Permitting Green Infrastructure:

A Guide to Improving Municipal Stormwater Permits and Protecting Water Quality

American Rivers
Rivers Connect Us

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Introduction

This guide is intended to be a resource for community and watershed advocates that provides clear examples of new developments in municipal stormwater permits that foster on-site management of stormwater by encouraging or requiring that runoff be controlled through the practices commonly referred to as "low impact development" or "green infrastructure." These permits represent an emerging new generation of regulatory approaches and reflect the emerging expertise of water advocacy organizations, stormwater professionals and permitting agencies. Our goal is to provide up-to-date information about new trends in stormwater permitting and examples of permits that demonstrate leadership toward standards that will build green infrastructure and compliance with water quality standards. With this tool, we hope to inform and inspire continued progress toward stormwater permitting and management that protects our rivers and other shared waters, invigorates healthy communities, and provides cost-effective solutions for stormwater managers.

The foundation for this guide is a matrix that contains model permit language along with the legal and regulatory standards that inform them, and excerpts from comment letters that have helped to drive this evolution. Relevant portions of Municipal Separate Storm Sewer System (MS4) permits have been selected from current or draft permits to demonstrate the state of the art in stormwater permitting.

Our goal is to provide up-to-date information about new trends in stormwater permitting and examples of permits that demonstrate leadership toward standards that will build green infrastructure and compliance with water quality standards.

Stormwater permitting is often an esoteric area of practice, familiar to a specialized cadre of engineers, permit writers, program managers, regulatory agency staff, and environmental advocates. Although this guide will likely be useful for this professional community, it is primarily intended for community and watershed advocates, and other interested citizens, who are concerned about stormwater pollution and looking for ways to improve stormwater management in their communities. By providing a short history of the Clean Water Act's stormwater provisions, and the federal and state permitting programs authorized by those provisions, we hope to provide all readers with an ability to engage in improved efforts to prevent stormwater pollution.

Stormwater Permitting in the United States

Like many sources of water pollution, stormwater generally falls under the prohibitions and requirements created by the federal Clean Water Act. The degree to which stormwater is regulated by this important law, in fact, whether it's regulated at all, isn't always clear. The uncertainty stems from the early history of the Clean Water Act, which divided sources of water pollution into two categories: point sources and non-point sources. A point source is a discrete conveyance of water pollution, such as a pipe or channel. In contrast, a non-point source is any other source of water pollution where stormwater runs off of surfaces such as fields, rooftops, or road. Discharges from point sources are prohibited unless they are covered by a NPDES permit (for "National Pollutant Discharge Elimination System.") Congress originally believed that

non-point source discharges would be difficult to subject to "end of pipe" treatment methods, and exempted them from the requirement to be covered by a permit. Although stormwater from city streets, parking lots, rooftops and other hardened surfaces is often collected in storm sewer systems and discharged from pipes, the EPA in 1973 adopted narrow regulations attempting to exempt "non-point source" discharge from the NPDES program unless they were significant sources of water pollution.

The landmark case *Natural Resources Defense Council v. Costle* in 1977 forced the EPA to reverse this position, and initiate a program to bring urban runoff and several other categories of stormwater under the NPDES program. Following this decision, EPA eventually issued a series of regulations intended to address stormwater dischargers by establishing some initial permitting requirements. However, these rules suffered from various legal deficiencies and delays, failing to achieve significant reductions in stormwater pollution of the nation's waterways. Then, as now, evidence from water quality monitoring and several major studies indicated that stormwater drainage from urban areas and construction sites were leading causes of water quality impairment. Recognizing the severity of this uncontrolled source of pollution and the lack of guidance under the existing law for stormwater regulation, in 1987, Congress passed the Water Quality Act which amended the Clean Water Act to include the provisions in section 402(p) that specifically address stormwater discharges.[1]

The 1987 amendments created the basis for EPA's current program of requiring permits for stormwater discharges in specific categories: discharges from large municipal separate storm sewer systems (the genesis for the now common acronym "MS4"), discharges from medium municipal separate storm sewer systems, discharges from some (but not all) industrial operations, including construction sites larger than five acres, and any other sources which EPA identifies as contributing to a violation of a water quality standard or being a significant contributor of pollutants to waters of the United States.

Importantly, Congress clarified that stormwater discharges from municipal storm sewers are "point source" discharges, thus imposing the same two levels of pollution control that apply to other "end of pipe" pollution sources. Under this arrangement, municipal stormwater dischargers are required to comply with permit limits based on a level of technology specified by the Act. Here, the revisions to the Act in section 402(p) require MS4 discharges to be controlled by technologies that "reduce the discharge of pollutants to the maximum extent practicable." CWA §402(p)(3)(B)(iii). Unfortunately, Congress didn't define this term with any more detail, and EPA has not done so either, leaving this critical decision up to permit writers at state environmental agencies. Like other point sources, where discharges that are subject to these technology-based standards exceed local water standards, MS4 operators are also obliged to implement more stringent water quality based permit controls that are tailored to achieve compliance.

Definitions

National Pollutant Discharge Elimination System (NPDES): Authorized under the Clean Water Act, the NPDES permit program regulates point source discharges into waters of the United States.[1]

Point Source: A discrete conveyance of water pollution including but not limited to a pipe, ditch, channel, conduit, well, concentrated animal feeding operation, or ditch that discharges or that may discharge pollutants.[2]

Non-point Source: Any type of water pollution other than a point source, generally coming from diffuse sources caused by rainfall or snow melt moving over land or through the ground.[3]

Municipal Separate Storm Sewer Systems (MS4s): A conveyance or system of conveyances owned by a state, city, town, village or other public entity that discharges pollutants into waters of the United States; used or designed to collect or convey stormwater; not a combined sewer; and not part of a sewage treatment plant.[4]

[1]National Pollutant Discharge Elimination System, U.S. EPA, Available online at < http://cfpub.epa.gov/npdes/index.cfm >.
[2]What is Nonpoint Source Pollution?, U.S. EPA, Available online at < http://water.epa.gov/polwaste/nps/whatis.cfm>.
[3]What is Nonpoint Source Pollution?, U.S. EPA, Available online at < http://water.epa.gov/polwaste/nps/whatis.cfm>.
[4]Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s), U.S. EPA, Available online at < http://cfpub.epa.gov/npdes/stormwater/munic.cfm >.

Following the distinctions set out in the 1987 revisions to the Clean Water Act, EPA issued regulations for categories in phases, beginning with large and medium MS4s and industrial operations in 1990 with its "Phase I Rule" and then addressing small MS4s and other sources in a "Phase II Rule" in 1999.

Phase I MS4 Permits

The Phase I requirements apply to the MS4s serving urban areas with a population of 100,000 or greater, the departments of transportation serving these communities, and 11 categories of industries that typically have stormwater discharges including construction activities on sites that were five acres or larger in size. At its core, the Phase I regulations required large municipalities to develop and implement stormwater prevention plans and comply with other requirements intended to reduce stormwater discharges. Among these, and most relevant to this Guide, is a requirement that MS4 stormwater management plans include a component that addresses stormwater runoff at the completion of construction of new or redevelopment sites.[2]

By 2006, EPA or state agencies had issued nearly 1,000 Phase I permits. Generally, Phase I permit holders are now on their second or third permit cycle, as original permits expire and are re-issued or replaced by updated versions. While many of the initial MS4 permits simply required the permittees to implement stormwater management plans (or SWMPs), subsequent generations of permits, especially in California and other more progressive jurisdictions, have become far more specific and detailed. These jurisdictions are now incorporating provisions specifically designed to reduce stormwater discharges from new and re-development projects by imposing standards that require on-site management of precipitation.

Phase II MS4 Permits

In the "Phase II Rule", issued in 1999, EPA extended the NPDES permit requirement to smaller MS4s serving municipalities with populations of at least 50,000 or at least 10,000 where the overall density exceeds 1,000 per square mile (40 C.F.R. §122.34 et seq.) and to construction sites disturbing one acre or more. The Phase II Rule also allowed state permit agencies to extend the permitting requirements to even smaller MS4s designated by rule when it discharges to impaired waters or may cause impairments to water quality (40 C.F.R. §122.32(a)(2). Phase II affects a much broader universe of stormwater systems, and includes not just those operated by municipal governments, but also systems managed by military bases, smaller transportation departments, hospitals, prisons, and universities. The Phase II rules also extended the permit requirement, with pollution prevention BMPs, to construction sites one acre or larger in size. Like the Phase I program, Phase II regulations require MS4 operators to obtain coverage under an NPDES permit, and to implement a Stormwater Management Plan. These SWMP's must include the development and implementation of "six minimum measures" that prevent or reduce stormwater pollution to the maximum extent possible. Again, one of these minimum control measures requires that MS4 operators implement a program designed to reduce discharges from new development and redevelopment projects.

Unlike the Phase I permit program, the Phase II program is most commonly administered under a general permit, issued by EPA or a state agency, under which small MS4s can apply for coverage by filing a Notice of Intent (NOI) to comply with the terms and requirements of the general permit. As a result, while permitting agencies make some occasional effort to respond to unique local conditions, many Phase II communities are subject to boilerplate requirements reflecting baseline federal regulatory requirements. Again, most of these requirements are cast in terms of narrative best management practices, although several states have moved toward more objective standards for the management of runoff from new development and

redevelopment projects. Typically, these standards impose a requirement for a specified volume of runoff to be managed, treated, or controlled on-site.

Green Infrastructure and the Future of Municipal Stormwater Permitting

Despite decades of efforts attempting to control municipal stormwater under the Clean Water Act's programs, stormwater continues to negatively impact our nation's waters. While significant strides have been made to reduce these impacts, the current regulatory approach has proven to be generally ineffective at preventing excessive stormwater volumes and pollutants from degrading water quality around the country.

The National Research Council (NRC) conducted a comprehensive and authoritative examination of EPA's stormwater permitting and regulatory program, which it documented in a 2009 report, "Urban Stormwater Management in the United States." The NRC report identified two significant shortcomings:

- First, the stormwater permit program's over-reliance on general permits, most of which contain vague, subjective, and unenforceable permit terms and,
- Second, the relative lack of permits that require stormwater management practices that will actually reduce runoff volume rather than simply convey or detain it.

On the first point, Phase II permits in particular tend to rely on "narrative" requirements that permittees adopt programs or control measures to reduce stormwater discharges to the "maximum extent practicable." Because very few states have translated this flexible legal standard into numerical or objective permit limits, permit holders have tremendous discretion to self-identify and self-police their own stormwater control practices, including the level of control that permit holders apply to new development and redevelopment projects within their jurisdictions. In many cases, this level of control is expressed in similarly superficial terms. For example:

> *The permittee must develop, implement, and enforce a program to address stormwater runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into the MS4. The program must ensure that controls are in place that would prevent or minimize water quality impacts. The permittee must:*
>
> *1) Develop, implement, and document strategies which include the use of structural and/or non-structural BMPs appropriate for the community that address the discharge of pollutants from new development and redevelopment projects, and/or that maintain or restore hydrologic conditions at sites to minimize the discharge of pollutants and prevent in-channel impacts associated with increased imperviousness;*
>
> *2) Use an ordinance or other regulatory mechanism to address post- construction runoff from new development and redevelopment projects to the extent allowable under State or local law.*[3]

This open-ended, generalized approach to expressing permit requirements has given rise to the second shortcoming identified by the NRC panel: a long-standing preference for stormwater

management practices that are designed to control the rate of water delivered by storm sewers to local waterways. This preference for detention of stormwater volumes often does little to address the impacts of the large amounts of concentrated runoff that are created and discharged from our built environments. Equally troubling from a water quality perspective, even though on-site or regional detention basins have evolved to reduce peak flows rates following rain events, they provide only some measure of water quality treatment, doing little to significantly reduce the amount of pollutants carried by runoff from developed areas.

In response, the NRC panel affirmed the stormwater community's emerging shift towards runoff control measures that "harvest, infiltrate, and evapotranspire stormwater," and which allow a site to be developed while maintaining as much of the natural hydrology as possible. Achieved through practices that are commonly referred to as Low Impact Development (or LID) or, in the case of this report, "green infrastructure," these approaches reduce pollutants and excessive volume by using natural processes or similar approaches that capture, infiltrate, and reuse precipitation, better approximating the natural hydrologic cycle. Green infrastructure prevents stormwater from accumulating and running off developed properties by reducing impervious areas, allowing rain to infiltrate into the soil, to be taken up by plants, or captured for later use in cisterns or rain barrels. In addition to water quantity and quality gains, many of these practices provide additional benefits such as improved groundwater recharge, increased energy efficiency, and improved air quality.

Green Infrastructure

Green infrastructure practices capture and infiltrate rainwater where it falls. By replicating the natural hydrologic cycle, this approach reduces pollutants and excessive stormwater volumes.

Credit: U.S. Environmental Protection Agency

As a result, green infrastructure practices are increasingly recognized as one of the most effective solutions to the water quantity and quality problems associated with polluted stormwater runoff. Representing a dramatic departure from the "collect and convey" systems traditionally preferred by urban engineers, who for thousands of years have built systems to move rainwater away from property and neighborhoods as quickly as possible. While these curbs, gutters, tunnels and culverts served the flood control and public health needs of the past, they are now significantly challenged by the sheer volume of runoff that has been produced by the dramatic conversion of open space into paved surfaces and rooftops that dominate modern communities. Indeed, the increased volumes, discharge rates and pollutant concentrations common to these systems are now among the leading stressors of water quality in the United States.

In contrast, the green infrastructure approaches recommended by the NRC and increasingly preferred by stormwater utilities and engineers, reduce volumes, flow rates, and pollutants by managing precipitation on-site, before it has a chance to flow into storm sewers and surface waters. In doing so, these green infrastructure approaches represent a significant advance in water quality protection and an increasingly feasible solution in stormwater management technology.

EPA and State Responses to Green Infrastructure

Despite these advantages, the permits and regulations that govern stormwater management have only incrementally evolved to allow or favor green infrastructure. By a recent count, only

eighteen states have expanded their embrace of green infrastructure in municipal and construction stormwater permits. At a national level, over the last decade, EPA has supported this trend with revised permits, policy guidance and numerous technical resources designed to assist local agencies and the public with a shift toward green infrastructure approaches. For several years, EPA has taken a leadership role in promoting the use of green infrastructure to manage wet weather impacts on water quality. Through a series of policy memoranda, the Agency has encouraged state permit writers to incorporate green infrastructure-related provisions into NPDES stormwater permits, "to the maximum extent possible."[4] In the wake of the NRC research and report, EPA has emphasized the need for stormwater permits that require dischargers to take steps that reduce the volume, duration, and velocity of runoff by integrating flow or volume based restrictions into permit terms.[5] In one of a series of factsheets released in 2012, EPA highlights the important role that flow controls play in stormwater management strategies, especially for their effectiveness at protecting and restoring the physical, chemical and biological integrity of the nation's waters.[6]

Recognizing that the state of knowledge and expertise surrounding green infrastructure is continually progressing, EPA guidance stresses that "CWA NPDES permits and enforcement agreements that incorporate green or gray infrastructure solutions require enforceable performance criteria, implementation schedules, monitoring plans and protocols, progress tracking and reporting, and operation and maintenance requirements."[7] Focusing on just one of these criteria, EPA notes that NPDES permits can foster green infrastructure implementation in a number of ways, including:

- Establishing performance standards for post-construction stormwater volume control for sites undergoing development/redevelopment. Performance standards to control the volume of discharges and to mimic the pre-construction hydrology of a site will lead to implementation of BMPs and green infrastructure to infiltrate, evapotranspire, and/or harvest and beneficially use stormwater.
- Requiring that green infrastructure/low impact development measures be considered/ implemented as part of local building and site development approval processes.
- Establishing ceilings on effective impervious area.[8]

While simply requiring that green infrastructure measures be considered by permittees is a significant step forward, as a permit term this approach retains some of the weakness of a discretionary, narrative standard. Far preferable is the incorporation of an objective, readily identifiable and enforceable performance standard that can be most effectively met through green infrastructure practices. As EPA notes in its broadly phrased list, even objective standards can reflect a range of preferred approaches, expressing limits on effective impervious area, requirements to manage designated runoff or precipitation volumes on-site, or mandates to evaluate and match pre-development hydrology characteristics.

