be the high costs incurred by urban centers. Correcting CSO/SSO problems will require large capital outlays and substantial operating and maintenance expenditures. CSO long-term control plans often include the separation of storm sewers from sanitary sewers, the holding and treatment of combined flows, and other costly measures. SSO expenses include retrofits of sewer collection systems, inventory and elimination of inflow and infiltration sources, and construction of additional retention and/or treatment capacity. If these costs result in large increases in urban and older suburban community sewer rates and taxes that far exceed those in surrounding exurban jurisdictions, development and location choices may be affected.

In 1998, the U.S. General Accounting Office (GAO) investigated the question: "Do requirements for water quality treatment (including combined sewer overflows) encourage development in greenfields rather than in existing urban and suburban areas?" According to GAO's report: "Issues associated with the costs of compliance have been raised by the CSO Partnership, a consortium of about 100 communities with combined sewer overflow problems. A Partnership official stated that municipalities served by such systems are often required to raise their water and sewer rates to cover the costs of compliance; the higher rates then discourage growth in these jurisdictions and drive development out to the surrounding areas. However, we did not find any quantitative research supporting this view."[76]

EPA has estimated necessary wastewater capital infrastructure costs at greater than $210 billion, including nearly $82 billion for sanitary sewer overflow fixes.[77] According to the Association of Metropolitan Sewerage Agencies and the Water Environment Federation, $330 billion in wastewater collection and treatment investments are needed over the next twenty years.[78] An industry estimate of need further suggests that there is a funding gap of $12 billion per year for wastewater infrastructure, even taking into account current sources of funding.[79]

These undeniably large numbers are consistent with the magnitude of the needs identified in individual CSO and SSO communities. For example, the St. Louis Metropolitan Sewerage Agency has identified wastewater infrastructure needs totalling more than $3.5 billion over the next twenty years. Detroit officials estimate needed

The ability of particular sewer and treatment authorities or municipalities to obtain funding from the Clean Water State Revolving Loan Fund, on private capital markets, or through federal earmarks also affects the costs of urban development.

expenditures at nearly $6 billion.[80] The wastewater system serving Pittsburgh and its older suburbs has identified $3 billion in infrastructure expenditures needed to deal with CSO long-term control problems.[81] The small city of Fall River, Massachusetts, with 90,000 citizens, is scheduled to spend $115 million to abate CSOs.[82]

The ability of particular sewer and treatment authorities or municipalities to obtain funding from the Clean Water State Revolving Loan Fund, on private capital markets, or through federal earmarks also affects the costs of urban development. For the most part, state revolving loan funds favor the replacement of on-lot systems with new sewer systems over the rehabilitation of large-scale urban CSO/SSOs. Such funds also rarely support solutions that are targeted toward removal of inflow and infiltration from house laterals and other privately owned conveyances that contribute to the public sewers' wet weather problems.[83]

At the same time, older urban communities often have to pay a high interest rate to obtain capital on the private capital markets. This contrasts with newer sprawl communities, which often issue bonds with the prospect of supporting the debt on a rising rate base (as the population served goes up rather than down). The CSO problems of the largest cities have been addressed, at least in part, with some direct federal funding — through earmarks on the EPA budget or occasionally other appropriations vehicles. Whether the federal government should again invest grant money in large urban and older suburban sewer infrastructure systems is a subject of lively debate.

EPA has recognized in general terms the possibility that necessary expenditures on CSO and SSO problems will compete with the needs of new exurban development. In response, the agency has offered only the recommendation that problems be corrected before new capacity and service areas are constructed.[84] However, in many cases the new development is occurring outside the service areas of the utilities and communities with the CSO/SSO problems; older city systems may be landlocked and unable to add new customers in any event. Moreover, even where the utility service area includes areas with potential new development, the system often seeks to add

these customers in order to expand the rate base to support the system (including the wastewater treatment plants) over the long term. Thus, to hold off on any expansions of service until CSO/SSO problems have been funded can be fiscally as well as politically difficult.

Despite these challenges to urban areas with chronic CSO/SSO problems, actual rate increases have not been at a level likely to dramatically affect consumer behavior. For example, New Orleans signed a consent order in 1998 committing to $200 million in expenditures to address combined sewers.[85] In March 2000, the New Orleans city council approved a 30 percent increase in local sewer rates. While this sounds large, the increase amounts to only $2.39 per month for a typical family of four based on water use. This produces a total monthly sewer bill of $13.56 (water is billed separately).[86]

Although CSO/SSO rehabilitation costs may be quite high, costs for construction of new sewer systems and wastewater treatment plants for new communities can be even higher, and so the rate competition between cities and exurbs may not be significant.

Furthermore, although CSO/SSO rehabilitation costs may be quite high, costs for construction of new sewer systems and wastewater treatment plants for new communities can be even higher, and so the rate competition between cities and exurbs may not be significant. For example, Richmond, Virginia, has spent $200 million on its CSO rehabilitation project, resulting in increased sewer rates. Monthly rates are about $3 to $9 per month higher in Richmond than in the surrounding counties, and the cost difference is even greater in comparison with the many on-lot subdivisions being constructed in the formerly rural suburbs and exurbs that have no monthly sewer bills. However, in the nearby, rapidly suburbanizing Hanover County, sewer rates exceed Richmond's by $7 per month to support the construction of new sewers and wastewater treatment capacity. These mixed cost differences, combined with the fact that Richmond has lower gas and water rates than most of the surrounding area, diminish any competitive disadvantage that Richmond might suffer due to the cost of CSO retrofits.

ATLANTA, GEORGIA: LINKING CSO AND SSO REMEDIES TO URBAN IMPROVEMENT

Atlanta's CSO and SSO compliance has been driven by a series of lawsuits by environmental groups, which in turn have stimulated enforcement action by EPA and Georgia's environmental protection division (EPD). Compliance will require substantial expenditures of funds. At the same time, the Atlanta region has been one of the fastest sprawling areas in the nation, but the years of rapid sprawl occurred well in advance of the newly increased expenditures for CSO/SSO upgrades.

In the early 1990s, the State of Georgia sought to force the City of Atlanta to abate problems with its CSOs, which affect about 21 square miles of downtown and midtown Atlanta. The state issued permits and administrative orders requiring compliance by December 1993, but the city missed the relevant deadlines. In 1995, environmental groups filed suit in federal court to compel action. In 1998, the United States, State of Georgia, and environmental groups entered into a settlement agreement with Atlanta to address violations at all of the city's CSO facilities in connection with the 1995 lawsuit. The agreement, memorialized in a consent decree, requires completion of all remedial action by July 1, 2007. The consent decree includes a $2.5 million civil penalty, completion of remedial

Linking CSO Rehabilitation with Urban Revitalization

Expenditures to correct CSO/SSO problems may help in reviving urban economic vitality, especially in cities that are restoring waterfronts as part of downtown revitalization efforts. Because investments in controlling CSOs and SSOs can improve water quality and promote smart growth, this linkage also helps create a constituency to support CSO/SSO expenditures.

Atlanta's efforts to comply with CSO and SSO regulations illustrate the program's connection with downtown revitalization. (See Atlanta box.) Driven by a series of lawsuits by environmental groups that stimulated enforcement action by EPA and Georgia's environmental protection division, Atlanta's CSO/SSO program will require large expenditures. At the same time, urban development, including new residential development, is occurring in several Atlanta sections. This reinvestment in the city has spurred interest both in correcting its environmental problems and restoring the Chattahoochee River. Atlanta's CSO program is creating a greenway corridor along the Chattahoochee and South Rivers and their Atlanta tributary streams and performing a one-time stream cleanup along selected streams. Such supplemental environmental projects are becoming a mainstay of CSO settlement agreements across the country. The idea is that the

action for the CSOs, and a $27.5 million supplemental environmental project. Remedial action is in three phases: evaluation of the CSO discharges, development of remedial measures, and construction and implementation.

The supplemental environmental project consists of creation of a greenway corridor along the Chattahoochee and South Rivers and their Atlanta tributary streams and a one-time stream cleanup along selected streams. Such supplemental environmental projects have begun to become a mainstay of CSO settlement agreements across the country. The idea is that greater environmental benefit, including improved water quality, may be achieved through investment in means other than the abatement or removal of the last increment of CSO discharge. In addition, the project helps maintain community interest in the success of the CSO project while promoting the enjoyment of the benefits of improving water quality beyond those property owners (often public or industrial) whose land immediately abuts the waterway.

In 1999, the Georgia EPD required Atlanta to take further steps to reduce the amount of pollutants, particularly metals, that were being discharged via the city's combined sewer system. The city challenged the permit requirements as going beyond what had been agreed to. Thus, there are still bumps in the road of compliance and improvement of water quality.

Atlanta's sewer system also suffers from SSOs. On July 29, 1999, a consent decree was filed in the U.S. District Court in the Northern District of Georgia. It requires Atlanta to eliminate all unpermitted discharges and sanitary sewage overflows, including sewage overflows to dry land. It also requires the city to implement corrective actions sufficient to bring its wastewater collection systems, transmission systems, and treatment plants into full compliance within fourteen years. In addition, the agreement prohibits connection of new sewer lines to the Atlanta system where the existing systems lack capacity to handle new flow, unless the city increases local system capacity there or reduces flow from other sources.

Correction of CSO/SSO problems may help in reviving Atlanta's urban economic vitality, which in turn can create a constituency to support CSO/SSO expenditures. Recent reinvestment in the city has helped spur interest in correcting Atlanta's environmental problems and in recovering the Chattahoochee River as a civic resource. Urban development, including new housing, is occurring in a number of sections of the city. At the same time, the new regional transportation agency is attempting to ensure that transportation infrastructure expenditures support the urban core.

Sources: Kevin B. Smith, "Combined Sewer Overflows and Sanitary Sewer Overflows: EPA's Regulatory Approach and Policy Under the Federal Water Pollution Control Act," 26 Envtl. L. Rep. (Envtl. L. Inst.) 10296, 10300 (June 1996); Environmental News Network, April 8, 1999; City of Atlanta CSO Settlement, Fact Sheet (1998); Charles Seabrook, "Federal Crackdown could mean billion-dollar fines for Atlanta," *Atlanta Journal-Constitution* (1998); See also www.epa.gov/region4/water/wpeb/atlantacd.htm (visited June 6, 2000).

In Richmond, Virginia, the capture of CSOs has made it possible to promote a highly visible riverfront as a civic amenity. The city began to deal with CSOs as an aesthetic and environmental problem affecting the attractiveness of the city's waterfront, where CSOs drain into the James River.

greatest benefit to water quality and the environment in general may be achieved through investment in means other than the abatement or removal of the last increment of CSO discharge. In addition, the project helps sustain community interest in the success of the CSO project in improving water quality. It also promotes the enjoyment of the project's benefits by a broader population beyond those property owners (often public or industrial) whose land immediately abuts the waterway.

In Richmond, Virginia, the capture of CSOs has made it possible to promote a highly visible riverfront as a civic amenity. (See Richmond box, next page.) The city began to deal with CSOs as an aesthetic and environmental problem affecting the attractiveness of the city's waterfront, where CSOs drain into the James River. The overflows were creating an unsightly and smelly environment inimical to the redevelopment and orientation of tourism toward the river.

In response to Richmond's CSO problem, the Virginia Department of Public Utilities has embarked on a 12-year, $117-million CSO control program. Richmond identified CSO discharge points in parks, recreation sites, and other public areas as the highest priority for capture and redirection. On the north side of the James, 1.3 miles of pipe up to 8 feet in diameter have been installed in the beds of the Haxall and Kanawha Canals, collecting CSO flow and diverting it to the 50-million gallon Shockoe retention basin. This phase of the program has been tied to the restoration of the historic canals and revitalization of the downtown riverfront.[87]

Watershed-Based Strategies to Integrate Smart Growth with CSO Control

Regional, watershed-based strategies can cost effectively control CSOs and eliminate SSOs. By addressing these issues on a watershed basis, these efforts promote integrated planning while cutting costs. In some areas they are explicitly linked to smart growth initiatives.

RICHMOND, VIRGINIA:
URBAN SEWER REHABILITATION COSTS AND BENEFITS

The capture of CSOs has made it possible for Richmond to promote a highly visible riverfront as a civic amenity; without the expenditures, the riverfront would have been far less viable. The city began to deal with CSOs in the early 1980s as an aesthetic and environmental problem affecting the attractiveness of the city's waterfront, where CSOs drain into the James River. As a result, the Richmond Department of Public Utilities has embarked on a 12-year, $117-million CSO control program. The program is constructing huge sewer interceptors along both sides of the James.

In 1983, the city put into service a retention basin south of the city, paid for primarily with federal grant funds. Richmond's technical solution since that time has largely been to connect discharge points throughout the city and send them downstream to the retention basin or a treatment facility. Richmond identified CSO discharge points in parks, recreation sites, and other public areas as the highest priority for capture and redirection. On the north side of the James, 1.3 miles of pipe up to eight feet in diameter have been installed in the beds of the Haxall and Kanawha Canals, collecting CSO flow and diverting it to the 50-million gallon Shockoe retention basin. This phase of the program has been tied to the restoration of the historic canals and revitalization of the downtown riverfront. Additional basins will be constructed to capture overflows further upstream. Along the south side of the river, another pipeline will extend 2.2 miles to the Manchester Dam, and a portion of the pipe will be beneath the river bottom.

Although CSO retrofits have been costly and resulted in increased rates, it is unclear whether the costs have put Richmond development at a competitive disadvantage. The city has spent $200 million on the CSO project, resulting in substantial increases in sewer rates. Rates are increasing in part because the rate base, as in many older cities, is not growing. An influx of federal grant funds in the early 1980s (which no longer are available) may have helped prevent even greater increases. Richmond Public Utilities sees the city's rates as being high enough to deter businesses and others from the city, especially in comparison with surrounding counties where rates are much lower.

Richmond's monthly rates are about $3 to $9 higher than the rates in the surrounding counties. The difference is far more notable in comparison with the many on-lot subdivisions being constructed in the formerly rural suburbs and exurbs, where there are no monthly sewer bills. However, in nearby Hanover County, monthly sewer rates are $7 higher than in Richmond to support the construction of new sewers and wastewater treatment capacity in the rapidly suburbanizing area that formerly relied on individual on-lot systems. Determining the impact of cost differences between Richmond and neighboring suburbs is complicated further by the fact that the city's gas and water rates generally are lower than those of surrounding areas.

Sources: CSO Partnership and Richmond Public Utilities; McGuire, Woods (law firm); Virginia Dept. of Environmental Quality.

ALLEGHENY COUNTY, PENNSYLVANIA: REGIONAL APPROACHES

The Allegheny County Sanitary Authority (ALCOSAN) serves the City of Pittsburgh and 82 other municipalities. It operates and maintains the regional wastewater treatment plant and the nine large interceptor sewers that convey sewage from the municipalities' and city's collector sewers. The collector sewers are operated and maintained by the municipalities themselves. The city's system is a CSO system, but there are also forty SSO outfalls in 51 of the municipalities.

ALCOSAN submitted its long-term control plan to EPA in 1999 and is awaiting approval. EPA also has ordered the SSO municipalities to conduct monitoring and provide flow data for stormwater and is apparently planning to undertake enforcement actions. Estimates of infrastructure funding needed to upgrade the ALCOSAN facilities and the municipal collectors and to construct retention basins and other facilities are in the vicinity of $3 billion. Several rounds of ALCOSAN rate increases already have occurred to facilitate expansion of the treatment plant's capacity (in part to handle more of the wet weather flow), but substantial further rate increases lie ahead.

In 1997-1998, ALCOSAN and the county health department (the local first-line regulator) launched the Three Rivers Wet Weather Demonstration Project. The Three Rivers Project, modeled in part on the Rouge River Demonstration Project in the Detroit Area, is a collaborative effort designed to find ways for the municipalities to work together to design and fund projects to regionally handle the SSO and CSO problems. The project has obtained small amounts of federal earmarked funding to operate a grant program to induce the ALCOSAN municipalities to design and build innovative solutions to wet weather problems on a "sewershed" basis. The Three Rivers Project has awarded several rounds of grants and also is serving as a forum for the identification of technical solutions, innovative funding mechanisms, and new governance structures needed to address the issues.