In the 2010 MS4 Permit Improvement Guide, EPA echoed its list of preferred permitting approaches with specific recommendations for state permit writers.[9] The Guide details the Agency's own selection of model performance standards that would add objectivity to post-construction stormwater management permit requirements by pulling language from permits, related documents, or EPA guidance

Green street in Portland, Oregon.

Credit: U.S. Environmental Protection Agency

that reflected then current best thinking about prescriptions for on-site management.[10]

Following the trend set in EPA's Permit Improvement Guide, the permits described here generally follow the same approaches outlined above – setting objective performance standards for on-site stormwater management, explicitly calling for green infrastructure practices, or, less frequently, establishing limits on the effective impervious area created by development projects. We will provide examples from each category, illustrating the differences that individual states have taken to respond to local concerns, capacities, and water quality drivers. Not surprisingly, there has been innovation and evolution in MS4 permits since EPA published its Guide, which is reflected in these selections from current and draft permits.

The permits described here set objective performance standards for on-site stormwater management, explicitly call for green infrastructure practices, or, less frequently, establish limits on the effective impervious area created by development projects.

Numerous state agencies have also responded to the emerging acceptance of green infrastructure's water quality and economic benefits by drafting stormwater permits that reflect EPA's encouragement and concerns. Importantly for the purposes of this guide, the maturation of green infrastructure and its embrace by EPA and state regulatory agencies demonstrates that adoption of these management approaches is increasingly practicable at municipal and individual project scales. As a result of citizen advocacy and litigation or the leadership of state permitting agencies, green infrastructure requirements or standards are increasingly featured as post-construction performance requirements in MS4 permits and state stormwater technical manuals. This emerging generation of state and federal stormwater NPDES permits now more fully reflects the "maximum extent practicable" level of technology required by the Clean Water Act.

Green Infrastructure Technical Resources:

- The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Environmental, and Social Benefits, Available online at www.cnt.org/repository/gi-values-guide.pdf
- Green Values National Stormwater Management Calculator, Available online at greenvalues.cnt.org/national/calculator.php
- PA's Municipal Handbook: Funding Options, Available online at water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_funding.pdf
- EPA's Municipal Handbook: Incentive Options, Available online at water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_incentives.pdf
- Green Streets, EPA's Municipal Handbook: Managing Wet Weather with Green Infrastructure, Available online at water.epa.gov/infrastructure/greeninfrastructure/upload/gi_munichandbook_green_streets.pdf
- Water Quality Scorecard: Incorporating Green Infrastructure Practices at the Municipal, Neighborhood, and Site Scales, Available online at www.epa.gov/smartgrowth/pdf/2009_1208_wq_scorecard.pdf
- EPA's Stormwater Management Model (SWMM) with LID Controls, Available online at www.epa.gov/nrmrl/wswrd/wq/models/swmm

Case Studies

- National Low Impact (LID) Atlas, Available online at clear2.uconn.edu:8080/lidmap/index_original.php
- EPA Green Infrastructure Case Studies: Municipal Policies for Managing Stormwater with Green Infrastructure, Available online at www.epa.gov/owow/NPS/lid/gi_case_studies_2010.pdf

Key Concepts to Improve MS4 Permits

Ensuring that permits incorporate objective effluent limitations

By providing example language from actual MS4 permits, this guide highlights the need for each MS4 permit to contain specific, objective language detailing the permitting agencies expectations for post-construction stormwater management. This specificity is necessary to ensure compliance with, and enforceability of, MS4 permit provisions and stands in stark contrast to the practice of many states. Commonly, MS4 permits contain a narrative requirement merely mandating that MS4 permittees ensure that development projects comply with the state's stormwater technical manual.

This approach is problematic for several reasons. First, the Clean Water Act requires that "all applicable effluent limitations must be incorporated into each NPDES permit."[11] However, this is more than a paperwork exercise. Effluent limitations contained in the explicit language of an NPDES permit, include the design or performance standards that limit post-construction discharges and mark out the terms of compliance with the permit.[12] Failure to comply with these limits can expose a permit holder to enforcement actions brought by a regulatory agency or citizen; these enforcement actions may be more difficult to bring when effluent limitations are not expressed "within the four corners" of the permit but instead are located in some secondary source like a stormwater technical manual.

Additionally, the permit is the first document that permit holders look to for certainty and clarity about their responsibility. By expressing design or performance standards in the express language of the permit, permittees receive immediate notice and assurance about the level of stormwater prevention or treatment that they must provide. There is less room for misinterpretation or misunderstanding.[13] EPA has noted the importance of providing clear, objective performance standards within MS4 NPDES permits in the Permit Improvement Guide. It's the Agency's expectation that:

> *The permit writer's role is to determine what is necessary to achieve in a permit term, and to develop clear, enforceable language that conforms to these determinations. Accordingly, the permit should set forth objective standards, criteria or processes, which will aid the permittee in complying with the permit, as well as the permitting authority in determining compliance in the MS4 permit. In order for permit language to be clear, specific, measurable and enforceable, each Permit Requirement will ideally specify:*
>
> > *What needs to happen*
> > *Who needs to do it*
> > *How much they need to do*
> > *When they need to get it done*
> > *Where it is to be done*

For each Permit Requirement: "What" is usually the stormwater control measure or activity required. "Who" in most cases is implied as the permittee (although in some cases the permitting authority may need to specify who exactly will carry out the requirement if there are co-permittees). "How much" is the performance standard the permittee must meet (e.g., how many inspections). "When" is a specific time (or a set frequency) when the stormwater control

measure or activity must be completed. "Where" indicates the specific location or area (if necessary). These questions will help determine compliance with the permit requirement.[14]

While state stormwater technical manuals are incredibly important in setting out design specifics and other criteria that are tailored to local conditions and requirements, they are best thought of as tools that help the regulated community comply with the limitations expressed in their permits. All of the state and EPA issued permits in this guide are buttressed by technical manuals that evolve as stormwater technology matures, creating an effective pollution reduction and treatment package to reduce stormwater impacts.

Protecting urban waters from stormwater while encouraging smart growth

Stormwater is by its nature the unfortunate byproduct of the way we build our communities. Areas of existing development, with their impervious streets, roofs, and parking lots, are sources of permanent stormwater pollution and the cause of serious degradation of urban waters. Restoring these waters to sufficient quality to be a community asset as well as valuable habitat will require that cities and towns take active steps to reduce the runoff effects of existing impervious surfaces. This can be accomplished in several ways, including the incremental gains realized when old buildings or paved areas are redeveloped provided there are regulations or standards requiring that these projects reduce stormwater impacts from pre-project levels. For example, applying the same on-site retention performance standard that applies to new development projects could significantly reduce the volume and pollution loads in stormwater from a redevelopment project.

There have been some differences of opinion about whether applying stringent stormwater standards to redevelopment projects may create a disincentive to urban redevelopment. Advocates for "smart growth" in particular have occasionally raised concerns that increasing stormwater management costs for urban redevelopment costs may push developers to suburban areas where these management costs may be lower. A recent report conducted by ECONorthwest, an independent economics consulting firm, looked at this question, and found that the effect of stormwater regulations is far more nuanced, and far less substantial, than many fear. While there may be little evidence that definitively connects objective, on-site retention standards to redevelopment obstacles, some states have made a policy decision to create incentives for smart growth projects within their MS4 permits. In general, these incentives take the form a relaxation in the degree of performance required for on-site stormwater management. The compendium of MS4 permit examples in the following section highlights two permits that reflect this approach.

Credit: U.S. Environmental Protection Agency

Green street in Seattle, Washington

[1] For a more complete history of stormwater under the Clean Water Act and its regulations, see Waterkeeper Alliance's guide to the MS4 program, *All Stormwater is Local*, at www.waterkeeper.org/ht/a/GetDocumentAction/i/10528.
[2] See 40 CFR 122.26(d)(2)(iv)(A)(2).
[3] Excerpted from Colorado Department of **P**ublic Health and the Environment, Permit No. COR-090000, CDPS GENERAL PERMIT STORMWATER DISCHARGES ASSOCIATED WITH MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s), Feb. 8, 2008.
[4] http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_memo_protectingwaterquality.pdf

[5] http://water.epa.gov/infrastructure/greeninfrastructure/upload/EPA-Green-Infrastructure-Factsheet-4-061212-PJ.pdf
[6] Id.
[7] http://water.epa.gov/infrastructure/greeninfrastructure/upload/gi_memo_protectingwaterquality.pdf
[8] http://water.epa.gov/infrastructure/greeninfrastructure/upload/EPA-Green-Infrastructure-Factsheet-4-061212-PJ.pdf
[9] EPA, *MS4 Permit Improvement Guide*, available at http://www.epa.gov/npdes/pubs/ms4permit_improvement_guide.pdf.
[10] See EPA, *MS4 Permit Improvement Guide*, at 56-58.
[11] See *Waterkeeper Alliance, Inc. v. EPA*, 399 F.3d 486, 502 (2d Cir. 2005).
[12] 33 U.S.C. § 1362(11)
[13] See *Environmental Defense Center v. EPA,* 344 F.3d 832, 856 (9th Cir.2003).
[14] EPA, Permit Improvement Guide, at 6.

The Matrix

The remainder of this Guide is built around a comparison of several different permitting approaches to requiring or driving green infrastructure responses to stormwater discharges from new development or redevelopment projects. In terms of organization, it's intended to be a "matrix," linking each example of a permitting approach to a comment letter that addresses the some aspect of that approach. This first part of the Matrix provides excerpts from MS4 permits that reflect the categories EPA outlined in its Permit Improvement Manual:

1. Objective performance standard that control volume and mimic pre-development hydrology
2. Explicit requirements for green infrastructure measures
3. Limits or ceilings on the amount of effective impervious area

Additionally, the Matrix highlights permit language that ties specific performance standards for redevelopment projects to credits or incentives that encourage smart growth approaches. Following this first part of the Matrix, a second part links the same core permitting approaches with excerpts from comment letters written by local watershed advocates. Readers may wish to turn between to the two sections, linking their consideration of a particular permit with a comment letter that reflects a watershed advocacy position on the management approach adopted in the permit.

Part One: MS4 Permits with Green Infrastructure Components

The permits selected for inclusion in this guide demonstrate a range objective post-construction control standards. They also have either an express preference or requirement for green infrastructure practices, or set a performance standard that often will be met most effectively through these practices. The standards accomplish several permitting goals:

- They establish a current, locally relevant definition of "maximum extent practicable." While there may be local debate about how fully the standards actually reflect this statutory mandate, by expressing a performance standard in objective terms, the permit writers have removed the potential that individual MS4s or site developers will adopt a less rigorous level of stormwater reduction;

- They locate effluent limitations within "the four corners" of the MS4 permit, again limiting the potential for misunderstanding or an unduly expansive exercise of discretion by an MS4 or site developer;

- They mark out the evolving acceptance the NRC's recommendation for control measures that focus on reducing volume as a surrogate for reducing actual pollutant loads. By preventing contaminated stormwater from reaching storm sewers and local waters, and by reducing the erosive damage caused by high-volume stormwater flows, green infrastructure is likely to be more effective at restoring the integrity of our lakes, rivers, streams and coastal waters.

Objective Performance Standards

Stormwater permits have often included objective standards, usually related to the quantity (or volume) of water that had to be managed to reduce the likelihood of flooding caused by runoff from new development projects. These standards, generally speaking, related to how runoff would be managed after it had been created by rain or snow collecting on impervious surfaces. Any permit terms that were intended to "reduce stormwater to the maximum extent practicable" were typically expressed in the narrative, vague terms described above.

In recent years, there has been an emerging trend in MS4 permits that apply objective, numeric performance standards to the reduction of stormwater at its sources by specifying a volume of precipitation that must be managed on-site without discharge. This shift has significantly improved the implementation of green infrastructure as the most effective way of meeting retention standards on most site. There are a variety of approaches that state permit writers have taken to express retention standards: specifying a rain depth that must be managed (e.g., the first 1"), identifying a design storm as the management reference (e.g., runoff from a 2 year-24 hour storm), or more recently, requiring on-site management of a specified storm with a high probability of recurrence (e.g., an 85th percentile storm). This latter approach seems to have several benefits, including its flexibility as it responds to "real time" changes in precipitation patterns over the next several years, its ability to accommodate differences in precipitation across different regions of a state, and its alignment with the level of performance that federal construction projects must meet as required by section 438 of the Energy Independence and Security Act.

Many new MS4 permits combine an objective performance standard with a list of preferred or required management techniques, explicitly linking the on-site management specifications with green infrastructure practices that a project developer must use where practicable.

Permit Type: Percentile Storm Standard, Specified Green Infrastructure Practices, and Hydromodification Protections

California stormwater permits are notably the most prescriptive in the nation. The draft Phase II permit under consideration by the State Water Resources Control Board is no exception. It also reflects much of the progress seen in better, current generation MS4 permits. It incorporates an objective, numeric on-site management standard tied to the precipitation volume of an 85th percentile storm, and supplements this with additionally stringent retention or treatment requirements designed to prevent hydromodification of stream channels or provide additional pollutant removal. The draft permit notably also includes credits for "smart growth" projects, allowing them to meet more relaxed performance criteria, and extends the full performance standard requirements to road construction.

California Draft Phase II Permit (Nov 15, 2012 draft). Available at http://www.swrcb.ca.gov/water_issues/programs/stormwater/docs/phsii2012_3rd/order_final.pdf

E.12. POST CONSTRUCTION STORM WATER MANAGEMENT PROGRAM

E.12.a. Post-Construction Treatment Measures

All Permittees shall regulate development to comply with the following Sections:

- E.12.b Site Design Measures
- E.12.c. Regulated Projects
- E.12.d Source Control Measures
- E.12.e Low Impact Development (LID) Design Standards
- E.12.f Enforceable Mechanisms
- E.12.g Operation and Maintenance of Storm Water Control Measures
- E.12.h Post-Construction Storm Water Best Management Practice Condition Assessment
- E.12.i Planning and Development Review Process
- E.12.j Post-Construction Stormwater Management Requirements for Development Projects in the Central Coast Region

E.12.b. Site Design Measures

(i) **Task Description** – Within the second year of the effective of the permit, the Permittee shall require implementation of site design measures for all projects that create and/or replace (including projects with no net increase in impervious footprint) between 2,500 square feet and 5,000 square feet or more of impervious surface, including detached single family homes that create and/or replace 2,500 square feet or more of impervious surface and are not part of a larger plan of development.

(ii) **Implementation Level** -

Projects shall implement one or more of the following site design measures to reduce project site runoff:

(a) Stream Setbacks and Buffers
(b) Soil Quality Improvement and Maintenance
(c) Tree planting and preservation
(d) Rooftop and Impervious Area Disconnection
(e) Porous Pavement
(f) Green Roofs
(g) Vegetated Swales
(h) Rain Barrels and Cisterns

Project proponents shall use the River Friendly Landscaping Benefits State Water Board SMARTS Post-Construction Calculator, or equivalent to quantify the runoff reduction resulting from implementation of site design measures.

E.12.c. Regulated Projects

(i) **Task Description** – Within the second year of the effective date of the permit, the Permittee shall implement standards to effectively reduce runoff and pollutants associated with runoff from development projects as defined below:

(ii) **Implementation Level** - The Permittee shall regulate all projects that create and/or replace 5,000 square feet or more of impervious surface (Regulated Projects). The Permittee shall require these Regulated Projects to implement measures for site design, source control, runoff reduction, storm water treatment and baseline hydromodification management as defined in this Order.

Regulated projects as do not include:

(a) Detached single family home projects that are not part of a larger plan of development;

(b) Interior remodels;

(c) Routine maintenance or repair such as: exterior wall surface replacement, pavement resurfacing within the existing footprint.

Development includes new and redevelopment projects on public or private land that fall under the planning and permitting authority of a Permittee. Redevelopment is any land-disturbing activity that results in the creation, addition, or replacement of exterior impervious surface area on a site on which some past development has occurred.

(a) Where a redevelopment project results in an increase of more than 50 percent of the impervious surface of a previously existing development, runoff from the entire project, consisting of all existing, new, and/or replaced impervious surfaces, must be included to the extent feasible.

(b) Where a redevelopment project results in an increase of less than 50 percent of the impervious surface of a previously existing development, only runoff from the new and/or replaced impervious surface of the project must be included.

(c) Effective Date for Applicability of Low Impact Development Runoff Standards to Regulated Projects:

By the second year of the effective date of the permit, the Permittee shall require these Post-Construction Standards be applied on applicable new and redevelopment Regulated Projects, both private development requiring municipal permits and public projects. These include discretionary permit projects that have not been deemed complete for processing and discretionary permit projects without vesting tentative maps that have not requested and received an extension of previously granted approvals. Discretionary projects that have been deemed complete prior to the second year of the effective date of this Order are not subject to the Post-Construction Standards herein. For the Permittee's Regulated Projects, the effective date shall be the date their governing body or designee approves initiation of the project design.

(d) Road Projects - Any of the following types of road projects that create 5,000 square feet or more of newly constructed contiguous impervious surface and that are public road projects and/or fall under the building and planning authority of a Permittee shall comply with Low Impact Development Standards except that treatment of runoff of the 85th percentile that cannot be infiltrated onsite shall follow USEPA guidance regarding green infrastructure to the extent feasible. Types of projects include:

(1) Construction of new streets or roads, including sidewalks and bicycle lanes built as part of the new streets or roads.

(2) Widening of existing streets or roads with additional traffic lanes.

(i) Where the addition of traffic lanes results in an alteration of more than 50 percent of the impervious surface of an existing street or road, runoff from the entire project, consisting of all existing, new, and/or replaced impervious surfaces, must be included in the treatment system design. Where the addition of traffic lanes results in an alteration of less than 50 percent (but 5,000 square feet or more) of the impervious surface of an existing street or road, only the runoff from new and/or replaced impervious surface of the project must be included in the treatment system design.

(3) Specific exclusions are:

(a) Sidewalks built as part of new streets or roads and built to direct storm water runoff to adjacent vegetated areas.

(b) Bicycle lanes that are built as part of new streets or roads that direct storm water runoff to adjacent vegetated areas.
(c) Impervious trails built to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas, preferably away from creeks or towards the outboard side of levees.
(d) Sidewalks, bicycle lanes, or trails constructed with permeable surfaces.

. . .

E.12.e. Low Impact Development (LID) Design Standards

(i) **Task Description** – The Permittee shall require all Regulated Projects to implement low impact development (LID) standards to effectively reduce runoff, treat stormwater, and provide baseline hydromodification management to the extent feasible, to meet the "Numeric Sizing Criteria for Storm Water Retention and Treatment" under Section E.12.c.

(ii) **Implementation Level** – The Permittee shall adopt and implement requirements and standards to ensure design and construction of development projects achieve the following LID Design Standards.

(a) **Site Assessment** – At the earliest planning stages, the Permittee shall require Regulated Projects to assess and evaluate how site conditions, such as soils, vegetation, and flow paths, will influence the placement of buildings and paved surfaces. The evaluation will be used to meet the goals of capturing and treating runoff and assuring these goals are incorporated into the project design. The Permittee may adopt or reference an existing LID site assessment methodology25 such as the Low Impact Development Manual for Southern California (Low Impact Development Center – See California Stormwater Quality Association's LID website). Permittees shall require Regulated Projects to consider optimizing the site layout through the following methods:
(1) Define the development envelope and protected areas, identifying areas that are most suitable for development and areas to be left undisturbed.
(2) Concentrate development on portions of the site with less permeable soils and preserve areas that can promote infiltration.
(3) Limit overall impervious coverage of the site with paving and roofs.
(4) Set back development from creeks, wetlands, and riparian habitats.
(5) Preserve significant trees.
(6) Conform the site layout along natural landforms.
(7) Avoid excessive grading and disturbance of vegetation and soils.
(8) Replicate the site's natural drainage patterns.
(9) Detain and retain runoff throughout the site.

(b) Drainage Management Areas – The Permittee shall require each Regulated Project to provide a map or diagram dividing the developed portions of the project site into discrete Drainage Management Areas (DMAs), and to manage runoff from each DMA using Site Design Measures, Source Controls and/or Stormwater Treatment and Baseline Hydromodification Measures.

(c) Numeric Sizing Criteria for Storm Water Retention and Treatment The Permittees shall require facilities designed to evapotranspire, infiltrate, harvest/use, and biotreat storm water to meet at least one of the following hydraulic sizing design criteria:
(a) Volumetric Criteria
(1) The maximized capture storm water volume for the tributary area, on the basis of historical rainfall records, determined using the formula and

volume capture coefficients in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87 (1998) pages 175-178 (that is, approximately the 85th percentile 24-hour storm runoff event); or

(2) The volume of annual runoff required to achieve 80 percent or more capture, determined in accordance with the methodology in Section 5 of the CASQA's Stormwater Best Management Practice Handbook, New Development and Redevelopment (2003), using local rainfall data.

(b) Flow-based Criteria

(1) The flow of runoff produced from a rain event equal to at least 0.2 inches per hour intensity; or

(2) The flow of runoff produced from a rain event equal to at least 2 times the 85th percentile hourly rainfall intensity as determined from local rainfall records.

(d) Site Design Measures – as defined in E.12.b. Implementation of Site Design Measures and E.12.e(ii)(a) Site Assessment, site layout and design measures shall be based on the objective of achieving infiltration, evapotranspiration and/or harvesting/reuse of the 85th percentile 24-hour storm runoff event

(e) Source Controls – as defined in E.12.d.

(f) Storm Water Treatment Measures and Baseline Hydromodification Management Measures - After implementation of Site Design Measures, remaining runoff from impervious DMAs must be directed to one or more facilities designed to infiltrate, evapotranspire, and/or biotreat the amount of runoff specified in Section E.12.ii.c (Numeric Sizing Criteria for Storm Water Retention and Treatment). The facilities must be demonstrated to be at least as effective as a bioretention system with the following design parameters

(1) Maximum surface loading rate of 5 inches per hour, based on the flow rates calculated. A sizing factor of 4% of tributary impervious area may be used.

(2) Minimum surface reservoir volume equal to surface area times a depth of 6 inches.

(3) Minimum planting medium depth of 18 inches. The planting medium must sustain a minimum infiltration rate of 5 inches per hour throughout the life of the project and must maximize runoff retention and pollutant removal. A mixture of sand (60%-70%) meeting the specifications of American Society for Testing and Materials (ASTM) C33 and compost (30%-40%) may be used.

(4) Subsurface drainage/storage (gravel) layer with an area equal to the surface area and having a minimum depth of 12 inches.

(5) Underdrain with discharge elevation at top of gravel layer.

(6) No compaction of soils beneath the facility, or ripping/loosening of soils if compacted.

(7) No liners or other barriers interfering with infiltration.

(8) Appropriate plant palette for the specified soil mix and maximum available water use.

(g) Alternative Designs — Facilities, or a combination of facilities, of a different design than in (f) may be permitted if the following measures of equivalent effectiveness are demonstrated:

(1) Equal or greater amount of runoff infiltrated or evapotranspired

(2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment

(3) Equal or greater protection against shock loadings and spills

(4) Equal or greater accessibility and ease of inspection and maintenance

(h) Allowed Variations for Special Site Conditions - The bioretention system design parameters in (f) may be adjusted for the following special site:

(1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.
(2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a "flow-through planter").
(3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.
(4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide additional treatment to address pollutants of concern unless these high-risk areas are isolated from stormwater runoff or bioretention areas with little chance of spill migration.

(i) Exceptions to Requirements for Bioretention Facilities - Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters may be used for the following categories of Regulated Projects:
(1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district, and having at least 85% of the entire project site covered by permanent structures;
(2) Facilities receiving runoff solely from existing (pre-project) impervious areas,
(3) Smart growth projects, and;
(4) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.
By 2014the second year of the effective date of the permit, each permittee shall adopt or reference appropriate performance criteria for such biotreatment and media filters.

Permit Type: Standard Based on Percentile Storm, Comparable to E.I.S.A. Section 438

In 2007, Congress enacted the Energy Independence and Security Act; Section 438 of that Act requires that new federally sponsored development projects manage stormwater on-site to replicate the predevelopment hydrology. EPA was tasked with developing technical guidance to assist federal agencies in complying with this statutory mandate, and in 2009 the Agency issued a formal technical guidance memo. This memo sets a standard of managing the precipitation to prevent runoff from a locally relevant 95th percentile storm through green infrastructure practices. In announcing this "unofficial" requirement, EPA moved the stormwater management bar forward considerably, setting a new reference point for what could be considered "maximum extent practicable" (although the Agency has never made this point explicitly.)

In a handful of states, EPA is still the NPDES permitting agency, and in at least one instance has translated the EISA technical guidance approach into permit language. In the draft Phase I permit for Boise, Idaho, EPA Region 10 has required the permittees to establish stormwater management standards or ordinances that will require new development and redevelopment projects to prevent runoff from the first 0.6 inches of rainfall. Locally, this volume translates into the 95th percentile storm. Other notable features of this draft permit are its off-site compliance allowances and requirements, mandatory pilot projects for retrofits to reduce the impacts of existing imperviousness, and a requirement that green infrastructure be integrated into future road, street and parking lot repair and construction.

Boise Draft Phase I Permit (October 2011 draft). Available at www.epa.gov/region10/pdf/permits/npdes/id/ids027561-dp.pdf.

B. Minimum Control Measures. The following minimum control measures must be accomplished through each permittee's Storm Water Management Program:

…

2. **Storm Water Management for Areas of New Development and Redevelopment.** At a minimum, the permittees must implement and enforce a program to control storm water runoff from new development and redevelopment projects that result in land disturbance of 5,000 square feet or more. This program must apply to private and public sector development, including roads and streets. The program implemented by the permittees must ensure that permanent controls or practices are utilized at each new development and redevelopment site to protect water quality. The program must include, at a minimum, the elements described below:

a) **Ordinance or other regulatory mechanisms.** No later than the expiration date of this permit, each permittee must update its applicable ordinance or regulatory mechanism which requires the installation and long-term maintenance of permanent storm water management controls at new development and redevelopment projects. Each permittee must update their ordinance/regulatory mechanism to the extent allowed by local and state law, consistent with the individual permittee's respective legal authority to do so, within five years of the permit effective date.

(i) The ordinance/regulatory mechanism must include site design standards for all new and redevelopment that require, in combination or alone, storm water management measures that keep and manage onsite the runoff generated from the first 0.6 inches [1] of rainfall from a 24-hour event preceded by 48 hours of no measureable precipitation. Runoff volume reduction can be achieved by canopy interception, soil amendments, evapotranspiration, rainfall harvesting, engineered infiltration, extended filtration, and/or any combination of such practices that will capture the first 0.6 inches of rainfall. An Underground Injection Control permit may be required when certain conditions are met. The ordinance or regulatory mechanism must require that the first 0.6 inches of rainfall be 100% managed with no discharge to surface waters, except when the permittee chooses to implement the conditions of II.B.2.a.ii below.

(ii) For projects that cannot meet 100% infiltration/evapotranspiration/reuse requirements onsite, the permittee's program may allow offsite mitigation within the same sub-watershed, subject to siting restrictions established by the permittee. The

[1] Author's note: 0.6 inches of rainfall reflects the local 95th % storm for the Boise area.

permittee allowing this option must develop and apply criteria for determining the circumstances under which offsite mitigation may be allowed. A determination that the onsite retention requirement cannot be met must be based on multiple factors, including but not limited to technical or logistic practicality (e.g. lack of available space, high groundwater, groundwater contamination, poorly infiltrating soils, shallow bedrock, and/or a land use that is inconsistent with capture and reuse or infiltration of storm water). Determinations may not be based solely on the difficulty and/or cost of implementing such measures. The permittee allowing this option must create an inventory of appropriate mitigation projects and develop appropriate institutional standards and management systems to value, estimate and track these situations. Using completed watershed plans or other mechanisms, the permittee must identify priority areas within subwatersheds in which off-site retention may be conducted.

(iii) The ordinance or regulatory mechanism must include the following water quality requirements:

· Projects with potential for excessive pollutant loading(s) must provide water quality treatment for associated pollutants before infiltration.

· Projects with potential for excessive pollutant loading(s) that cannot implement adequate preventive or water quality treatment measures to ensure compliance with Idaho surface water standards must properly convey storm water to a NPDES permitted wastewater treatment facility or via a licensed waste hauler to a permitted treatment and disposal facility.

(iv) The ordinance or other regulatory mechanism must include procedures for the permittee's review and approval of permanent storm water management plans for new development and redevelopment projects.

(v) The ordinance or other regulatory mechanism must include sanctions (including fines) to ensure compliance, as allowed under state or local law.

b) **Storm Water Design Criteria Manual.** No later than two years from the effective date of this permit, each permittee must update as necessary their existing Storm Water Design Criteria Manual specifying acceptable permanent storm water management and control practices. The manual must contain design criteria for each practice. In lieu of updating a manual, a permittee may adopt a manual created by another entity which complies with this section. The manual must include:

(i) Specifications and incentives for the use of site-based practices appropriate to local soils and hydrologic conditions;

(ii) A list of acceptable practices, including sizing criteria, performance criteria, design examples, and guidance on selection and location of practices; and

(iii) Specifications for proper long term operation and maintenance, including appropriate inspection interval and self-inspection checklists for responsible parties.

c) **Green Infrastructure/Low Impact Development (LID) Strategy and Pilot Projects.** Within two years of the effective date of this permit, the permittees must develop a strategy to provide incentives for the increased use of LID techniques in private and public sector development projects within each permittee's jurisdiction. The strategy must outline methods of evaluating the Green Infrastructure/LID pilot projects described below. Permittees must begin implementation of the Green Infrastructure/LID Strategy, and complete three pilot projects prior to the expiration date of this permit.

(i) The permittees must report on the progress of each pilot project beginning with the 3rd year Annual Report. Each pilot project must include an evaluation of the effectiveness of LID concepts used for on-site control of water quality and/or quantity. The permittees must report the results of the pilot project evaluation efforts in subsequent Annual Reports. Each Pilot Project must involve at

least one or more of the following characteristics:
- The project manages runoff from at least 3,000 square feet of impervious surface;
- The project involves transportation related location(s) (including parking lots); - The drainage area of the project is greater than five acres in size; and/or
- The project involves mitigation of existing storm water discharges to one or more of the water bodies listed in Table II.C.