At the same time, the Pennsylvania Economy League and Allegheny Conference on Community Development, with support from several of the region's philanthropic institutions, in 2000 convened a multi-county/multi-stakeholder task force to determine how to address water quality and governance issues on a large-scale watershed basis. These discussions, chaired by the president of Carnegie Mellon University, are attempting to identify ways to address the Allegheny River, Monongahela River, and Ohio River holistically with respect to the development, reconstruction, and maintenance of water and sewer infrastructure. These discussions are not directly tied to the ALCOSAN long-term control plan or the Three Rivers Project, but rather are attempting to identify solutions that can be applied even more widely.

A key issue is the extent to which EPA will be willing or able to support regional solutions while meeting its enforcement and compliance objectives. The existence of potential enforcement makes it possible to have these discussions and launch these efforts. At the

same time, enforcement on a municipality by municipality basis may make it more difficult to arrive at sewershed or large-scale watershed solutions; the willingness and ability of EPA to use its enforcement leverage to support multi-jurisdictional collaboration is the unknown factor.

Sources: Environmental Law Institute, *Plumbing the Future: Sewage Infrastructure and Sustainability in Western Pennsylvania* (1999); Memorandum, Jared Cohon to Steering Committee for Southwestern Pennsylvania Water and Sewer Infrastructure Project (June 2, 2000).

For example, the Three Rivers Wet Weather Demonstration Project is a collaborative effort designed to find ways for the City of Pittsburgh and 82 other municipalities to work together to design and fund projects to handle SSO and CSO problems on a regional basis. (See Allegheny County box, previous page.) In 1997-98, the Allegheny County Sanitary Authority (ALCOSAN) and the county health department (the local first-line regulator) launched the project, modeled in part on the Rouge River Demonstration Project in the Detroit Area. The Three Rivers project encourages municipalities to design and build innovative solutions to wet weather problems on a "sewershed" basis.

In 2000, the Pennsylvania Economy League and Allegheny Conference on Community Development, with support from several of the region's philanthropic institutions, convened a multi-county/multi-stakeholder task force to determine how to address water quality and governance issues on a large-scale watershed basis. These discussions are attempting to identify ways to address the Allegheny River, Monongahela River, and Ohio River holistically with respect to the development, reconstruction, and maintenance of water and sewer infrastructure. Although these discussions are not directly tied to the ALCOSAN long-term control plan or the Three Rivers project, they will identify even more far reaching strategies that encompass the CSO control program.[88]

The city of Grand Rapids, Michigan, has joined its surrounding communities in integrating smart growth techniques with sewer system management. The region used the occasion of expiring intermunicipal service agreements to work out principles for new agreements that incorporate smart growth. In effect, the partnership developed a modest version of tax base sharing out of its regional approach to solving sewer service and rate issues.

A local cooperation committee developed principles including that "growth should pay for growth," an urban growth boundary should be established, and communities

should develop utility master plans for developing and financing their utility systems. A 1998 Water/Sewer Agreement drew an urban service boundary and provided economic incentives for communities to make sustainable land use decisions by including land area as a factor in the rate base and linking lot size calculations to connection fees. The partnership resulted in development of a broader Urban Cooperation Agreement to provide for the sharing of resources (beginning at a contribution of $1 per capita) to regionally address the purchase of development rights, housing and human services, recreational and cultural facilities, planning, and disaster recovery and emergency services.[89]

OPPORTUNITIES

EPA's program for SSO enforcement and CSO compliance can strongly influence the infrastructure agenda in older municipalities. Enforcement also may have significant regional effects if it drives older municipalities to address requirements community-by-community rather than in collaboration with other jurisdictions in the watershed. Enforcement solutions can increase water quality benefits and reduce overall compliance costs if they support intermunicipal cooperation and regional or watershed-based approaches.

The Association of Metropolitan Sewerage Agencies sponsored a study of performance measures for the CSO program. The work group that conducted the study recommended a watershed approach built on three principles:

- targeting efforts to watersheds where pollution poses the greatest risk to health, ecological resources, desirable use of the water, or a combination of these;
- involvement of all parties in the watershed in analyzing problems and creating solutions; and
- actions drawing on the full range of methods and integrating them into a coordinated attack on the problem.

This approach cross-references the importance of the Total Maximum Daily Load process, which requires states to establish wasteload allocations for point sources and load allocations for nonpoint sources that are contributing to the failure of identified waters to meet water quality standards.[90] SSOs also can be addressed on a watershed basis, often at substantial savings. Such approaches may require sophisticated modeling of storm events and runoff patterns.[91]

EPA enforcement also may affect development if it leads to higher rates that make older communities less competitive with new communities for residents, businesses, and institutions.

A key question is whether and to what extent EPA will be willing or able to support regional solutions while meeting its enforcement and compliance objectives. The specter of potential enforcement makes it possible to have these discussions and launch these efforts, but enforcement on a municipality by municipality basis may make it more difficult to arrive at sewershed or large-scale watershed solutions. To some extent, EPA has recognized alternatives to the elimination of CSOs. For example, in Region 1, in 1998 EPA allowed the Massachusetts Water Resources Authority a two-year variance from some CSO requirements in exchange for watershed-based efforts to reduce stormwater pollution in the Charles River and funding of a multi-year study aimed at developing a place-based approach to reduce or eliminate pollutants.[92]

EPA enforcement also may affect development if it leads to higher rates that make older communities less competitive with new communities for residents, businesses, and institutions. While these rates alone may not be high enough to tip a development balance, in combination with other rates (such as property taxes, stormwater fees, and business and professional privilege taxes), they may discourage some infill development and urban business location. One way of addressing this issue may be to provide a means to evaluate the steepness of the urban utility rate against that of surrounding jurisdictions, and to use that as a basis for making funding decisions. CSO/SSO remediation can require hefty capital expenditures that are no longer supported by grant funding (since the switch to a state revolving loan fund under the Clean Water Act in the 1980s). However, some cities and municipalities have succeeded in obtaining varying levels of earmarked federal appropriations for these purposes. It may be less effective to depend on the vagaries of Congressional representation than to provide some level of outright grant support for areas where the urban-exurban rate gradient is particularly steep.

Elimination of SSOs and control of CSOs can be compatible with smart growth. Indeed, such expenditures can restore the attractiveness of urban waterfronts (as in Atlanta and Richmond, for example), thus contributing to the economic revitalization of the urban core that is central to smart growth techniques.

total maximum daily load program

The development of Total Maximum Daily Loads (TMDLs) for impaired waters presents a significant opportunity to integrate planning for land uses across a watershed both spatially and temporally. Faced with the daunting task of setting limits for water pollutants and distributing their loads among the full range of discharge sources, state and local governments have begun to find that smart growth techniques can facilitate TMDL development and the long-term implementation of TMDL load allocations. Smart growth can help control stormwater discharges, reduce the quantity and peak flow of stormwater, and preserve open space and buffers. In addition, the TMDL process includes allowances for future growth, providing a mechanism to evaluate the patterns of development that will protect water quality and those that will not.

PROVISIONS OF THE TMDL PROGRAM

The move to improve on the Clean Water Act's technology-based regulations has gathered momentum in the 1990s through recognition of the long ignored section 303(d). Section 303(d) takes a quantitative water quality-based approach to regulation, requiring states to identify polluted waters and calculate the total maximum daily load (TMDL) of specific pollutants for each stream segment. A TMDL assesses the amount of pollutants that a waterbody can absorb and still meet water quality standards; sets allowable limits for these pollutants; and distributes pollutant loads among discharge sources. A TMDL is supposed to build on current standards by targeting waters that are still polluted after the institution of technology improvements. TMDLs are established for waters polluted by point sources, nonpoint sources, or a combination of the two.

Under section 303(d), states must identify polluted waters for which existing pollution controls are not stringent enough to attain water quality standards; create TMDLs for these impaired waters; and submit periodic lists of these waters and

TMDLs to the U.S. Environmental Protection Agency (EPA). EPA requirements under section 303(d) include reviewing the states' impaired water lists and TMDLs; approving or rejecting these lists and TMDLs within thirty days of submission; and creating lists or TMDLs for states with unsatisfactory lists or TMDLs.

EPA adopted TMDL regulations in 1985 and revised them in 1992.[93] The regulations required states to submit lists of impaired waters to EPA every two years on April 1 of every even-numbered year; to prioritize listed waters including an identification of pollutants causing or expected to cause impairment and targeting waters for TMDL development within two years; to provide the methodology used to create each list; and to develop TMDLs that factor in seasonal variations and a margin of safety to account for any uncertainty about effluent levels and their effect on water quality.