(ii) The permittees must monitor the performance of each pilot project and report the results as available in subsequent Annual Reports. The permittees must calculate or model changes in runoff quantities for each of the pilot project sites in the following manner:

· For retrofit projects, changes in runoff quantities shall be calculated as a percentage of 100% pervious surface before and after implementation of the LID practices.
· For new construction projects, changes in runoff quantities shall be calculated for development scenarios both with LID practices and without LID practices.
· The permittees must measure runoff flow rate and subsequently prepare runoff hydrographs to characterize peak runoff rates and volumes, discharge rates and volumes, and duration of discharge volumes. The evaluation must include quantification and description of each type of land cover contributing to surface runoff for each pilot project, including area, slope, vegetation type and condition for pervious surfaces, and the nature of impervious surfaces.
· The permittees must use these runoff values to evaluate the overall effectiveness of various LID practices and to develop recommendations for future LID practices that address appropriate use, design, type, size, soil type and operation and maintenance practices.

(iii) **Riparian Zone Management and Outfall Disconnection.** Within five years from the effective date of this permit, the permittees must identify and prioritize riparian areas appropriate for permittee acquisition and protection. Prior to the expiration date of this permit, the permittees undertake at least one project designed to reduce the flow of untreated urban storm water discharging through the MS4 system through the use of vegetated swales, storm water treatment wetlands and/or other appropriate techniques

(iv) **Repair of Public Streets, Roads and Parking Lots.** When public streets, roads or parking lots are repaired as defined in Part VII, the permittees performing these repairs must evaluate the feasibility of incorporating runoff reduction techniques into the repair using canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, rain gardens, infiltration trenches, extended filtration and/or evapotranspiration and/or any combination of the aforementioned practices. Where such practices are found to be technically feasible, the permittee performing the repair must use such practices in the design and repair. These requirements apply only to projects whose design process is started after the effective date of this permit. As part of the 5th Year Annual Report, the permittees must list the locations of street, road and parking lot repair work completed since the effective date of the permit that have incorporated such runoff reduction practices, and the receiving waterbody(s) benefitting from such practices. This documentation must include a general description of the project design, estimated total cost, and estimates of total flow volume and pollutant reduction achieved compared to traditional design practices.

Permit Type: Objective Performance Standard Expressed as a Measured Level of Precipitation

Several MS4 permits, from different regions of the country, reflect the approach shown in the nearly twin Tennessee and West Virginia Phase II permits. These permits both explicitly require that "stormwater discharges from new development and redevelopment sites be managed such that post-development hydrology does not exceed the pre-development hydrology at the site, in accordance with the performance standards" expressed in the permits. These performance standards, in turn, require that the volume associated with the first inch of rainfall be 100% managed on-site through runoff reduction or harvesting techniques. The permits allow regulated MS4 to set up programs that allow off-site compliance for projects where attaining this level of performance is infeasible, including an in-lieu fee program or off-site runoff reduction within the same HUC12 watershed. As with the draft Idaho permit described elsewhere in this guide, the West Virginia Phase II permit applying the runoff reduction requirements to public streets and parking lots as they are reconstructed or modified. Also, both Tennessee and West Virginia permits make allowances for smart growth and redevelopment projects that incorporate desirable density, brownfields, or transit oriented outcomes. Qualifying projects may be allowed to reduce the amount of runoff managed on-site by generous amounts; some observers have noted that these allowances may be overly generous and frustrate efforts to achieve broader water quality goals.

Generally, in both Tennessee and West Virginia, the 1" standard falls well below the 95th percentile performance standard in EISA. Closer to the 85th percentile storm standard which is more analogous to the traditional "water quality volume" design goal intended to provide some modicum of protection against stormwater pollutant loadings.

Tennessee Phase II MS4 Permit, (August 31, 2010). Available at http://www.tn.gov/environment/wpc/stormh2o/finals/tns000000_ms4_phase_ii_2010.pdf :

4.2.5. Permanent Stormwater Management in New Development and Redevelopment

4.2.5.1 Permit requirements

Develop, implement, and enforce a program to address permanent (post-construction) stormwater runoff management from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharge into your small MS4. Your program must ensure that controls are in place that would prevent or minimize water quality impacts.

Develop and implement strategies which include a combination of structural and/or nonstructural best management practices (BMPs) appropriate for your community.

Develop and implement a set of requirements to establish, protect and maintain a permanent water quality buffer along all waters of the state at new development and redevelopment projects.

Use an ordinance or other regulatory mechanism to address permanent runoff from new development and redevelopment projects to the extent allowable under state or local law. Your ordinance must allow for the maximum penalties per day for each day of violation as specified in TCA 68-221-1106.

4.2.5.2 Performance Standards

The MS4 must implement and enforce permanent stormwater controls that are comprised of runoff reduction and pollutant removal. The permittee must require that stormwater discharges from new development and redevelopment sites be managed such that post-development hydrology does not exceed the pre-development hydrology at the site, in accordance with the performance standards contained in this section. Runoff reduction is the preferred control practice as it can achieve both volume control and pollutant removal. If runoff reduction and/or pollutant removal cannot be fully accomplished on-site per 4.2.5.2.1 and 4.2.5.2.2, then the MS4 may propose off-site mitigation and/or payment into a fund for public stormwater projects. The MS4 must develop and apply criteria for determining the circumstances under which these alternatives will be available. A determination that standards cannot be met on site may not be based solely on the difficulty or cost of implementing measures, but must include multiple criteria that would rule out an adequate combination of infiltration, evapotranspiration and reuse such as: lack of available area to create the necessary infiltrative capacity; a site use that is inconsistent with capture and reuse of stormwater; physical conditions that preclude use of these practices.

4.2.5.2.1 Runoff Reduction (green infrastructure)

Site design standards for all new and redevelopment require, in combination or alone, management measures that are designed, built and maintained to infiltrate, evapotranspire,

harvest and/or use, at a minimum, the first inch of every rainfall event preceded by 72 hours of no measurable precipitation. This first inch of rainfall must be 100% managed with no storm water runoff being discharged to surface waters. For all new and redevelopment on private property, the MS4 may opt to have controls installed on that private property, in the public right-of-way, or a combination of both. Limitations to the application of runoff reduction requirements include, but are not limited to:

- Where a potential for introducing pollutants into the groundwater exists, unless pretreatment is provided;
- Where pre-existing soil contamination is present in areas subject to contact with infiltrated runoff;
- Presence of sinkholes or other karst features.

Pre-development infiltrative capacity of soils at the site must be taken into account in selection of runoff reduction management measures.

The MS4 may develop a program to allow for incentive standards for redeveloped sites. The MS4 may provide a 10% reduction in the volume of rainfall to be managed for any of the following types of development. Such credits are additive such that a maximum reduction of 50% of the standard in the paragraph above is possible for a project that meets all 5 criteria:

- Redevelopment;
- Brownfield redevelopment;
- High density (>7 units per acre);
- Vertical Density, (Floor to Area Ratio (FAR) of 2 or >18 units per acre); and
- Mixed use and Transit Oriented Development (within ½ mile of transit).

4.2.5.2.2 Pollutant Removal

For projects that cannot meet 100% of the runoff reduction requirement unless subject to the incentive standards, the remainder of the stipulated amount of rainfall must be treated prior to discharge with a technology reasonably expected to remove 80% total suspended solids (TSS). The treatment technology must be designed, installed and maintained to continue to meet this performance standard.

4.2.5.2.3 Off-site mitigation

For projects that cannot meet 100% of the runoff reduction requirements, the MS4 may allow runoff reduction measures to be implemented at another location within the same USGS 12-digit hydrologic unit code (HUC) as the original project. Off-site mitigation must be a minimum of 1.5 times the amount of water not managed on site. The off-site mitigation location (or alternative location outside the 12-digit HUC) and runoff reduction measures must be approved by the MS4. The MS4 shall identify priority areas within the watershed in which mitigation projects can be completed. The MS4 must create an inventory of appropriate mitigation projects, and develop appropriate institutional standards and management systems to value, evaluate and track transactions. Mitigation can be used for retrofit or redevelopment projects, but should be avoided in areas of new development.

4.2.5.2.4 Payment into Public Stormwater Project Fund

For projects that cannot meet 100% of the runoff reduction and pollutant removal standards, and cannot provide for off-site mitigation, the MS4 may allow the owner to make payment in a public stormwater project fund established by the MS4. Payment into a public stormwater fund must be at a minimum 1.5 times the estimated cost of on-site runoff reduction controls.

West Virginia Phase II MS4 Permit, (June 22, 2009), Available at http://www.dep.wv.gov/WWE/Programs/stormwater/MS4/permits/Pages/default.aspx.

5. Controlling Runoff from New Development and Redevelopment

The SWMP shall include an ongoing program to develop, assess, implement, and enforce their program to reduce pollutants in stormwater runoff to your small MS4 from new development and redevelopment activities. This program shall be applied to all sites that disturb a land area one acre or greater, including projects less than one acre that are part of a larger common plan of development or sale. The program shall apply to private sector and public sector development, including roads. The program must ensure that controls are in place that will increase groundwater recharge of stormwater runoff where and when possible, and would protect water quality and reduce the discharge of pollutants. Except where otherwise stated, newly permitted MS4s shall begin implementation of the requirements contained in Part II.C.5 of this permit within two years after the approval date of their SWMP.

The program shall include the following measures:

a. Long-term Stormwater Controls

The permittee shall protect the physical, chemical and biological integrity of receiving waters, and their designated uses, from the impacts of stormwater discharges through the implementation of watershed protection elements and site and neighborhood design elements.

The purpose of watershed protection elements is to manage the impacts of stormwater on receiving waters that occur because of regional or watershed-scale management decisions. The

primary purpose of site and neighborhood design elements is to manage the impacts of stormwater on receiving waters that occur because of site and neighborhood design management decisions. The technical principles of these management practices have many complementary similarities, and must be implemented in tandem.

All elements and standards are required, and must be described in the stormwater management program plan.

i. Watershed Protection

The permittee shall incorporate watershed protection elements into the subdivision ordinance or equivalent document. In addition, the permittee shall incorporate watershed protection elements into all relevant policy and/or planning documents as they come up for regular review. If a relevant planning document is not scheduled for review during the term of this permit, the permittee must identify the elements that cannot be implemented until that document is revised, and provide the DWWM a schedule for incorporation and implementation that cannot exceed seven years from the effective date of this permit. Planning documents include, but are not limited to; comprehensive or master plans, subdivision ordinances, general land use plan, zoning code, transportation master plan, specific area plans, such as sector plan, site area plans, corridor plans, or unified development ordinances.

A. Watershed protection elements. As relevant, policy and/or planning documents must include the following, except where noted:

(1) Minimize the amount of impervious surfaces (roads, parking lots, roofs, etc.) within each watershed, by minimizing the creation, extension and widening of parking lots, roads and associated development.

(2) Preserve, protect, create and restore ecologically sensitive areas that provide water quality benefits and serve critical watershed functions. These areas may include, but are not limited to; riparian corridors, headwaters, floodplains and wetlands.

(3) Implement stormwater management practices that prevent or reduce thermal impacts to streams, including requiring vegetated buffers along waterways, and disconnecting discharges to surface waters from impervious surfaces such as parking lots.

(4) Seek to avoid or prevent hydromodification of streams and other water bodies caused by development, including roads, highways, and bridges.

(5) Implement standards to protect trees, and other vegetation with important evapotranspirative qualities.

(6) Implement policies to protect native soils, prevent topsoil stripping, and prevent compaction of soils.

B. Measurable Goals. For each of the six watershed elements in i.A, the permittee shall develop quantifiable objectives that include a time frame for achieving them. Short-term objectives (less than five years) and long-term objectives (greater than five years) are appropriate for many of these elements.

C. Reporting. Annual reports must include status of implementation of these elements with respect to incorporation into relevant documents and implementation via relevant policies. Reports should include proposed time frames, changes and measurable goals.

ii. Site and Neighborhood Design

The permittee shall develop a program to protect water resources by requiring all new and redevelopment projects to control stormwater discharge rates, volumes, velocities, durations and temperatures. These standards shall apply at a minimum to all new development and redevelopment disturbing one acre or greater, including projects less than one acre that are part of a larger common plan of development or sale. The permittee shall begin implementation of the requirements contained in Part II.C.5.a.ii [other than Part II.C.5.a.ii.A(3) and Part II.C.5.a.ii.A.(4)] within four years after the approval of the SWMP.

A. Performance Standards. The permittee must implement and enforce via ordinance and/or other enforceable mechanism(s) the following requirements for new and redevelopment:

1. Site design standards for all new and redevelopment that require, in combination or alone, management measures that keep and manage on site the first one inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation. Runoff volume reduction can be achieved by canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration and/or evapotranspiration and any combination of the aforementioned practices. This first one inch of rainfall must be 100% managed with no discharge to surface waters, except when the permittee chooses to implement the conditions in paragraph 4 below. This can be achieved through on site utilization of practices to include dry swales, bioretention, rain tanks and cisterns, soil amendments, roof top disconnections, permeable pavement, porous concrete, permeable pavers, reforestation, grass channels, green roofs and other practices that alone or combined will capture the first one inch of rainfall runoff volume. Extended filtration practices that are designed to capture and retain up to one inch of rainfall may discharge volume in excess of the first inch through an under drain system. An Underground Injection Control permit may be required when certain conditions are met.
2. The following additional water quality requirements, as applicable:
    i. A project that is a potential hot spot with reasonable potential for pollutant loading(s) must provide water quality treatment for associated pollutants (e.g., petroleum hydrocarbons at a vehicle fueling facility) before infiltration.
    ii. A project that is a potential hot spot with reasonable potential for pollutant loading(s) that cannot implement adequate preventive or water quality treatment measures to ensure compliance with groundwater and/or surface water quality standards, must properly convey stormwater to a NPDES-permitted wastewater treatment facility or via a licensed waste hauler to a permitted treatment and disposal facility.
    iii. A project that discharges or proposes to discharge to any surface water or ground water that is used as a source of drinking water must comply with all applicable requirements relating to source water protection.
3. When considered at the watershed scale, certain types of development can either reduce existing impervious surfaces, or at least create less ‘accessory’ impervious surfaces. Incentive standards may be applied to these types of projects. A reduction of 0.2 inches from the one inch runoff reduction standard may be applied to any of the following types of development. Reductions are additive up

    to a maximum reduction of 0.75 inches for a project that meets four or more criteria. The permittee may choose to be more restrictive and allow a reduction

of less than 0.75 inches if they choose. In no case will the reduction be greater than 0.75 inches.

a) Redevelopment

b) Brownfield redevelopment

c) High density (>7 units per acre)

d) Vertical Density, (Floor to Area Ratio (FAR) of 2 or >18 units per acre)

e) Mixed use and Transit Oriented Development (within ½ mile of transit)

4. For projects that cannot meet 100% of the runoff reduction requirement on site, two alternatives are available: off-site mitigation and payment in lieu. If these alternatives are chosen, then the permittee must develop and fairly apply criteria for determining the circumstances under which these alternatives will be available. A determination that standards cannot be met on site may not be based solely on the difficulty or cost of implementing measures, but must include multiple criteria that would rule out an adequate combination of the practices set forth in section 1, above, such as: too small a lot outside of the building footprint to create the necessary infiltrative capacity even with amended soils; soil instability as documented by a thorough geotechnical analysis; a site use that is inconsistent with capture and reuse of stormwater; too much shade or other physical conditions that preclude adequate use of plants. In instances where alternatives to complete on site management of the first inch of rainfall are chosen, technical justification as to the infeasibility of on site management is required to be documented.

   These alternatives are available, in combination or alone, for up to 0.6 inches of the original obligation at a 1:1.5 ratio, i.e., mitigation or payment in lieu must be for 1.5 times the amount of stormwater not managed on site. If, as demonstrated to the permittee, it is technically infeasible to manage on site a portion of all of the remaining 0.4 inches, off site mitigation or payment in lieu will be applied at a 1:2 ratio for that portion. For any of these options to be available, the permittee must create an inventory of appropriate mitigation projects, and develop appropriate institutional standards and management systems to value, evaluate and track transactions.

   i. Off-site mitigation. Runoff reduction practices may be implemented at another location in the same sewershed/watershed as the original project, approved by the permittee. The permittee shall identify priority areas within the sewershed/watershed in which mitigation projects can be completed. Mitigation must be for retrofit or redevelopment projects, and cannot be applied to new development. The permittee shall determine who will be responsible for long term maintenance on mitigation projects.

   ii. Payment in lieu. Payment in lieu may be made to the permittee, who will apply the funds to a public stormwater project. MS4s shall maintain a publicly accessible database of approved in lieu projects.

5. When public (local or otherwise) streets or parking lots, that are greater than 5000 square feet but less than one acre, are modified or reconstructed runoff

   reduction practices shall be included in the design work. These requirements apply only to projects begun after the effective date of this permit.

South Carolina Phase II MS4 Permit

The current South Carolina Phase II permit follows a similar approach, setting a 1 inch on-site management performance standard, and listing examples of the different ways that regulated MS4s may choose to express this in their local stormwater plans and codes, including: rainfall (volume or size), recharge/runoff, or annual pollutant load (which will be accomplished through low impact development practices (LID) including impervious cover limitations and treatment means.)

This permit is particularly interesting for the way it guides and constrains the discretion of local MS4 stormwater programs, seemingly addressing one of the criticisms levied in the NRC report. By specifying a limited set of regulatory approaches that MS4s can use in crafting local SWMPs and stormwater standards, the South Carolina permit meets the need for local flexibility with a menu of approved options that will deliver compliance with the overall one inch retention standard and green infrastructure preference.

South Carolina Phase II MS4 Permit, (March 3, 2011). Available at **http://www.scdhec.gov/environment/water/publicnote/pubs/SCR03DPN.pdf**

4.2.5.1 Post-Construction Stormwater Management Program

4.2.5.1.1 Permittees shall implement a program to control stormwater discharges from new development and redeveloped sites that disturb at least one acre (including projects that disturb less than one acre that are part of a larger common plan of development or sale, LCP) that discharge into an MS4. The program must apply to private and public development sites, including roads.

4.2.5.1.2 The Post-Construction Stormwater Management Program shall require that controls are in place to meet the performance standards in Part 4.2.5.2 to the MEP and to protect water quality.

4.2.5.1.3 Written procedures for implementing this program, including, but not limited to, the components described in Parts 4.2.5.2 – 8, must be incorporated into the SWMP document.

4.2.5.2 Site Performance Standards

4.2.5.2.1 Permittees must establish, implement and enforce a requirement that owners or operators of new development and redeveloped sites discharging to the MS4, which disturb greater than or equal to one acre (including projects that disturb less than one acre that are part of a LCP), design, install, implement, and maintain stormwater control measures that maintain predevelopment conditions and protect water quality to the MEP.

4.2.5.2.2 New Development Standards to be used can be either one, combination, or equivalent combination of design strategies, control measures, practices or provisions such as infiltration, evapotranspiration, rain harvesting, and stormwater reuse and recharge that demonstrate the runoff reduction and pollutant removal necessary to maintain predevelopment conditions and to protect water quality to the MEP. Permittees must require that the first inch of runoff be managed. Table 4.2.5.2.2.1, below, contains examples of specific standards that could be adopted. Permittees must describe the site design strategies, control measures and other practices deemed necessary by the MS4 to maintain, or in the case of redevelopment improve, pre-development hydrology in order to meet 4.2.5.2.1 above.

Table 4.2.5.2.2.1 Site Performance Standards

Basis for Performance Standard	*Description*	*Performance Standard*
Rainfall	*Minimum storm volume to be retained on site.*	*Design, construct, and maintain stormwater management practices that manage rainfall on-site, and prevent the offsite discharge of the precipitation from [insert standards, such as "the first one inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation"].Discharge volume reduction can be achieved by canopy interception, soil amendments, evaporation, rainfall harvesting, engineered infiltration, extended filtration and/or evapotranspiration and any combination of the aforementioned practices. This first one inch of rainfall must be 100% managed with no discharge to surface waters, except when the permittee chooses to implement the conditions in Part 5.2.5.d below*
Rainfall	*Minimum storm size to be retained on site.*	*Design, construct, and maintain stormwater management practices that manage rainfall on-site, and prevent the offsite discharge of the precipitation from all rainfall events less than or equal to [insert standards, such as "the 95th percentile rainfall event"]. This objective must be accomplished by the use of practices that infiltrate, evapotranspire and/or harvest and reuse rainwater. The 95th percentile rainfall event is the event whose precipitation total is greater than or equal to 95 percent of all storm events over a given period of record.*
Recharge/Runoff	*Hydrologic analysis.*	*Design, construct, and maintain stormwater management practices that preserve the pre-development runoff conditions following construction. The post-construction rate, volume, duration and temperature of discharges must not exceed the pre-development rates and the predevelopment hydrograph for 1, 2, 10, 25, 50 and 100 year storms must be replicated through site design and other appropriate practices. These goals must be accomplished through the use of infiltration, evapotranspiration, and/or rainwater harvesting and reuse practices. Defensible and consistent hydrological assessments and modeling*
Recharge	*Groundwater recharge requirement.*	*Any "major development" project, which is one that disturbs [insert standards, such as at least one (1) acre of land or creates at least 0.25 acres of new or additional impervious surface], must comply with one of the following two groundwater recharge requirements:* *• Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site; or* *• Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater discharges volume from pre-construction to post-construction for the two-year storm is infiltrated.*
Annual Pollutant Load Hydrologic Analysis	*Loading Calculations*	*Design, construct and maintain stormwater management practices that preserve the pre-development runoff conditions following development. Post construction annual pollutant loads are not allowed to exceed predevelopment levels. Whenever and wherever appropriate, runoff volume and peak discharge rates for specific design storms should be taken into account as well. These goals will be accomplished through low impact development practices (LID) including impervious cover limitations and treatment means. Water quality modeling methods used to support establishment of this standard must be defensible and be consistent with the MEP standard, to protect water quality and to satisfy the appropriate water quality requirements of the CWA2*

4.2.5.2.3 Incentives for Redeveloped Sites. When considered at the watershed scale, certain types of developed sites can either reduce existing impervious surfaces, or at least create less 'accessory' impervious surfaces. SMS4 may develop a program to allow adjustments to the performance standard for new development or redevelopment sites that qualify.

4.2.5.2.4 Additional Requirements and Exceptions: The permittee shall implement the following additional requirements where applicable:

a. A site with potential for contaminating groundwater must provide treatment for associated pollutants (e.g., petroleum hydrocarbons at a vehicle fueling facility).

b. A site that discharges or proposes to discharge to any surface water or ground water that is used as a source of drinking water must comply with all applicable requirements relating to source water protection.

c. Sites may not use infiltration techniques as a method for stormwater control in areas of documented soil contamination.

d. Proposed storm water controls with potential to adversely impact ground water that are required under for Post-Construction Storm Water Management in New Development and Redevelopment or Permanent / Long Term Storm Water

e. For projects that cannot meet the performance standard in Part 4.2.5.2.2 on site, alternatives such as off-site mitigation and payment in lieu should be made available. A determination that standards cannot be met on site must include multiple criteria that would rule out fully meeting the performance standard in Part 4.2.5.2.2, such as: too small a lot outside of the building footprint to create the necessary infiltrative capacity even with amended soils; soil instability as documented by a thorough geotechnical analysis; a site use that is inconsistent with capture and reuse of stormwater; or too much shade or other physical conditions that preclude adequate use of plants. Sites must still maximize stormwater retention on-site, before applying the remaining stormwater to one of the alternatives. In instances where alternatives are chosen, technical justification as to the infeasibility of on site management is required to be documented.

Requirements for Green Infrastructure

A second, increasingly common approach for MS4 permit writers is to explicitly require, or at least strongly suggest, that green infrastructure practices be the default approach to reducing stormwater discharges to the maximum extent practicable. While this approach does not have the bright line measure of compliance that an objective retention standard can provide, it does set an expectation that traditional detention and conveyance structures are no longer the norm for stormwater management. Perhaps more powerfully, naming the types or categories of practices that make up green infrastructure has the effect of focusing permittees and developers on the effectiveness of these practices at meeting management standards that may be specifically expressed in a state stormwater technical manual. Interestingly, the Illinois permit expresses a preference for green infiltration practices that manage runoff from multiple sites, rather than extensively decentralized approaches that address runoff on a purely site

specific basis. This may be one approach to resolving operations and maintenance concerns that may arise with the implementation of numerous, smaller, on-site practices.

Again, this listing of green infrastructure-based practices or attributes may be even more effective when paired with an objective standard.

Illinois General Stormwater Permit for Small Municipal Separate Stormwater Systems, (Feb. 20, 2009). Available at www.epa.state.il.us/water/permits/storm-water/ms4.html.

5. Post-construction storm water management in new development and redevelopment

   The permittee must:

   a. Develop, implement, and enforce a program to address and minimize storm water runoff from new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale or that have been designated to protect water quality, that discharge into your small MS4 within the MS4 jurisdictional control. Your program must ensure that appropriate controls are in place that would protect water quality and reduce the discharge of pollutants to the maximum extent practicable. In addition, each permittee should adopt strategies that incorporate storm water infiltration, reuse and evaportranspiration of storm water into the project to the maximum extent practicable;
   b. Develop and implement strategies which include a combination of structural and/or non-structural BMPs appropriate for all projects within your community for all new development and redevelopment that will reduce the discharge of pollutants, the volume and velocity of storm water flow to the maximum extent practicable. When selecting BMPs to comply with the requirements contained in this Part, the permittee should adopt one or more of the following general strategies, in order of preference. Proposal of a strategy should include a rationale for not selecting an approach from among those with a higher preference. When approving a plan for development, redevelopment, highway construction, maintenance, replacement or repair on existing developed sites or other land disturbing activity covered under this Part, the permittee should require the person responsible for that activity to adopt one or more of these strategies, in order of preference, or provide a rationale for selecting a more preferred strategy.
      i. Preservation of the natural features of development sites, including natural storage and infiltration characteristics;
      ii. Preservation of existing natural streams, channels and drainage ways,
      iii. Minimization of new impervious surfaces;
      iv. Conveyance of storm water in open vegetated channels;
      v. Construction of structures that provide both quantity and quality control, with structures serving multiple sites being preferable to those serving individual sites; and
      vi. Construction of structures that provide only quantity control, with structures serving multiple sites being preferable to those serving individual sites.
   c. develop and implement a program to minimize the volume of storm water runoff and pollutants from public highways, streets, roads, parking lots and sidewalks (public

surfaces) through the use of BMPs that alone or in combination result in physical, chemical or biological pollutant load reduction, increased infiltration, evaportranspiration and reuse of storm water. The program shall include, but not be limited to the following elements:

i. appropriate training for all MS4 employees who manage or are directly involve in (or who retain others who manage or who are directly involved in) the routine maintenance, repair or replacement of public surfaces in current green infrastructure or low impact design techniques applicable to such projects.

ii. appropriate training for all contractors retained to manage or carry out routine maintenance, repair or replacement of public surfaces in current green infrastructure or low impact design techniques applicable to such projects. Contractors may provide training to their employees for projects which include green infrastructure or low impact design techniques.

Permit Type: Narrative Performance Goal with a Preference for Green Infrastructure

There isn't always a bright line distinguishing the approaches that permits will take to express a stormwater reduction performance standard. Several blend an explicit runoff reduction requirement with either a list of practices that permittees can use to achieve that requirement, or a statement expressing a preference for green infrastructure practices. The South Carolina permit noted elsewhere follows this approach, as does the new draft Phase II permit for Minnesota. Minnesota's permit will mandate that the stormwater management standards imposed by MS4s give "highest preference to Green Infrastructure techniques and practices" to meet the permits "no net increase from pre-project conditions" performance standard.

While delving into state stormwater technical manuals is beyond the scope of this guide (other than to note their parallel and important role in setting out design and performance requirements), it is worth noting that Minnesota's new Minimum Impact Design Standards includes a requirement that the post-construction volume from a 1.1" storm be managed on site. For most Minnesota jurisdictions, this corresponds to a 93rd percentile storm.

Minnesota Draft Phase II Permit, (May 18, 2012). Available at www.pca.state.mn.us/index.php/view-document.html?gid=17811.

5. Post-Construction Stormwater Management

New permittees shall develop, implement, and enforce, and existing permittees shall continue to develop, implement, and enforce a Post-Construction Stormwater Management program that reduces water quality impacts from construction activity related to new development and redevelopment projects with land disturbance of greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, within the permittee's jurisdiction and that discharge to the permittee's small MS4. The program shall consist, at a minimum, of the following:

a. A Regulatory Mechanism(s) that incorporates:

(1) Site plan review

The permittee shall incorporate into the Regulatory Mechanism(s) requirements that owners and/or operators of construction activity submit site plans to the permittee for review and approval, prior to start of the project.

(2) Conditions for Post-Construction Stormwater Management

The permittee shall develop and implement a Post-Construction Stormwater Management program that requires the use of any combination of BMPs, with highest preference given to Green Infrastructure techniques and practices (e.g., infiltration, evapotranspiration, reuse/harvesting, conservation design, urban forestry, green roofs, etc.), necessary to meet the following conditions on the site of a construction activity to the MEP:

(a) For new development projects – no net increase from pre-project conditions (on an annual average basis) of:

1) Stormwater discharge Volume, unless precluded by the stormwater management limitations in Part III.D.5.a(3)(a).

2) Stormwater discharges of Total Suspended Solids (TSS).

3) Stormwater discharges of Total Phosphorus (TP).

(b) For redevelopment projects – a net reduction from pre-project conditions (on an annual average basis) of:

1) Stormwater discharge Volume, unless precluded by the stormwater management limitations in Part III.D.5.a(3)(a).

2) Stormwater discharges of TSS.

3) Stormwater discharges of TP.

(3) Stormwater management limitations and exceptions

(a) Limitations

1) The permittee's Regulatory Mechanism(s) shall prohibit the use of infiltration techniques to achieve the conditions for post-construction stormwater management in Part III.D.5.a(2) when the infiltration structural stormwater BMP will receive discharges from, or be constructed in:

a) Areas where industrial facilities are not authorized to infiltrate industrial stormwater under an NPDES Industrial Stormwater Permit issued by the Agency.

b) Areas where vehicle fueling and maintenance occur.

c) Areas with less than three (3) feet of separation distance from the bottom of the infiltration system to the elevation of the seasonally saturated soils or the top of bedrock.

d) Areas where high levels of contaminants in soil or groundwater will be mobilized by the infiltrating stormwater.

2) The permittee's Regulatory Mechanism(s) shall restrict the use of infiltration techniques to achieve the conditions for post-construction stormwater management in Part III.D.5.a(2), sufficient to provide a functioning treatment

system and prevent adverse impacts to groundwater, when the infiltration device will be constructed in:

a) Areas of predominately Hydrologic Soil Group D (clay) soils.

b) Areas within 1,000 feet up-gradient, or 100 feet down-gradient of active karst features.

c) Areas within a Drinking Water Supply Management Area. (DWSMA) as defined in Minn. R. 4720.5100, subp. 13.

d) Areas where soil infiltration rates are more than 8.3 inches per hour.