As a result of the TMDL process, by 1998 states had listed approximately 21,845 waters with 41,318 associated impairments.[94] Direct pollution discharges are the sole cause in only about 10 percent of polluted waters. The remainder is polluted by runoff from agricultural lands, city streets, suburban lawns, or a combination of sources. The top 15 impairments include sediments and nutrients accumulation, habitat alteration, and flow alteration, all of which can be attributed to land-disturbing activities and other land uses.[95]

Current TMDL Regulations

In August 1999, EPA issued proposed revisions to the TMDL program, incorporating many of the suggestions of a multi-stakeholder committee it had chartered under the Federal Advisory Committee Act (FACA).[96] EPA issued a final TMDL rule on July 13, 2000. The July rule, adopted by EPA just days ahead of Congressional appropriations bill limitations on TMDL rulemaking, is scheduled to go into effect October 30, 2001, or thirty days after Congress allows the rule to go into effect. In general the 2000 regulations are more specific than the prior regulations. Among other things they require TMDLs to include implementation plans, and they establish a ten-year timetable (extendable by an additional five years) for states to implement TMDLs.

EPA also changed the timing requirements for listing impaired waters. Until March 2000, EPA regulations required states to list their impaired waters by April 1 of even-numbered years, either as part of the states' biennial water quality reports or separately.[97] The last submission period was April 1998. However, in March 2000, EPA removed the requirement that states submit a section 303(d) list by April 1, 2000 (al-

though retaining the 2000 submittal for states where EPA is under court order, consent decree, or a commitment in a settlement agreement).[98] All other states now have until April 1, 2002 to submit their next TMDL list to EPA; thereafter the submittals will be on a four-year cycle rather than a two-year cycle.[99]

EPA envisions a system in which one implementation plan could be used for several similar TMDLs, such as all the TMDLs in a watershed dealing with a certain pollutant.

To establish TMDLs for an impaired water, states must:

- Establish ceilings: A TMDL must have a set limit (sometimes called a ceiling or cap) on the amount of pollutants allowed into a water body that are responsible for water quality problems. This ceiling is the maximum amount of the pollutant (the "total maximum daily load" or "TMDL") that the body segment can receive and safely absorb while meeting state water quality standards.
- Set source-specific limits: States must limit or allocate the acceptable pollution discharge (or TMDL) among all polluters, including both point and nonpoint sources. To meet TMDLs and achieve water quality standards, neither point nor nonpoint sources can exceed their allocations.
- Adopt an implementation plan and management measures: For all sources, but particularly for nonpoint sources, states must evaluate controls for effectiveness in reducing pollution to ensure that the water quality standards can be met.

When the available information and data are insufficient for determining exactly how to clean up a watershed, or when future land use patterns may cause additional pollution loads, states use a "margin of safety." The margin of safety accounts for the uncertainty about the relationship between the pollution source and the water quality of the impaired stream or lake, usually because of lack of information.

The July 2000 regulations require states to submit implementation plans for how each TMDL will be carried out.[100] EPA envisions a system in which one implementation plan could be used for several similar TMDLs, such as all the TMDLs in a watershed dealing with a certain pollutant. As part of a TMDL, the implementation plan would be subject to EPA approval or disapproval. The implementation plan must contain reasonable assurance that the implementation activities will occur.

Reasonable assurance means a high degree of confidence that the wasteload and load allocations in the TMDLs will be met. For point sources, that is showing that permits will

be brought into compliance with the wasteload allocation. For nonpoint sources, that is showing that nonpoint source controls, specific to the pollutant of concern, will be implemented along a specific schedule with adequate funding. Examples of reasonable assurance include regulations, local ordinances, performance bonds, trading programs, voluntary best management practices, and monitoring programs.

INFLUENCE OF TMDLS ON DEVELOPMENT

TMDLs do not appear to be barriers to smart growth. Indeed, limited evidence suggests that they can promote it. The TMDL process can bring all the stakeholders from the watershed to the table to discuss all sources of pollution and come up with creative solutions. This can foster more effective land use planning, improved technological solutions to stormwater discharge and sewer overflows, and better use of best management practices for construction runoff.

There is a natural connection between land use patterns and TMDLs. Land use patterns have an impact on waters through sediment and nutrient runoff, habitat and vegetation alteration, and other negative modifications to waters. At the same time, pollutant loads may change as land uses change. Discharges of agricultural chemicals may decline as a farm landscape suburbanizes, while discharges of sediment, motor oil, and lawn chemicals and fertilizers may increase. Land use patterns influence both the point sources (primarily water treatment plants and stormwater) and nonpoint sources (runoff from urban areas and construction sites) that impair the nation's waterways.

TMDLs provide a way to integrate thinking about land uses and their impacts on water quality. They often force a watershed-wide water management planning process that carries impacts for land use planning and development patterns. However, to date too few TMDLs have been implemented to draw clear conclusions about the relationship between TMDLs and development patterns, despite indications of what it could or should be. Once implemented, TMDLs undoubtedly will have an impact on where and how development occurs. States and localities have the opportunity to use TMDLs to reinforce sustainable land use patterns that protect water quality while discouraging sprawling development.

In practice, the long process of listing watersheds and developing TMDLs has spurred local watershed assessments, tributary management strategies, and connections between land use planning and water quality management. Several components of the

TMDL regulations have a direct relationship with development and can be leveraged to promote smart growth. These include the provisions for establishing an allowance for future loading, assigning priority to TMDLs, and prohibiting discharges under permits.

Allowance for Future Loading as an Impetus for Smart Growth

Although the 1992 regulations required that a "margin of safety" for scientific uncertainty and future loadings be included in TMDLs, the rules did not specifically require an analysis of future growth. However, some TMDLs have included future growth in their analysis. Of 45 TMDL allocations examined nationwide, seven included a quantified future development margin.[101] This growth allocation raises the issue of how and where communities should permit new development.

EPA identifies smart growth policies as a way to reduce future loadings and suggests that states consider adopting smart growth policies in TMDL areas.

The July 2000 regulations defining the new minimum elements of a TMDL explicitly require an allowance "for reasonably foreseeable increases in pollutant loads including future growth."[102] By requiring TMDLs to address the growth issue, the regulations raise issues of equity between present-day and future sources. EPA identifies smart growth policies as a way to reduce future loadings and suggests that states consider adopting smart growth policies in TMDL areas. Obviously, the adoption of some growth management measures may provide a way to reduce the increment allotted for future loadings and thus provide easier allocation targets for dischargers.

In broad terms, the allowance for future loading has two effects that may be conducive to smart growth. First, it requires states and localities to look at the water quality effects of potential development in a particular watershed or region. This examination may reveal that land has been overzoned — overallocated to potential developed uses in comparison with the uses the municipality really believes will occur. This is a typical occurrence in many jurisdictions, where "by right" development includes substantial office, commercial, and residential development with no meaningful planning regarding transportation nodes, town centers, or open space. Second, because the TMDL process involves the whole set of land users, decisions can be made that address existing uses in the context of their likely evolution and development. This affords an opportunity for allocating community resources wisely even as pollutant loads are being allocated among present and future users.

Assigning Priority to TMDLs

The 1992 regulations require that the TMDL list include a priority ranking for all listed water quality limited segments that still require TMDLs. The priority ranking must take into account the severity of the pollution and the uses to be made of such waters and identify the pollutants causing or expected to cause violations of the applicable water quality standards.[103] Thus, a state-designed priority scheme can assign priority to TMDLs that serve a smart growth agenda as they improve water quality.

The July 2000 regulations require states to establish methods to prioritize the waters slated for TMDL development. These guidelines must take into account many factors such as the use of water bodies for drinking water; the presence of endangered species; the historical, cultural, economic and aesthetic uses of the water body; the severity of the impairment; and the complexity and cost of establishing and implementing the TMDL.[104] The priority ranking, at the discretion of the states and EPA, suggests a number of factors that states may wish to consider, such as immediate program needs; vulnerability of particular water bodies as aquatic habitats; recreational, economic, and aesthetic importance of particular water bodies; degree of public interest and support; and state or national policies and priorities.[105]

This ranking may allow states to give priority attention to "easier" TMDLs and delay complex and time-consuming TMDLs. In particular, some comments on the proposed regulations noted that impaired streams in urban areas might not obtain TMDLs in a timely fashion because of their complexity and difficulty. With "efficiency" as well as state and national "policies and priorities" factored into the ranking, some commentors expressed concern that states will leave the most polluted waters for last on their TMDL development schedules.