3) For work on linear projects where the lack of right-of-way precludes the installation of volume control practices that meet the conditions for post-construction stormwater management in Part.III.D.5.a(2), the permittee's Regulatory Mechanism(s) may allow exceptions as described in Part III.D.5.a(3)(b), below. The permittee's Regulatory Mechanism(s) shall ensure that a reasonable attempt be made to obtain right-of-way during the project planning process.

(b) Exceptions for stormwater discharge volume

The permittee's Regulatory Mechanism(s) may allow for lesser volume control on the site of the original construction activity than that in Part III.D.5.a(2) only under the following circumstances:

1) The owner and/or operator of a construction activity is precluded from infiltrating stormwater through a designed system due to any of the infiltration related limitations described above, and

2) The owner and/or operator of the construction activity implements, to the MEP, volume reduction techniques, other than infiltration, (e.g., evapotranspiration, reuse/harvesting, conservation design, green roofs, etc.) on the site of the original construction activity that reduces stormwater discharge volume, but may not meet the conditions for post-construction stormwater management in Part III.D.5.a(2).

(3) Mitigation provisions

Mitigation provisions for circumstances where the permittee or other owners and operators of a construction activity cannot cost effectively meet the conditions for post-construction stormwater management for TSS and/or TP in Part III.D.5.a(2) on the site of the original construction activity. For this purpose, the permittee shall identify, or may require owners or operators of a construction activity to identify,

locations where mitigation projects can be completed. The mitigation provisions of the Regulatory Mechanism(s) shall ensure that any stormwater discharges of TSS and/or TP not addressed on the site of the original construction activity are addressed through mitigation and, at a minimum, shall ensure the following mitigation requirements are met:

(a) Mitigation may be implemented at a location separate from the original construction activity, but must be within the same Department of Natural Resource (DNR) catchment area or the next adjacent DNR catchment area up-stream. The DNR catchment areas may be locally corrected, in which case the local corrections may be used. The highest preference for mitigation projects must be given to locations that yield benefits to the same receiving water that receives runoff from the original construction activity.

(b) Mitigation projects must involve the creation of new structural stormwater BMPs or the retrofit of existing structural stormwater BMPs.

(c) Routine maintenance of structural stormwater BMPs already required by this permit cannot be used to meet mitigation requirements of this Part.

(d) Mitigation projects shall be completed within 24 months after the start of the original construction activity.

(e) The permittee shall determine, and document, who will be responsible for long-term maintenance on all mitigation projects of this Part.

(f) If the permittee receives payment from the owner and/or operator of a construction activity for mitigation purposes in lieu of the owner or operator of that construction activity meeting the conditions for post-construction stormwater management in Part III.D.5.a(2), the permittee shall apply any such payment received to a public stormwater project, and all projects must be in compliance with Part III.D.5.a(4)(a)-(e).

The new Phase I permit for Louisville and Jefferson County, Kentucky adopts a similar approach of setting a water quality volume-based on-site retention standard coupled to a requirement that the permittees require green infrastructure practices.

Kentucky MS4 Permit for Louisville and Jefferson County, (June 7, 2011). Available at **http://www.msdlouky.org/insidemsd/wwwq/ms4/MS4_Permit20110611.pdf**

Part 5 Post Construction Stormwater Management in New Development and Redevelopment

...

d. Within 12 months of the effective date of this permit, develop and submit to the Division of Water, an on-site stormwater runoff quality treatment standard, to be adopted by ordinance or other regulatory mechanism for all new development and redevelopment projects. The proposed local standard will require, in combination or alone, management measures that are designed, built and maintained to infiltrate, evapo-transpire, harvest and reuse stormwater runoff. The permittee shall develop a locally derived water-quality treatment standard that requires new development projects to implement controls to manage runoff through water-

quality control measures. The standard shall be based, at a minimum, on an analysis of precipitation records to determine the equivalent surface depth of runoff (e.g. ~0.75 inches) produced from an 80th percentile precipitation event.

Effective Impervious Coverage Ceiling

It has become widely accepted that waters, especially small order streams, become significantly impaired when their watersheds are converted to relatively low levels of imperviousness. For some waters, biologic functions can be impaired when impervious levels reach as low as 10%. In an interesting effort to adapt this approach to a site-specific level, one California Phase I permit incorporates an Effective Impervious Area cap into an objective performance standard. The EIA cap effectively requires retention of 95 percent of the 85th percentile storm. There is some relief from this standard for projects where it is technically infeasible to reduce EIA to 5%, but successfully making this demonstration is intended to be difficult, and does not include economic factors. Where meeting the 5% EIA limit is demonstrably infeasible, new development projects must meet or exceed the 30% cap that applies to redevelopment projects.

Ventura County (CA) Phase I Permit, (July 8, 2010). Available at www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/municipal/ventura_ms4/AdoptedVenturaCountyms4/Order.pdf.

4.E.III. New Development/Redevelopment Performance Criteria

1. Integrated Water Quality/Flow Reduction/Resources Management Criteria
    a. Except as provided in subpart 4.E.III.1.(c) below, Permittees shall require all New Development and Redevelopment projects identified in subpart 4.E.II to control pollutants, pollutant loads, and runoff volume emanating from impervious surfaces through infiltration, storage for reuse, evapotranspiration or bioretention/biofiltration by reducing the percentage of Effective Impervious Area (EIA) to 5 percent or less of the total project area.
    b. Impervious surfaces may be rendered "ineffective," and thus not count toward the 5 percent EIA limitation, if the stormwater runoff from those surfaces is fully retained on-site for the design storm event specified in provision (c), below. To satisfy the EIA limitation and low-impact development requirements, the permittees must require stormwater runoff to be infiltrated, reused or evapotranspired on-site through a stormwater management technique allowed under the terms of this permit and implementing documents. If on-site retention determined to be technically infeasible pursuant to 4.E.III.2(b), an on-site biofiltration system that achieves equivalent stormwater volume and pollutant load reduction as would have been achieved by on-site retention shall satisfy the EIA limitation. An on-site biofiltration system that releases above the design volume shall achieve 1.5 times the amount of stormwater volume and pollutant load reduction as would have been achieved by on-site retention and, thereby, shall satisfy the EIA limitation.
    c. The permittees shall require all features constructed or otherwise utilized to render impervious surfaces "ineffective," as described in provision (b) above, to be properly sized to infiltrate, store for reuse, or evapotranspire, without any

runoff at least the volume of water, or in the case of bioinfiltration with release above the design volume, 1.5 times the volume of water, that results from:

1) The 85th percentile 24-hour runoff event determined as the maximized capture stormwater volume for the area using a 48 to 72-hour draw down time, from the formula recommended in Urban Runoff Quality Management, WEF Manual of Practice No. 23/ASCE Manual of Practice No. 87, (1998);
2) The volume of annual runoff based on unit basin storage water quality volume, to achieve 80 percent or more volume treatment by the method recommended in the Ventura County Technical Guidance Manual for Storm Water Quality Control Measures (July 2002 and its revisions); or
3) The volume of runoff produced from a 0.75 inch storm event.

d. To address any impervious surfaces that may not rendered "ineffective," surface discharges of stormwater runoff if any, that results from New Development and Redevelopment projects identified in subpart 4.E.II which have complied with subparts 4.E.III.1.(a)-(c), above, shall be mitigated in accordance with subpart 4.E.III.4.

2. Alternative Compliance for Technical Infeasibility

a. To encourage smart growth and infill development of existing urban centers where on-site compliance with post-construction requirements may be technically infeasible, the perrmittees may allow projects that are unable to meet the Integrated Water Quality/Flow Reduction/Resources Management Criteria in subpart 4.E.III.1, above, to comply with this permit through the alternative compliance measures described in subpart 4.E.III.2.(c), below.
b. To utilize alternative compliance measures, the project applicant must demonstrate that compliance with the applicable post-construction requirements would be technically infeasible by submitting a site-specific hydrologic and/or design analysis conducted and endorsed by a registered professional engineer, geologist, architect, and/or landscape architect. Technical infeasibility may result from conditions including the following:
   1) Locations where seasonal high groundwater is within 5 feet of the surface
   2) Locations within 100 feet of a groundwater well used for drinking water
   3) Brownfield development sites or other locations where pollutant mobilization is a documented concern
   4) Locations with potential geotechnical hazards
   5) Smart growth and infill or redevelopment locations where the density and/or nature of the project would create significant difficulty for compliance with the on-site volume retention requirement
   6) Other site or implementation constraints identified in the LID Technical Guidance document required by subpart 4.E.IV.4.
c. Alternative Compliance Measures. When a permittee finds that a project applicant has demonstrated technical infeasibility, the permittee shall identify alternative compliance measures that the project will need to comply with as a substitute for the otherwise applicable post-construction requirements listed n subparts 4.E.III.1.(a)-(c) of this permit. The Ventura County Technical Guidance Manual shall be revised to identify the alternative compliance measures and shall include the following requirement:
   1) Minimum on-site requirement.
   2) Offsite mitigation volume.
   3) Location of off site mitigation.
   4) Timing and Reporting Requirements for Offsite Mitigation Projects. …

Part Two: Excerpts from Public Comment Letters on MS4 Permits

Objective Performance Standards

Excerpted from Natural Resources Defense Council, San Francisco Baykeeper to San Francisco Regional Water Quality Control Board, April 3, 2009

Re. February 11, 2009, Draft San Francisco Bay Municipal Regional Stormwater NPDES Permit *(the draft permit is referred to throughout as the Tentative Order)*

B. The New Draft of the Tentative Order Does Not Contain—Nor Does It Justify the Lack of—Specific Standards for Implementation, which Board Staff Have Acknowledged Are Appropriate and Necessary.

As noted in our February 29, 2008, letter, the Tentative Order's fact sheet establishes the need for "more specificity in NPDES permit language and requirements," including the creation of "a specific level of implementation for each action or set of actions." (Tentative Order Fact Sheet, at 1.) The Tentative Order also notes that "Water Board staff found it difficult to determine the permittees' compliance with the current permits, due to the lack of specific requirements and measurable outcomes of some required actions." (Tentative Order Fact Sheet, at 3-4.) This observation comports with our observations and the observations of governmental agencies, as mentioned above. Despite this acknowledgement and our repeated attempts to call attention to the vague language of the Tentative Order, however, the new draft falls far short of establishing the "specific requirements and measurable outcomes" whose necessity no one questions and which are necessary for the Tentative Order to be lawful.

. . .

a. Lack of Specific Performance Standards

There is no numeric performance requirement for any of the treatment options in the hierarchy. The standard is, apparently, "practicability," a phrase which appears not only to be inconsistent with the *Maximum Extent* Practicable Standard but is also left otherwise undefined.16 Despite this lack of a numeric performance requirement, the Fact Sheet states in conclusory fashion that the hierarchy of treatment measures will ensure that "the amount of runoff stored and recycled or infiltrated … and treated[sic] by landscape-based measures is maximized." (Fact Sheet, at 25.) Such conclusory statements are a hallmark of this Tentative Order's supporting documentation, and by failing to define a level of performance as is explicitly required by federal and state law, the Tentative Order would allow far less than the Tentative Order's self-

proclaimed "maximization" of recycling, infiltration, and treatment by landscape-based measures and could be interpreted in numerous ways that conflict with the Clean Water Act's

mandate. The Tentative Order's failure to define "MEP" in a meaningful way is particularly problematic because it allows the Permittees to self-regulate by defining for themselves what constitutes MEP. This is poor policy and flatly unlawful. (*See, e.g.*, *Environmental Defense Center, Inc. v. U.S. E.P.A.* (9th Cir. 2003) 344 F.3d 832, 855-56.)

Indeed, by not setting forth a numeric performance standard that requires the installation of effective stormwater BMPs, such as the "effective impervious area" ("EIA") limitation or a comparable volume-based control, and by not requiring any demonstration of the infeasibility of installing LID BMPs, the Regional Board will *not* be able "to more systematically and fairly measure permit compliance." (Tentative Order Fact Sheet, at 26.) Instead, nearly everything is left to the discretion of the Permittees, which violates federal law. (*See* section F.2 of our February 29th Letter regarding impermissible self-regulatory systems (at 21-22).)

The Response to Comments purports to explain why the Regional Board does not need to impose a numeric performance standard like EIA, despite State Board and EPA admonitions to the contrary. The reasoning in the Response to Comments, however, derives from anecdotal statements without supporting materials and provides no refutation of the two, Bay Area-specific, scientific studies of LID implementation by renowned stormwater expert Dr. Richard Horner that we have submitted to the Regional Board. The Response to Comments claims, without citing any reports or other evidence, that "the variety of site conditions and constraints in the Bay Area" requires the Regional Board to "preserve flexibility in selection of treatment measures," (Response to Comments, at 11), even though Dr. Horner's studies and our comments specifically addressed the Bay Area's "site conditions and constraints" and demonstrated how a numeric standard could be feasibly implemented, to the great benefit of water quality. The Regional Board has also ignored the multitude of other stormwater compliance documents around the country that impose significantly more stringent requirements than the Tentative Order, as outlined below. The Regional Board staff's decision to ignore calls for a numeric performance standard because of anecdotal and scientifically undefended positions has resulted in a Tentative Order that does not comport with federal law, scientific evidence, the advice of expert agencies, and other MS4 permits around the country.

Excerpted from American Rivers, California Coastkeeper Alliance, Heal the Bay and Natural Resources Defense Council, to California State Water Quality Control Board, July 23, 2012

Re. Second Draft Phase II Small MS4 General Permit

We are pleased to see that the Revised Draft Permit requires that "All Permittees must implement post-construction and monitoring programs as specified in this Order."[41] . . .

a. The Draft Permit properly requires retention of the 85th percentile, 24-hour storm event. The Draft Permit properly establishes requirements broadly for projects to retain, or "capture, infiltrate, and evapotranspire the runoff from the 85th percentile storm" to the MEP. Regulatory

bodies in a wide variety of jurisdictions, including in California, have already successfully implemented requirements to retain a specified volume of rainfall such as the 85th percentile storm onsite through LID practices such as infiltration, harvesting and reuse, or evapotranspiration, thus ensuring that pollutant loads do not reach receiving waters. These include, for example:

Ventura County: MS4 permit requires onsite retention of ninety-five percent of rainfall from the 85th percentile storm; offsite mitigation allowed if onsite retention is technically infeasible.[42]

North and South Orange County: MS4 Permit requires onsite retention of the 85th percentile storm.[43]

Central Coast, CA: MS4 permit limits impervious surfaces that generate runoff at development projects to between three and ten percent of total project area as a permanent criterion;[44]

West Virginia: Statewide Phase II MS4 permit requires on-site retention of "the first one inch of rainfall from a 24-hour storm" event unless infeasible;[45]

Philadelphia, PA: Infiltrate the first one inch of rainfall from all impervious surfaces; if onsite infiltration is infeasible, the same performance must be achieved offsite.[46]

These jurisdictions, among many others implementing similar requirements, have recognized the paramount importance of mandating onsite retention of a certain quantity of stormwater since onsite retention prevents *all* pollution in that volume of rainfall from being discharged to receiving waters. The requirement to retain runoff from the 85th percentile storm onsite is particularly necessary for smaller MS4s, including those with populations of 25,000 or less, which include areas that may not yet have seen large scale development and whose receiving waters are still pristine.[47] As detailed above, most runoff is the result of man-made development in the landscape. California's Regional Boards have repeatedly recognized that even small increases in impervious surface within an area can have significantly deleterious effects on surface waters. For example, the Los Angeles Regional Board recently noted that, "[s]tudies have demonstrated a direct correlation between the degree of imperviousness of an area and waterbody degradation . . . Significant declines in the biological integrity and physical habitat of streams and other receiving waters have been found to occur with as little as 3-10 percent conversion from natural to impervious surfaces in a subwatershed."[48] Given the need to protect such watersheds, it is critical that the permit apply the requirement to retain the runoff produced by the 85th percentile storm to all small MS4s, not only those above a certain size threshold.