However, many of the early TMDLs were conducted for areas with violations from their wastewater treatment facilities that were contributing heavily to local water impairment. Officials seemed to feel that these impairments would be relatively easy to remedy through issuance of new NPDES permits and through stricter enforcement against the facilities. In addition, urban areas often were targeted as a relatively easy place for initial best management practices and vegetation restoration to minimize runoff.

For example, the Boulder Creek Enhancement Project in Boulder, Colorado, illustrates how a pre-TMDL implementation plan promoted livability in an urban area and was consistent with potential future infill development or redevelopment.[106] The plan

included renewing the city's NPDES permit for its wastewater treatment plant — a 17-year-old facility operating at nearly 80 percent capacity. The implementation plan combined these treatment plant upgrades with the restoration of the creek banks and streamside vegetation, which had been largely destroyed in the course of years of urban development. The estimated cost of the riparian improvements was less than the treatment plant upgrades alone, and improving the physical condition of the stream made it more appealing to the community for potential use as a city park. In effect, the priority setting approach for TMDLs dovetailed with a smart growth agenda.

INTEGRATING TMDLS WITH LAND USE PLANNING

Because TMDLs have been developed on only a small set of waters, as yet there is no basis on which to project the extent of the program's likely effect on land use decisions. However, a wealth of evidence indicates that land use decisions affect water quality and therefore can have a significant role in the development and implementation of TMDLs.

Growth affects water quality by increasing the percentage of impervious surface, destroying natural buffers, adding to the volume of stormwater runoff from construction sites, and increasing the use of the existing sewer infrastructure, including septic systems. Therefore, the preservation of water quality is a core driver of smart growth. For example, the states of Maryland, Virginia, and Pennsylvania are working to protect the Chesapeake Bay by concentrating development in suitable areas; protecting sensitive areas; directing growth to existing population centers; and reducing resource consumption throughout the region.[107]

By setting specific numerical limits on how much of a pollutant can be in the waters, the TMDL process brings all of the sources of pollution to the table to discuss water quality management. Although the TMDL requirement only affects those water segments that a state lists as impaired, many areas are choosing to carry out TMDLs or a TMDL-like process for an entire tributary or watershed. This process and the need for specific load allocations among polluters sets the stage for the integration of water quality management with land use planning.

In a rapidly suburbanizing area, TMDLs will need to consider allocations for agriculture, forestry, urban stormwater, sewage treatment, and other sources. TMDL implementation forces an integrated approach to the many different types of water pollution that result from human land development patterns. Because of their focus on

water quality and the need to include all types of discharges in solving the problem of water quality impairment, TMDLs may affect land use patterns in the future. At the least, they provide a framework for states and localities to rethink their land use choices and begin to coordinate land use planning and water quality management.

TMDLs can provide a meaningful intersection for state agencies and laws, including forestry, agriculture, planning, and water quality. For example, the Oregon Department of Environmental Quality (DEQ) has entered into memoranda of agreement with the Oregon Department of Agriculture and the Oregon Department of Forestry, specifying each agency's role in the TMDL process. DEQ has issued guidance on the elements necessary in a watershed plan if it also is to serve as a TMDL for nonpoint sources.[108] The TMDL process can — and is likely to — become the superstructure for integrating natural resources, water quality, and land use concerns.

In Oregon, the statewide comprehensive land use planning program further supports nonpoint source pollution controls (required by TMDLs) by providing a framework in which local jurisdictions can implement enforceable mechanisms related to development. Passed in 1973, Oregon's planning law requires municipal, county, and regional governments to develop local land use plans and to comply with 19 statewide planning goals. Plans are updated on an ongoing basis through a process known as periodic review.

This statewide planning process authorizes local ordinances governing land uses that affect watershed functions and aquatic habitat. The Tualatin Basin near Portland, Oregon, is an excellent example of land use planning to address water quality issues. (See Tualatin Basin box.) There, the combination of a history of water pollution issues, some uniquely powerful regional government agencies, and the political sensibilities of the Portland metropolitan area has resulted in numerous ongoing planning and regulatory efforts. Similarly, Georgia has begun to integrate water quality protection and land use planning in order to serve both water quality and quality of life goals. Under state law, protection of river corridors and other critical natural resources is to be accomplished through comprehensive planning at the local level. Localities in Georgia must develop comprehensive plans if they wish to receive and maintain the status of "qualified local government" that allows them to participate in certain state financial assistance programs.[109] These plans must contain the minimum environmental criteria set out by the Georgia Environmental Protection Division to protect large rivers from the impacts of human activities on land immediately adjacent to the

TUALATIN BASIN, OREGON: LAND USE PLANNING AND THE TMDL PROCESS

The Tualatin Basin near Portland, Oregon is an excellent example of land use planning being employed to address water quality issues. There, the combination of a history of water pollution issues, some uniquely powerful regional government agencies, and the political sensibilities of the Portland metropolitan area has resulted in a number of ongoing planning and regulatory efforts. State and local government officials, as well as non-government organizations working in the basin, cited these as relevant to nonpoint source control and an essential component of addressing TMDL concerns.

The Portland metropolitan area has a regional planning organization known as Metro that handles comprehensive land use planning for the entire region, composed of three counties and 24 cities and including part of the Tualatin Basin. More than a simple council of governments, Metro is the only directly elected regional government in the country. By law, once Metro adopts a policy at the regional level, its constituent local governments must amend their comprehensive land use plans to comply. Although Metro has the legal authority to compel local compliance, enforcement more typically is through fiscal measures, such as withholding regional transportation funding from the noncomplying jurisdiction.

In 1993, Metro began work on "Region 2040," a growth concept for the Portland metropolitan region, predicated on holding the urban growth boundary steady and protecting the natural resources within it. Metro projected growth trends and needs, removed 16,000 acres from the "buildable lands" category within the growth boundary, and concluded that there was no need to move the boundary (although it recently has been extended by 5,000 acres, amid much controversy). The 16,000 acres removed included all floodplains, wetlands, stream corridors, and slopes with a grade of more than 25 percent. In addition to this regulatory move, Metro inaugurated an Urban Green Spaces Program to acquire streamside habitat land through a nonregulatory, acquisition-based approach.

More recently, Metro adopted Title 3, a set of regulations on floodplain and water quality management in urban riparian areas that is designed to implement statewide planning Goal 6, to protect air, water, and land resources, and Goal 7, to reduce natural hazards and protect floodplains. Title 3 mandates regionwide erosion controls for all new developments, regardless of size; requires every local government to adopt vegetative corridors for stream segments within its jurisdiction; and improves the management of the 100-year floodplain. The regulations include a model local ordinance that already has been adopted and become enforceable in many of Metro's constituent communities. The formal deadline for Title 3 compliance was December 1999.

Both regulators and environmental organizations agree that the next major challenge for the urban portion of the Tualatin Basin will be the control of stormwater discharges and reduction of impervious surfaces. In dealing with stormwater issues, Metro can use the

continued on next page

Unified Sewerage Agency (USA), a regional service district that covers Portland, the urban areas of Washington County, and portions of Multnomah and Clackamas Counties. Formed about 30 years ago to deal with the sanitary waste problem in the watershed, USA was authorized to deal with stormwater following the TMDL suit filed in the late 1980s.

Metro has asked USA to assist with implementation of Goal 6 water quality standards through Title 3. Individual cities also have asked USA to help them meet the requirements, since Title 3 is modeled in part on USA's model municipal ordinance package that requires certain buffer widths. USA is willing to help but concerned about being perceived as another land use regulatory agency. In effect, however, land use and TMDL decisions are closely intertwined in a smart growth agenda.

Sources: *Putting the Pieces Together: State Nonpoint Source Enforceable Mechanisms in Context* (Environmental Law Institute Research Report, June 2000).

river.[110] At the same time, each local government with a protected river is directed to adopt a river corridor protection plan and ordinance that meets minimum planning standards.[111] Although this system is not currently integrated with the TMDL process, it could be used in the future to assist in both TMDL development and implementation on these urban waterways. (See Georgia box.)

The urban stormwater program may be strengthened by the TMDL program. This could lead to greater opportunities for smart growth in redevelopment, and for better siting of new development. Clean Water Act rules prohibit new or expanded NPDES discharges to impaired waters in violation of water quality standards.[112] Because of this prohibition, point source dischargers such as wastewater treatment plants are concerned about the potential effect of TMDLs on their operations. They will need to ensure that their ability to expand and upgrade is not impeded by poor development practices elsewhere in the watershed.