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41 *Supra* note 33, at E.1.b. (citing exceptions to provisions allowing for in-lieu program approvals by the Regional Boards).

42 Los Angeles Regional Water Quality Control Board (July 8, 2010) Ventura County Municipal Separate Stormwater National Pollutant Discharge Elimination System (NPDES) Permit; Order No. R4-2009-0057; NPDES Permit No. CAS004002.

43 Santa Ana Regional Water Quality Control Board, Order No. RB8-2009-0030, at ¶ XII.E.1; San Diego Regional Water Quality Control Board (December 16, 2009) Order No. R9-2009-0002 (South Orange County MS4 Permit).

44 Central Coast Regional Water Quality Control Board, Letter from Roger Briggs re: Notification to Traditional, Small MS4s on Process for Enrolling under the State's General NPDES Permit for Storm Water Discharges (Feb. 15, 2008.

45 State of West Virginia Department of Environmental Protection, Division of Water and Waste Management, General National Pollution Discharge Elimination System Water Pollution Control Permit, NPDES Permit No. WV0116025 at 13-14 (June 22, 2009.

46 City of Philadelphia (Jan. 29, 2008) Stormwater Management Guidance Manual 2.0, at 1.1

Excerpted from Natural Resources Defense Council et al to US EPA Region 3, June 4, 2010

Re: Comments on Draft NPDES Permit No. 0000221 for the District of Columbia

VII. The Draft Permit's Green Infrastructure Provisions Are Important and Well-Justified But Need to Be Strengthened to Address Water Quality Impairment

We strongly support the Draft Permit's use of measurable low impact development and green infrastructure requirements. These techniques have proven to be cost effective and environmentally beneficial mechanisms for dealing with stormwater pollution. Green infrastructure measures specified in the Permit, such as green roofs and tree planting, not only control stormwater pollution, but have the added benefits of improving air quality, reducing energy costs, and creating green jobs. . . .

B. The Draft Permit Utilizes the Appropriate Retention Standard, But Related Permit Provisions Should Be Clarified and Strengthened to Ensure the Effective Implementation of that Standard

Though stronger retention requirements are feasible, the Draft Permit's on-site retention standards for new and redevelopment are reasonable. The draft Permit requires, "stormwater controls to achieve on-site retention of 1.2" volume of stormwater from a 24-hour storm with a 72-hour antecedent dry period through evapotranspiration, infiltration and/or stormwater harvesting." (Draft Permit § 4.1.1.a.) The Permit alternatively requires the retention of predevelopment runoff volume of stormwater from the same volume storm. (Id.) The draft Permit states that these requirements are triggered where development or redevelopment, "disturbs land greater than or equal to 5,000 square feet[.]" (Draft Permit § 4.1.1.)

The on-site retention of stormwater, with no discharge, prevents 100% of a specified volume of water from leaving a site, thereby preventing 100% of the pollutants in that runoff from mobilizing and reaching receiving waters. As a result, it is a superior method of stormwater control than conventional best management practices ("BMPs") or other methods that allow for offsite discharge or only address pollution after it has already mobilized in runoff. This method has proven to be not adequately protective of water quality through several cycles of MS4 permitting. Moreover, standards and practices requiring the on-site retention of stormwater have already been established in permits and ordinances throughout the U.S.[143] Their adoption in all corners of the country demonstrates the practicability of this approach to stormwater management, and thus, that practices resulting in the onsite retention of stormwater are required under the Clean Water Act's "maximum extent practicable" standard.[144]

1. The Retention Standards are Feasible and Cost Effective for Development and Redevelopment

Industry commenters sometimes complain that stormwater controls are infeasible or cost prohibitive, especially on redeveloped sites. Yet these claims are belied by numerous studies showing that green infrastructure can be effectively implemented in developed and redeveloped sites at a low cost while still meeting strict stormwater management standards. For example, a study of three redeveloped sites in Maryland found that, "For highly urban sites, ESD [environmental site design – another term for green infrastructure] was comparable or less expensive than a traditional stormwater system."[145] The study showed that all three sites were

able to meet Maryland's 1" retention standard using green infrastructure and to do so at a substantial cost savings – upward of 40% at all three locations.[146] Moreover, EPA's Energy Independence and Security Act of 2007 ("EISA") section 438 guidance establishes an obligation for developers of new or redeveloped federal properties to use management methods that keep the precipitation from a 95th percentile storm onsite.[147] The EISA guidance document provided case studies which compared the costs of installing onsite control measures utilizing green infrastructure against the costs to install traditional stormwater other development need only meet the less stringent 1.2" standard.[149] (Draft Permit § 4.1.1.a and b.)

Likewise, in a study conducted in the San Francisco Bay area, Richard Horner, a member of the National Academy of Sciences Panel on Reducing Stormwater Discharge Contributions to Water Pollution, demonstrated that even in an urban infill redevelopment site with limited to no infiltration capacity, it is possible to retain 78.9% of the annual stormwater that would otherwise have been discharged to the stormwater drain. For new development sites with adequate infiltration capacity, 100% of stormwater could be retained onsite in nearly all cases.[150]

Consistent with these findings, analysis of the specific requirements in the Draft Permit conducted by LimnoTech, Inc. demonstrates that an on-site retention standard of 1.7 inches is practicable in most areas of Washington, DC using on-site stormwater management techniques alone. It proves even more practicable when coupled with off-site mitigation or fee-in-lieu provisions.[151] Their analysis showed that, in most of the assessed sewersheds, sufficient opportunities are present to install stormwater practices that will provide adequate capacity to achieve 1.7 inches of stormwater retention. In reality, these sewersheds likely have even greater stormwater retention opportunities because the opportunity analysis only evaluated the potential of four stormwater practices; rainwater harvesting, for example, was not considered. In addition, the off-site mitigation and fee-in-lieu provisions provide additional flexibility in meeting the proposed stormwater standards. The opportunity analysis also demonstrates that several of the sewersheds have "excess" stormwater volume retention capacity to allow the off-site provisions to be exercised.[152] Given that the Permit requires retention of significantly less rainfall than Limnotech found could be feasibly retained, the Limnotech study is strong evidence of the practicable nature of the 1.2 inch requirement.

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[143] See e.g., California Regional Water Quality Control Board Los Angeles Region Order 01-182 NPDES Permit No. CAS004001 (Dec. 13, 2001) at 28-19; California Regional Water Quality Control Board San Diego Region Order No.R9-2009-0002, NPDES No. CAS0108740 (Dec. 16, 2009); Maryland Dep't of Env't NPDES MS4 Permit, Montgomery County, MD (009-DP-3320) (MD0068349); W. Virginia Dep't of Env't Protection Draft General National Pollution Discharge Elimination System Water Pollution Control Permit, NPDES Permit No. WV0116025; Md. Code Regs. 26.08.04; Phila. Water Dep't Regs. 600.0 et seq.

[144] 33 U.S.C. § 1342(p).

[145] Meliora Environmental Design LLC, Comparison of Environmental Site Design for Stormwater Management for Three Redevelopment Sites in Maryland, 2008.

[146] Id.

[147] See U.S. EPA, Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act, Dec. 4, 2009, available at http://www.epa.gov/owow/NPS/lid/section438/pdf/final_sec438_eisa.pdf.

[148] Id.

[149] Id.

[150] Richard R. Horner, Supplementary Investigation of the Feasibility and Benefits of Low-Impact Site Development Practices for the San Francisco Bay Area (2007) at 4-5; Richard R. Horner, Initial Investigation of the Feasibility and Benefits of Low-Impact Site Development Practices for the San Francisco Bay Area (2007) at 16.

[151] See LimnoTech, Inc., Analysis of the Pollution Reduction Potential of DC Stormwater Standards (July 24, 2009).
[152] Id.

Requirements for Green Infrastructure

Excerpted from Conservation Law Foundation (CLF) to US EPA Region 1, 3/31/2010

Re: Draft General Permit for Small Municipal Storm Sewer System for Massachusetts North Coastal Watersheds

III. Performance Standards Reflecting Low-Impact Development and Green Infrastructure

CLF strongly urges EPA to include in the permit performance standards that reflect Low-Impact Development or "green infrastructure" stormwater management practices. These practices are widely available, well proven, are generally more effective than conventional infrastructure at pollutant removal and volume reduction, and confer additional benefits to the community and environment. As detailed in attachments A,B,C, and D1-75 to this comment letter, **LID/green infrastructure is the current expression of controlling polluted stormwater runoff to the "maximum extent practicable" ("MEP").** Furthermore, the attached documents demonstrate that the permit cannot effectively ensure that water quality standards will be met *without* inclusion of such LID/green infrastructure-based performance standards. Performance standards based on LID/green infrastructure should be included in this permit.27 In particular, performance standards for LID/ green infrastructure should be included in Section 2.4.5, the Post-Construction bylaw, and should be required as the means by which permittees fulfill water-quality based requirements under Section 2.

From the outset, EPA has made clear the expectations that technologies would evolve, and that the Maximum Extent Practicable standard in the second round of small MS4 permits would reflect what was learned about the effectiveness of the BMP implemented during the first round. The need to meet water quality standards was to drive the evolution of the MEP standard, itself, because the ultimate objective of all BMPs is to ensure the attainment of water quality standards. As EPA expressed in the MS4 Final Rule:

> The Maximum Extent Practicable standard] should continually adapt to current conditions and BMP effectiveness and should strive to attain water quality standards. Successive iterations of the mix of BMPs and measurable goals will be driven by the objective of assuring maintenance of water quality standards. If, after implementing the six minimum control measures there is still water quality impairment associated with discharges from the MS4, after successive permit terms the permittee will need to expand or better tailor its BMPs within the scope of the six minimum control measures for each subsequent permit.

64 Fed. Reg. 68722, 68754 (Dec. 8, 1999) (EPA Stormwater Phase II Final Rule).

EPA anticipated that "the NPDES permitting authority may ask the permittee to revise their mix of BMPs, for example, to better reflect the MEP pollution reduction requirement." 64 Fed. Reg. 68722, 68754 (Dec. 8, 1999) (EPA Stormwater Phase II Final Rule). **At this juncture, ten years after the Small MS4 program was first enacted, and given the wealth of data generated in the interim, it would be inappropriate for EPA Region 1 *not* to include LID-based performance standards and revise the scope of required BMPs to reflect LID/green infrastructure.**

Comments by Dr. Robert Roseen, Director of the University of New Hampshire Stormwater Center on the draft permit (Attachment A) and Dr. Stephanie Hurley's Statement on Low-Impact Development (Attachment B) confirm that Low-Impact Development and green infrastructure is well tested, effective at stormwater volume reduction and pollutant removal, suitable for New England, and confers ancillary benefits. Dr. Roseen's professional opinion is that "LID stormwater management works effectively throughout multiple seasons including challenging winter conditions. Data shows that it works better for water quality than conventional stormwater management."[28] He also confirms that studies have shown LID to be cost effective and in some cases to result in cost savings.[29] Furthermore, Dr. Roseen cautions that "with the raising of the standards for MEP . . . certain practices should be *disallowed* for usage. Practices that have been demonstrated to be contributing to the water quality failures should be eliminated . . . ."[30]

Dr. Hurley's professional opinion regarding LID is that it "offers a more ecological, flexible, and context-sensitive stormwater management approach—and more readily meets water quality and hydrologic performance standards—than conventional stormwater management."31 Furthermore, Dr. Hurley has personally evaluated LID implementation sites at various locations throughout the U.S. and internationally, and confirms that "the principles of LID design can be successfully applied in various topographies, geographies, and climates" including New England, and at a variety of scales.[32] Her conclusion is that LID represents the maximum extent practicable for stormwater treatment.[33]

The direct testimony of Richard Horner, before the Pollution Control Hearings Board for the State of Washington in the matter of the Seattle Phase I stormwater permit (Attachment D3) affirmed that LID techniques are " unquestionably 'known' and 'available' techniques. In many cases, implementation of LID for new or redevelopment is less costly than conventional BMPs, and offers other economic benefits such as improved property values or reduced water use."[34] Dr. Horner further asserted that the Seattle Phase I permit at issue did not "use all known available and reasonable methods" to control stormwater from new and redevelopment, and it was "highly unlikely" that compliance with water quality standards could be achieved using conventional techniques.[35] Further, he asserted that "LID approaches are far more protective of water quality than the conventional BMPs" and that the permit did not reflect the maximum extent practicable standard.[36]

The direct testimony of Dr. Derek Booth in the same matter asserted that "the [Seattle Phase I] Permit . . . does not protect rivers and streams, beneficial uses, or aquatic life. Continued reliance on such a [flow-based] standard for new development in western Washington will not prevent serious and significant additional degradation to these resources," and in his professional opinion, "a more protective performance standard that more closely matches natural hydrology . . . is readily achievable without sacrificing opportunities for future development. Achieving a more protective standard would rely on site- and basin-level LID BMPs that are in my opinion, sufficiently well known, understood, available and economically and technologically feasible that they can be implemented throughout western Washington."[37]

Thomas Holz, an experienced civil engineer, testified that "LID approaches are generally more effective at protecting water quality and beneficial uses than the engineered, end-of-pipe standards embraced in the 2005 [Washington] Manual and Permit. They are known, available, and reasonable (as well as "practicable") in virtually all new and redevelopment situations. (Attachment D1, at ¶ 33.) **In addition, a wealth of technical articles, case studies, litigation documents, and federal government guidance documents and fact sheets summarized in Attachment C and included as Attachments D4-75 all demonstrate these principles.**

The greater adoption of LID, spurred by regulatory approaches including the MS4 permit, will benefit Massachusetts communities by keeping pollutants and concentrated pulses of stormwater out of our rivers, ponds and streams, generating increased green space, cooling urban areas, and relieving some of the cost and maintenance burden on aging municipal stormwater infrastructure.

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[23] If this is a reference to 314 Code Mass. Regs. 4.04(5), it appears to be mischaracterized. That section requires a four part analysis to be performed by the applicant to demonstrate that a number of substantive criteria are met before *"limited degradation"* (i.e. a new or increased discharge) is allowed to a high quality water. 4.04(5) would not be properly characterized as a de minimis threshold.

[24] *Environmental Defense Center v. Browner,* 344 F.3d 832, 840 (9th Cir. 2003), *cert. denied*, 124 S.Ct.2811 (2004).

[25] *See* 40 C.F.R. § 122.4.

[26] including the Hobbs Brook Reservoir, which is listed as a Class A, Outstanding Resource Water. *See* 314 Code Mass. Regs. 4.06, Figures, available at http://www.mass.gov/dep/water/laws/tblfig.pdf.

[27] Whether an expression of technology-based effluent limitations, water-quality based effluent limitations, or both, such performance standards are timely and necessary for the reasons described above.

[28] Attachment A, at 1.

[29] *Id.* at 2.

[30] *Id.* at 1 (emphasis added).

[31] Attachment B, at 2.

[32] *Id.* at 2-3.

[33] *Id.* at 3.

[34] (Attachment D3, at ¶27).

[35] *Id.*

[36] *Id.*

[37] Attachment D2, at ¶ 33.

Excerpted from Waterkeeper Alliance to New York State Dep't of Environmental Conservation, Dec. 12, 2007,

Re. Draft State Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (MS4s), Permit No. GP-0-08-002

IX. The Permit Should Do More to Require and Encourage Smart Growth, Better Site Design, and Low Impact Development (LID) to Reduce Municipal Stormwater Pollution.