At the same time, the numerical load allocations required by the TMDL process may strengthen the stormwater permit program, potentially inducing municipalities (MS4 operators) to look more closely at the siting of development in addition to enforcing the site-by-site best management practices (BMPs) that typically are applied under the current system. For example, in California's Santa Ana region, a TMDL development process addresses nutrient and sediment pollution. The watershed is rapidly changing, with urban uses expanding from 48 percent of the area in 1983 to more than 64 percent only a decade later, and a concomitant decline in agricultural uses. The sediment TMDL currently assumes urban and construction areas of the water-

GEORGIA:
CONNECTING FUTURE GROWTH TO WATERSHED ANALYSIS

A 1997 consent decree started the TMDL identification and implementation process in Georgia. The decree established a process for TMDL development across the entire state using a basin approach. The process is intended to ensure that the streams and rivers in particular basins are examined together, in the context of common development and decisionmaking concerns. Georgia submitted to EPA its most recent list of waters under section 303(d) on March 2, 2000.

In part anticipating the coming TMDL process, Georgia adopted a policy that requires any locality asking the state for an environmental permit that facilitates growth and development, such as a wastewater permit or a water withdrawal permit, to conduct a watershed assessment. Although these assessments are not part of the formal TMDL process, they share some of its characteristics. In addition, under CWA, states may not issue a NPDES permit to a new source or new discharger if the discharge from its construction or operation will cause or contribute to the violation of water quality standards. This provision is specifically related to pollutant load allocations on waters.

Thirty growth-related watershed assessments currently are underway in Georgia, creating an additional pool of information about point and nonpoint sources of water pollution. Under the watershed assessment guidelines, the permit applicant must identify the point and nonpoint sources of water pollution affecting the watershed, carry out predictive modeling and land use scenarios based on future growth, and propose solutions to address current and future water quality problems. The watershed assessment must be carried out for the entire service area covered by the local authority.

The assessment includes gathering existing information about a watershed and its point and nonpoint pollution sources for use in evaluating current and predicted water quality problems and recommending short- and long-term solutions, including a list of corrective actions. The local government can use this information to develop a watershed protection plan, parts of which will be incorporated into a NPDES discharge permit or other enforceable program. The assessment will provide a key source of information for use in the TMDL basin approach, which then can establish additional requirements applicable to nonpoint source and point source dischargers.

Sources: *Putting the Pieces Together: State Nonpoint Source Enforceable Mechanisms in Context* (Environmental Law Institute Research Report, June 2000). Georgia Department of Natural Resources letter of March 2, 2000 to Ms. Beverly Banister, Water Management Division, USEPA. Planning for Domestic Wastewater Systems, Georgia Department of Natural Resources, Environmental Protection Division (February 1999). Georgia Department of Natural Resources, Environmental Protection Division Guidelines for Watershed Assessments for Domestic Water Systems, Rev. 2/24/99.

In the analysis for the allowance for future loading, EPA could call on states and localities to examine the water quality effects of potential development in a particular watershed or region.

shed will be covered by stormwater permits and establishes wasteload allocations. However, land use planners recently have become more involved in the TMDL implementation process. They realize that land use planning solutions will be needed to achieve the sediment reductions called for by the TMDL.[113]

OPPORTUNITIES

Many of the opportunities to integrate TMDL development with smart growth strategies fall to state and local governments because they bear primary responsibility for land use planning. Moreover, the high level of controversy over federal TMDL regulations may inhibit federal efforts to overtly influence the already sensitive area of growth management. Nevertheless, EPA could encourage state and local consideration of land use impacts on water quality through the allowance for future loading and the determination of TMDL priorities.

The adoption of some growth management measures may reduce the increment allotted for future loadings in the TMDL and thus allow for less stringent allocation targets for dischargers. In the analysis for the allowance for future loading, EPA could call on states and localities to examine the water quality effects of potential development in a particular watershed or region. This information would enable the community to invest its resources wisely as pollutant loads are being allocated among present and future users.

EPA also could strongly encourage states to consider the redevelopment potential of TMDL areas when determining which will receive the highest priority. The TMDL regulations provide guidelines on how to prioritize the waters slated for TMDL development, accounting for many factors including the historical, cultural, economic and aesthetic uses of the water body. This priority ranking could give preference to developing TMDLs where they can serve a locally oriented smart growth agenda while improving water quality.

findings and recommendations

The Clean Water Act influences land use patterns and land use patterns influence the implementation of the Clean Water Act. The Act's programs have the potential to promote revitalization and development of areas with existing infrastructure. The Clean Water Act offers opportunities to help promote and reinforce sustainable use of land in the stormwater management program, the CSO/SSO program, and the TMDL development and implementation process. Yet clean water programs will not necessarily promote smart growth unless federal, state, and local governments grasp opportunities to integrate water quality and smart growth goals. Some jurisdictions already have done so, resulting in efficiencies and environmental benefits.

Water quality has received relatively minor consideration in most development and planning decisions compared with road construction, tax liabilities and incentives, government subsidies, land costs, and political issues. Obligations or costs associated with water quality regulation are not a primary motivator for private developers, local governments, or states in their decisions about how, where, and what to build. Nevertheless, water quality programs have an increasing effect at the margin. As the TMDL program begins to give greater force to the urban stormwater permitting program and requires allocations for future growth, the Clean Water Act will exert greater influence over land use decisions. The strategies and techniques for improving water quality and fostering smart growth can be mutually reinforcing.

STORMWATER PERMIT PROGRAM

Findings

The municipal separate storm sewer system (MS4) and construction stormwater programs offer some opportunities to promote smart growth, infill development, and green infrastructure. Design techniques and local land use regulations that are intended to improve stormwater management can and do serve smart growth goals.

These techniques include the reduction of impervious surfaces, the preservation of open space, and the protection of watersheds and stream corridors.

Currently, the stormwater permit program's relationship with development is largely site-specific and technical. The program typically causes new construction sites to install best management practices to avoid runoff and erosion, and marginally increases municipal stormwater management expenditures. It has minimal influence on the location or pace of new development. However, stormwater design and financing techniques can encourage urban revitalization efforts by focusing on streamside restoration and the creation of green space to make urban areas more attractive. These techniques also can influence the design of new developments in ways that are more consistent with smart growth principles.

The stormwater program does not stimulate sprawl. The Phase 1 MS4 program increases operations and maintenance costs for some urban areas, but not to a degree that appears to disadvantage such areas in comparison with new development on the exurban fringe. The Phase 2 MS4 program provides so much flexibility and so few minimum requirements that it too does not appear likely to promote a preference for development outside of the urbanized areas subject to the program. The construction stormwater programs under both phases regulate construction sites inside and outside urbanized areas, and thus avoid creating a perverse incentive to construct in exurban areas to avoid regulation.

The following approaches can help the stormwater permitting program support smart growth, while also ensuring that smart growth helps to reduce stormwater pollution problems.

State, Regional, and Local Recommendations

Regional Coordination. Local governments could use stormwater management as a springboard for regional cooperation, facilitating both water quality improvements and smart growth. Regional programs have integrated multiple jurisdictions under general stormwater permit applications, providing efficiencies in planning and management while creating a forum for discussion of regional development issues. Moreover, state and local programs could use the new data and projections generated under the separate storm sewer regulations to more closely link stormwater controls to land use planning and development.

Smart Growth Incentives. States, as well as EPA, could create incentives for fostering smart growth that reduces stormwater impacts. For example, states and EPA could offer municipalities relief from some stormwater control measures where they improve stormwater management on a watershed basis through smart growth measures, such as transferable development rights and compact, mixed use development.

Revised Development Regulations. State and local governments could revise their land use ordinances, building codes, minimum facilities requirements, and stormwater ordinances to limit or eliminate the requirements for wide areas of impervious surfaces, including driveways, roads, and gutters, that typify exurban sprawl development. These ordinances often contribute to both more sprawl and increased stormwater problems.

States, as well as EPA, could create incentives for fostering smart growth that reduces stormwater impacts, including offering municipalities relief from some stormwater control measures where they improve stormwater management through smart growth measures.

Resource Protection Zoning. Resource protection zoning restricts incompatible land uses or limits the scale of development to prevent threats to water quality. Such zones typically include stream buffers, limits on building on steep slopes, and restricted building in or around wetlands and groundwater recharge areas. State and local ordinances could adopt resource protection zoning that uses smart growth techniques compatible with technical recommendations for improving stormwater management, including cluster development, conservation development, and related designs that site structures closer together on a smaller portion of the tract. These approaches preserve more open space, separate impervious surfaces from natural water ways, and reduce the total impervious surface.

Integrating Stormwater Management with Site Reuse. State and local programs could incorporate stormwater controls into brownfield site redevelopment and urban retrofit programs to combine smart growth goals with water quality goals. These programs could ensure that the redeveloped urban area actually reduced the amount of runoff, even at a higher density and occupancy.

Linking Stormwater Fees to the Size of Impervious Surfaces. Several hundred U.S. stormwater utilities derive funding for stormwater management from a system of user fees that directly links stormwater controls to development choices. These systems could assess fees based on the amount of impervious surface on a property and provide discounts for properties where stormwater is managed effectively on site. Such fee-based incentives provide opportunities for smart growth, encourage construction at appropriate densities, and avoid creating unnecessary impervious surfaces.

Technical Assistance. Communities that promote compact, mixed use, and infill development need to pay special attention to design and the use of best management practices to ensure that increased density does not mean larger amounts of impervious surfaces. They also could benefit from reducing the generation of stormwater runoff instead of simply collecting it in catchbasins and other hard infrastructure once it occurs. States and EPA could provide funding and technical support for aging urban areas to reduce their level of impervious surfaces and change their infrastructure to comply with best management practices for stormwater runoff — especially through addition of greenways, infiltration areas, and other green infrastructure. In addition, state and local programs could use the new data and projections to be provided under the municipal separate storm sewer regulations to more closely link stormwater controls to growth and development controls.

Federal Recommendations

EPA Flexibility. EPA could support state and local governments in efforts to address the location of development as well as management of stormwater site-by-site. The absence of numerical limits in stormwater permits and the lack of explicit links to water quality objectives in stormwater permits may lead to a missed opportunity to address the location of development. EPA should not discourage states and localities from pursuing such an approach if states and localities choose to make these links. It is not enough for stormwater regulation to treat each development as a given and simply promote better practices within each development.

Infill as a Best Management Practice. An unresolved issue under stormwater management programs is whether compact infill development itself can be a best management practice (BMP). Infill development can lower the volume of stormwater runoff in a watershed by reducing the total area of land covered by impervious surfaces such as roads, sidewalks, and buildings. It can enable communities to preserve

larger areas of open space, and can help reuse areas that are already covered with impervious surfaces. EPA could designate infill development as a BMP and/or work with state permitting authorities to determine the criteria under which such development could qualify as a BMP.

Brownfield Incentives. The reuse of brownfield sites can improve stormwater control by increasing the integrity of the new impervious surfaces and replacing some existing impervious surfaces with landscaping and buffer areas. However, state and local programs need to incorporate stormwater controls into brownfield redevelopment in order to assure that the redevelopment actually reduces the amount and speed of runoff. EPA could encourage redevelopment of brownfields and other urban sites to help manage stormwater and promote stormwater management as a goal of its grant programs.

State and local programs need to incorporate stormwater controls into brownfield redevelopment in order to assure that the redevelopment actually reduces the amount and speed of runoff.

Funding and Technical Support. Federal funding and technical support to aging urban communities could help them reduce the amount of impervious surface and improve their infrastructure to comply with best management practices for stormwater runoff — especially through the addition of greenways, infiltration areas, and other green infrastructure. EPA also could assist municipalities in designing and using best management practices to ensure that smart growth measures, such as compact and mixed use development, minimize impervious surfaces and prevent, rather than simply collect, stormwater runoff.

Road Siting. The Phase 2 regulations do not explicitly link road siting with water quality objectives, even though roads contribute substantially to stormwater runoff from paved surfaces and can induce development and additional paving on private lands adjacent to and surrounding the roads. The current approaches do not integrate analysis of the sprawl-inducing effects of road location with stormwater implications. The stormwater permit program could incorporate consideration of the direct impacts of runoff from roads and the indirect impacts of additional runoff from their potential attendant development. Federal, state, and local transportation planning also could link road siting decisions with water quality.

COMBINED SEWER OVERFLOW AND SANITARY SEWER OVERFLOW PROGRAMS

Findings

The relationship of CSO/SSO rehabilitation with development is largely financial. In theory, the high cost of CSO/SSO repairs in aging neighborhoods might discourage investments in those neighborhoods and push development to outlying areas with no CSO/SSO liability. In practice, in many cities sprawl already was well advanced before CSO/SSO repairs caused fees and taxes to rise. Moreover, in places where CSO/SSO repairs are coupled with waterfront revitalization and riparian restoration, they have made core urban areas more attractive to redevelopment and infill.

Some approaches to CSO and SSO rehabilitation may reinforce opportunities for smart growth and urban infill development while others do not. For example, watershed- and sewershed-based approaches may help promote intermunicipal cooperation in land use planning and infrastructure funding that can support smart growth as they correct wet weather flows. Conversely, enforcement focused on a single municipality at a time may result in more expensive solutions that offer few municipal redevelopment opportunities.

The examination of the CSO/SSO programs reveals several opportunities to leverage the CSO/SSO programs to support smart growth, while also ensuring that smart growth efforts reduce sewer related water pollution problems.

State, Regional, and Local Recommendations

Linking CSO/SSO Rehabilitation with Waterfront Restoration. Expenditures to correct CSO/SSO problems could be used to target priority areas and revive urban economic vitality, especially in cities that are restoring waterfronts as part of downtown revitalization efforts. CSO/SSO repairs and restructuring in urban areas can incorporate riparian restoration and riverfront revitalization. By reviving urban waterfronts and strengthening the urban core, CSO/SSO investments could make further residential and commercial development possible, and thus reinforce the rate base and tax base for urban infrastructure. These investments also could energize active community interest in rehabilitating the CSO and improving water quality, waterfront areas, and urban green space. State and local programs could incorporate CSO/SSO improvements into established, ongoing urban revitalization efforts.

State Revolving Loan Fund Priority. The rehabilitation of urban CSO/SSOs provides an opportunity for large-scale water quality improvements and urban revitalization. In recognition of these water quality and development benefits, states could develop criteria to favor funding the rehabilitation of large-scale urban CSO/SSOs over the replacement of on-lot systems with new sewer systems.

Linking Planning and Permitting. The municipalities of a region could draw urban service boundaries to direct growth and provide economic incentives for sustainable land use. In addition, state and local programs could link permits for new sewer system connections to the system's capacity to handle the extra load created by future development. They also could consider permits for sewer treatment plant expansion in the context of watershed assessments and land use planning. Local programs could share resources to regionally fund planning, the purchase of development rights, housing and human services, and recreational and cultural facilities.

Regional, watershed-based strategies could help target expenditures to cost-effectively control CSOs and eliminate SSOs. By addressing these issues on a watershed basis, these efforts could promote integrated planning while cutting costs.

Watershed-Based Strategies. Regional, watershed-based strategies could help target expenditures to cost-effectively control CSOs and eliminate SSOs. By addressing these issues on a watershed basis, these efforts could promote integrated planning while cutting costs. State and local programs could integrate smart growth techniques with sewer system management, using the expiration of existing intermunicipal service agreements to incorporate regional growth and land use planning priorities into the new agreements. State and local programs could link permits for sewer treatment plant expansions to watershed assessments and land use planning.

Federal Recommendations

Promoting Regional Cooperation. The potential for federal enforcement can spur municipalities to initiate regional cooperation. EPA could use permitting and enforcement approaches and incentives that support collaboration among local governments in a common growth and service area, especially on a watershed basis. EPA

could promote regional and watershed solutions to sewer problems while meeting enforcement and compliance objectives.

Supplemental Environmental Projects. EPA could further support development of supplemental environmental projects, which are common in CSO case settlements. These projects advance local smart growth approaches that in turn energize active community interest in the CSO project, improve water quality, and revitalize waterfront areas and urban green space.

Directing Funding to Avoid Sprawl. EPA enforcement may encourage sprawl if it leads to high utility rates that make older urban communities substantially less competitive with outlying communities in the same region. To avoid discouraging infill development, which can offer important water quality benefits, federal funding may be needed to support CSO/SSO repairs and restructuring in some, but not all, urban areas. Funding could be targeted to areas with an inadequate urban rate base, where state revolving loan funds cannot sufficiently buy down rates to prevent a steep rate differential in comparison with sprawl areas. To ameliorate this differential between urban and exurban areas, criteria could be developed to target some federal funding or state revolving funds to these disadvantaged areas.

TOTAL MAXIMUM DAILY LOAD PROGRAM

Findings

TMDLs present a significant opportunity to integrate planning for land uses across a watershed both spatially and temporally. Smart growth techniques can facilitate TMDL development and the long-term implementation of TMDL load allocations and wasteload allocations by better controlling stormwater discharges, reducing the quantity and peak flow of stormwater, and retaining more land in open space and buffers. Moreover, allocations for future growth provide a mechanism to evaluate the patterns of development that will protect water quality and those that will not.

The TMDL process of allocating the numerical limits for pollutants around a water segment encourages coordination among the many different sources such as industrial facilities, farms, and municipalities. Once in place, a TMDL can lead to collaboration among land use planning and water quality management authorities to ensure that future development does not jeopardize compliance with the TMDL requirements.

Because smart growth requires attention to rural and open space land uses as much as to development, TMDL development for exurban watersheds and watersheds that straddle the urban/rural interface provides opportunities to examine development decisions in the context of a set of regional impacts. The following techniques can leverage smart growth strategies to enhance TMDLs and use the TMDL process to promote smart growth.

State, Regional, and Local Recommendations

Incorporating Growth Management in Allowance for Future Loadings. In developing TMDLs, the adoption of some growth management measures may reduce the increment allotted for future loadings and thus allow for less stringent allocation targets for dischargers. By examining the water quality effects of potential development in a particular watershed or region, states and municipalities could create an opportunity to invest community resources wisely as pollutant loads were being allocated among present and future users. The TMDL process should involve the whole set of land users, so decisions about existing land uses can be made in the context of their likely evolution and development.

Considering Redevelopment Potential in Determining TMDL Priorities. The July 2000 TMDL regulations provide guidelines on factors to consider in assigning priority to the waters slated for TMDL development, accounting for many historical, cultural, economic, and aesthetic uses of the water body. This priority ranking, at the discretion of the states and EPA, affords an opportunity for regulators to promote priority schemes that give preference to developing TMDLs that will serve a locally oriented smart growth agenda while improving water quality.

Linking TMDL Allocations with Development Approvals. States and localities could connect permits that facilitate growth and development, such as wastewater facility expansion permits, site plan approvals, or water withdrawal permits, to the TMDL process in impaired watersheds. Before a permit can be granted, applicants and government agencies should analyze how that permit will affect the TMDL allocation and implementation. In effect, the numerical load allocations required by the TMDL process may well strengthen other permit programs and enable them to incorporate smart growth techniques designed to improve water quality.

Promoting Conservation Development Techniques. States could encourage incorporation of river corridor protection criteria, buffers, best management practices,

EPA, working with states, could explicitly recognize smart growth techniques as providing reasonable assurances sufficient to satisfy allocations for future growth.

operating standards, and other water quality requirements into local ordinances. Tying additional state funding to adoption of such local ordinances could promote use of these tools and serve TMDL implementation needs at the same time.

Federal Recommendations

Incorporating Growth Management in Allowance for Future Loadings. EPA, working with states, could explicitly recognize smart growth techniques as providing reasonable assurances sufficient to satisfy allocations for future growth or to reduce the margin of safety needed to account for uncertainty. Some smart growth techniques have substantial and predictable effects on water quality.

Considering Redevelopment Potential in Approving TMDL Priorities. EPA could strongly encourage states to consider prioritizing waterways where infill, redevelopment, and other smart growth techniques are in place or can be put into place relatively quickly. The prioritization of these areas may provide a basis for greater certainty in the development community and thus contribute to more likely investments in these areas.

endnotes

1 Smart Growth Network, Statement of Principles (1999). See also National Governors' Association, Resolution 13 "Principles for Better Land Use" (1999).

2 33 U.S.C. § 1342(p).

3 33 U.S.C. § 1342(p)(3)(B).

4 *Defenders of Wildlife v. Browner*, F. 3d (9th Cir. 1999).

5 40 CFR 122.26(d)(1)(iii)(B)(2).

6 40 CFR 122.26(d)(2)(iv).

7 See EPA, Guidance Manual for the Preparation of Part 2 of the NPDES Permit Applications for Discharges from Municipal Separate Storm Sewer Systems, EPA 833-B-92-002 (Nov. 1992). In addition to using its own planning and zoning and other regulatory authorities to control discharges into MS4s, any operator of an MS4 may petition the state permitting program (or EPA if EPA is the permitting authority) to require a separate NPDES permit for any discharge into the municipal separate storm sewer system. 40 CFR 122.26(f)(1).

8 40 CFR 122.26(d)(2)(iv)(A)(2).

9 40 CFR 122.26(d)(2)(iv)(D).

10 40 CFR 122.26(d)(2)(iv)(A)(3).

11 63 Fed. Reg. 7858 (Feb. 17, 1998).

12 EPA, Reducing Polluted Runoff: The Storm Water Phase II Rule, EPA-833-F-99-020 (October 1999). If an unincorporated township or county includes an MS4 that serves both urbanized and nonurbanized areas, however, only the urbanized area would be automatically subject to regulation.

13 64 Fed. Reg. at 68752.

14 40 CFR 122.32(d)(2000).

15 40 CFR 122.32(e)(2000).

16 EPA "recommends" general permits, and further recommends that general permits be issued on a watershed basis. 64 Fed. Reg. at 68737.

17 40 CFR 122.35(d)(3) (2000).

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19 64 Fed. Reg. at 68753.

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24 U.S. EPA Office of Water, Fact Sheet 2.0 "Storm Water Phase II Proposed Rule: Small MS4 Storm Water Program Overview," EPA 833-F-99-002 (April 1999).

25 64 Fed. Reg. at 68769.

26 Id.

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28 63 Fed. Reg. at 1565.

29 64 Fed. Reg. at 68741-42.

30 40 CFR 122.26(b)(15) (2000).

31 64 Fed. Reg. at 68777.

32 40 CFR 122.26(b)(15) (2000).

33 63 Fed. Reg. 1585.

34 64 Fed. Reg. 68847 (Dec. 8, 1999).

35 40 CFR 122.26(g) (2000).

36 Concern that this new exemption might lead to undesirable increases in the quantity of impervious surfaces resulted in EPA requiring that the checklist have an informational inquiry: "Have you paved or roofed over a large, formerly exposed, pervious area in order to qualify for no-exposure? Please indicate approximately how much area was paved or roofed over." 64 Fed. Reg. at 68808.

37 Adverse affects may be experienced at watershed imperviousness of 5 percent, and are frequent at imperviousness of 25 percent or more. See studies cited at 64 Fed. Reg. at 68725 (Dec. 8, 1999).

38 Nancy Schultz, "Experiences With Urban Stream Quality Management," Paper for Presentation at Urban Wet Weather Pollution Reduction Conference (July 1, 1998). Schultz identifies zoning, building code, and drainage requirements as (1) increasing concentration of development, (2) building impervious surfaces, (3) constructing sewers hastening speed and volume of stormwater discharges, and (4) leading to more stream "improvements" such as channelization and streambank armoring that further worsen water quality and habitat.

39 Thomas R. Schueler and Richard A. Claytor, Jr., "Better Site Design: Changing Development Rules to Protect the Environment," Land Development (Spring-Summer 1999), pp. 16-18.

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41 Areas experiencing this kind of urban "hollowing out" with rapid construction in exurbs include Philadelphia, Atlanta, Pittsburgh, Richmond, and other cities — largely in the eastern United States.

42 64 Fed. Reg. 68779 (Dec. 8, 1999).

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45 64 Fed. Reg. at 68752.

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47 See Environmental Law Institute, *Almanac of Enforceable State Laws to Control Nonpoint Source Water Pollution* (1998).

48 See Environmental Law Institute, *Putting the Pieces Together: Nonpoint Source Enforceable Mechanisms in Context* (2000).

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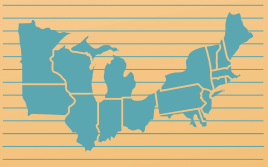

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