Smart growth, LID, and better site design have the potential to reduce stormwater, and its associated problems and risks, at the source. By reducing stormwater at its source, the need for stormwater BMPs and treatment facilities is reduced, saving time and money. Smart growth is planned development that focuses on urban in-fill rather than urban sprawl or development of green spaces, and typically features compact, mixed-use, and mass-transit development or redevelopment. Puget Sound Action Team, 2000. Better site design includes site and subdivision design techniques that minimize the impacts on topography, hydrology, vegetation, natural habitat(s), groundwater recharge, and stormwater runoff at the site of development and offsite. Fairfax County, 2005. LID is a comprehensive land planning and engineering design

approach with a goal of maintaining and enhancing the pre-development hydrologic conditions of developing watersheds. Low Impact Development Center, 2005. LID, depending on the site, may encompass the principles of smart growth and better site design.

It is now widely acknowledged these measures, and other source control measures that retain stormwater runoff for beneficial reuse and/or allow it to infiltrate it into the soil before it reaches storm sewers, can be highly effective in controlling stormwater pollution in a cost-effective manner while also providing ancillary environmental benefits, such as providing more greenspace, helping urban vegetation to flourish, and counteracting the urban heat island effect. These measures – which include green roofs, trees and tree boxes, rain gardens, permeable pavement, rain barrels, among other things – were recently touted by EPA in a guidance memo emphasizing that "green infrastructure" approaches that "infiltrate, evapotranspirate, or reuse stormwater" and "decentralized storage and infiltration approaches" can be "a cost-effective and environmentally preferable approach to reduce stormwater and other excess flows entering combined or separate sewer systems." U.S. EPA, *Using Green Infrastructure to Protect Water Quality in Stormwater, CSO, Nonpoint Source and other Water Programs,* Office of Water (March 5, 2007), available at http://www.epa.gov/npdes/pubs/greeninfrastructure_h2oprograms_07.pdf. In addition, the Association of State and Interstate Water Pollution Control Administrators, the National Association of Clean Water Agencies, and the Wet Weather Partnership have also publicly acknowledged the importance of these measures for controlling stormwater pollution. Further, the Phase II stormwater rule promotes smart growth principles by "encouraging policies that limit the adverse impacts of growth and development on water quality." (Federal Register, 1999.)

Developed areas are chronic sources of pollutants and significantly alter a watershed's hydrology, not just its landscape. Post-construction stormwater harms water quality and ecosystems through:

- Hydromodification, including flooding;
- Poisoning biota;
- Endangering public health, including drinking water supplies; and
- Increasing surface water temperatures.

When pervious rural and forest land is converted to impermeable developed surfaces, rainfall is converted to runoff, causing a fundamental disruption in the hydrologic cycle. The terrain, vegetation and soil characteristics, and the introduction of impervious surfaces transform stream conditions. Streams rise higher, flow faster, and reach peak flows, leading to bankfull events, more quickly than streams under natural conditions. Streams and rivers immediately begin to adjust their cross-sectional areas through incision, widening, or both, to accommodate larger flows (United States Environmental Protection Agency, 2002). Channels become increasingly unstable, with unvegetated banks, scoured or muddy beds, and sediment and debris accumulation that accelerate sediment transport and destroy habitat.

Hydromodification includes:

- Direct hardening or other modification to channels,
- Increased magnitude and frequency of bankfull events and subbankfull floods,
- Imbalances in stream equilibrium,
- Enlargement of channels,
- Upstream channel erosion that contributes greater sediment loads to the stream,
- Reduced dry weather flow to the stream,
- Decreased wetland perimeter of the stream,
- Fragmented riparian forests that are narrower and less diverse,
- Degraded in-stream habitat structure,
- Reduced large woody debris,

Increased stream crossings and potential fish barriers,
Increased stream temperatures,
Reduced aquatic diversity, and declines in water quality
(United States Environmental Protection Agency, 2007a).

Unfortunately, the Draft MS4 Permit mentions LID only in passing as an example of a non-structural post-construction measure that may be included in SWMPs, see Parts VII.5.a.iv and VIII.a.iv, but does not require or even encourage such measures.
The Permit should be revised to require the use of smart growth, LID, and better site design techniques sets the standard for proactive stormwater management. In particular, smart growth requirements, should include anti-sprawl measures such as:

Brownfield development,
Urban infill,
Greenspace preservation, and
Buffers and setback requirements.

Better site design should include limits on impervious surfaces such as reductions in:

Street width,
Street length,
Cul de sac areas,
Residential right of way widths,
Driveways and sidewalks,
Side yard setbacks (homes closer together),
Front yard setbacks/frontage (reduced driveway length) and
Parking lot area (through designs that maximize the number of spaces per unit area or use structured parking rather than lots).

Low impact development options should include:

Porous pavers for sidewalks, driveways, and parking lots;
The use of bioretention and filter strips for stormwater treatment in parking lots;
Vegetated open channels in right of ways;
Eliminating curb and gutter in favor of roadside swales;
Disconnected downspouts;
Rainwater use through rain barrels, rain gardens, and green roofs;
Use of native vegetation rather than turf for yards and green spaces; and
Preservation of riparian areas.

At the very minimum, the Permit should include a provision similar to the following, taken from another state's small MS4 permit:

Permittees should consider including provisions to allow non-structural preventive actions and source reduction approaches such as Low Impact Development (LID) techniques, measures to minimize the creation of impervious surfaces and measures to minimize the disturbance of native soils and vegetation. Provisions for LID should take into account site conditions, access and long term maintenance.

National Pollutant Discharge Elimination System and State Waste Discharge General Permit for Discharges from Small Municipal Separate Storm Sewers in Eastern Washington, at S5.B.5.a.ii (State of Washington, Department of Ecology, February 16, 2007).

In addition, the Permit should go beyond that and specifically promote LID, as EPA Region 10 recommended to Washington State in its comments on that permit.[16] EPA also recommended requiring permitees to: (1) identify current and potential non-structural actions to prevent stormwater impacts; and (2) establish goals and metrics to promote and measure LID use with

the intent that LID and non-structural actions be implemented widely throughout the area covered by the permit. Id.

[16] See Letter from EPA Region 10 Administrator Ronald A. Kreizenbeck, EPA to Jay Maning, Director, Washington State Department of Ecology, Oct. 27, 2006, attached at Appendix B.

Excerpted from Natural Resources Defense Council, San Francisco Baykeeper to San Francisco Regional Water Quality Control Board, April 3, 2009

Re. February 11, 2009, Draft San Francisco Bay Municipal Regional Stormwater NPDES Permit *(The draft permit is referred to throughout as the Tentative Order).*

IV. <u>The Tentative Order Is Inadequate to Control StormwaterPollution from New Development and Redevelopment and Fails to Ensure Compliance with the Minimum Requirements of State and Federal Law</u>

The Tentative Order's New Development and Redevelopment section remains legally inadequate and is not based on substantial evidence in the record before the Regional Board. As currently written, the Tentative Order does not require any specific level of LID implementation and would, as explained below, allow relatively ineffective conventional treat-and-discharge techniques, as well as wholesale waivers of otherwise universally applicable SUSMP sizing criteria. There is no stated analysis that supports the staff's proposals here or provides even a general assessment of the water quality impact of the proposed approach and, in particular, its extensive, unprecedented waiver provisions. Furthermore, the Tentative Order fails to meet the goals that staff articulate for it in the Fact Sheet, and it falls well below many other stormwater permits and regulatory documents around the country. In all of these respects, staff have failed to adequately respond to comments, deflecting in the most cursory fashion significant, expert comments submitted for their consideration.

. . .

The New Development and Redevelopment section is particularly critical for addressing the root causes of stormwater pollution, which is why we have heavily focused our comments here and in previous letters on these requirements. As the U.S. EPA has noted: "Most stormwater runoff is the result of the man-made hydrologic modifications that normally accompany development. The addition of impervious surfaces, soil compaction, and tree and vegetation removal result in alterations to the movement of water through the environment. As interception, evapotranspiration, and infiltration are reduced and precipitation is converted to overland flow, these modifications affect not only the characteristics of the developed site but also the watershed in which the development is located. Stormwater has been identified as one of the leading sources of pollution for all waterbody types in the United States. Furthermore, the impacts of stormwater pollution are not static; they usually increase with more development and urbanization."[3]

A. Research and Experience Around the Country Have Demonstrated that Low Impact Development Techniques Are Superior Stormwater Management Practices and Must Be Implemented with Clear Metrics.

While the Fact Sheet notes that "LID [is] a beneficial, holistic, integrated stormwater management strategy," (Fact Sheet, at 24), LID has been established, in fact, as a *superior and practicable* strategy and, therefore, must be required. In California, the Ocean Protection

Council, for instance, strongly endorsed LID last year by "resolv[ing] to promote the policy that new developments and redevelopments should be designed consistent with LID principles" because "LID is a practicable and superior approach . . . to minimize and mitigate increases in runoff and runoff pollutants and the resulting impacts on downstream uses, coastal resources and communities."[4] EPA has also called upon Regional Boards across California to prioritize the implementation of LID, even "recommend[ing] that the [South Orange County draft] permit be revised to put more emphasis on LID . . . [and to] require[] that LID be woven into the design of

specified new development and redevelopment projects."[5] Outside of California, the issues are the same—in Washington State, for instance, the Pollution Control Hearings Board has found that LID techniques are technologically and economically feasible and must, therefore, be required in MS4 permits.[6] The National Academy of Sciences recently issued a comprehensive report with the same recommendation for stormwater management programs: "Municipal permittees would be required under general state regulations to make [LID] techniques top priorities for implementation in approving new developments and redevelopments, to be used unless they are formally and convincingly demonstrated to be infeasible."[7]

Critically, the prioritization of LID practices is insufficient by itself to meet the MEP standard and *must* be paired with a measurable requirement for the implementation of LID. Since its inception, the MS4 permitting program has been seriously hampered by a pervasive absence of numeric performance standards for the implementation of best management practices ("BMPs") such as LID. For this reason, in December 2007, the State Water Resources Control Board commissioned a report which found that "[t]he important concept across all of [the] approaches [described in the report] is that the regulations established a *performance requirement* to limit the volume of stormwater discharges."[8] The report also noted that "[m]unicipal permits have the standard of Maximum Extent Practicable (MEP) which lends itself more naturally to specifying and enforcing a level of compliance for low impact development."[9] Another study, completed for the Ocean Protection Council, recommended the following standard: "Regulated development projects shall reduce the percentage of effective impervious area to less than five percent of total project area by draining stormwater into landscaped, pervious areas."[10] This is the same type of approach that we have advocated and scientifically supported for the Bay Area.

EPA has highlighted similar but more specific concerns, remarking that the MRP "needs to include a numeric value for the quantity of runoff which would be directed to pervious areas" and "suggest[ing] a requirement such as proposed in the August 2007 draft Ventura County MS4 permit [5% EIA]."[11] In South Orange County, EPA likewise observed that "the permit must include clear, measurable, enforceable provisions for implementation of LID…. We would not support replacing … approaches [such as EIA] with qualitative provisions that do not include measurable goals."[12] The MRP, however, contains nothing other than qualitative provisions, as explained below and in previous comment letters, and thus fails to satisfy the Clean Water Act's requirements.

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C. The Tentative Order's Post-Construction Provisions Do Not Meet the Clean Water Act's "Maximum Extent Practicable" Standard for Stormwater Pollution Reduction.

Our February 9, 2008, letter discussed various failings of the Tentative Order that prevent it from meeting the MEP standard. Little has changed from the prior draft of the Tentative Order,

unfortunately, as noted above, and the Tentative Order's post-construction provisions are still far from legally adequate.

1. The MEP Standard Requires that the Tentative Order Impose Far More Stringent Stormwater Control Measures and Performance Criteria.

Section 402(p) of the Clean Water Act establishes the MEP standard as a requirement for pollution reduction in stormwater permits. Regional Board staff have failed to implement this standard, apparently believing that it grants them unbridled discretion and allows them to exclude effective practices commonly implemented. In fact, "the phrase 'to the maximum extent practicable' does not permit unbridled discretion. It imposes a clear duty on the agency to fulfill the statutory command to the extent that it is feasible or possible." (*Defenders of Wildlife v. Babbitt* (D.D.C. 2001) 130 F.Supp.2d 121, 131 (internal citations omitted); *Friends of Boundary Waters Wilderness v. Thomas* (8th Cir. 1995) 53 F.3d 881, 885 ("feasible" means "physically possible").) As one state hearing board held:

[MEP] means to the fullest degree technologically feasible for the protection of water quality, except where costs are wholly disproportionate to the potential benefits…. This standard requires more of permittees than mere compliance with water quality standards or numeric effluent limitations designed to meet such standards…. The term "maximum extent practicable" in the stormwater context implies that the mitigation measures in a stormwater permit must be more than simply adopting standard practices. This definition applies particularly in areas where standard practices are already failing to protect water quality… (*North Carolina Wildlife Fed. Central Piedmont Group of the NC Sierra Club v. N.C. Division of Water Quality* (N.C.O.A.H. October 13, 2006) 2006 WL 3890348, Conclusions of Law 21-22 (internal citations omitted).) The North Carolina board further found that the permits in question violated the MEP standard both because commenters highlighted measures that would reduce pollution more effectively than the permits' requirements and because other controls, such as infiltration measures, "would [also] reduce discharges more than the measures contained in the permits." (*Id.* at Conclusions of Law 19.)

Similarly, in the Bay Area, we have demonstrated that an onsite retention standard based on the effective impervious area of a site would be a technologically feasible approach that would reduce stormwater discharges and pollution far more than the measures contained in the Tentative Order.28 We have even called to the Regional Board's attention an EPA study which found that LID practices are frequently *less costly* than conventional stormwater BMPs,[29] and we have submitted our own technical analyses highlighting the cost savings that accrue from saving water through LID.[30] Additionally, no one has offered concrete evidence that a single site in the Bay Area could not meet this standard, assuming that—as we have consistently recommended—the Tentative Order includes an appropriate infeasibility provision tied to a technically equivalent alternative compliance requirement. The Tentative Order, as written, fails to uphold the MEP standard because it does not impose anything close to the maximum technologically practicable, but not disproportionately expensive, stormwater management BMPs with an accompanying quantitative performance requirement.

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[3] U.S. Environmental Protection Agency (December 2007) *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, at v.
[4] California Ocean Protection Council (May 15, 2008) *Resolution of the California Ocean Protection Council Regarding Low Impact Development*, at 2.
[5] E-mail from Eugene Bromely, U.S. Environmental Protection Agency, to San Diego Regional Water Quality Control Board (January 24, 2008), re: Draft MS4 Permit for Southern Orange County, at 1.

[6] *Puget Soundkeeper Alliance et al. v. State of Washington, Dept. of Ecology et al.* (2008) Pollution Control Hearings Board, State of Washington, No. 07-021, 07-026, 07-027, 07-028, 07-029, 07-030, 07-037, Phase I Final, at 6, 46, 57-58.
[7] National Academy of Sciences, Committee on Reducing Stormwater Discharge Contributions to Water Pollution, National Research Council (2008) *Urban Stormwater Management in the United States*, at 500.
[8] State Water Resources Control Board (December 2007) *A Review of Low Impact Development Policies: Removing Institutional Barriers to Adoption*, at 23 (emphasis added) (hereinafter "SWRCB LID Report").
[28] Horner Initial Investigation, at 3, 16-19; Horner Supplementary Investigation, at 4-5.
[29] U.S. Environmental Protection Agency (December 2007) *Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices*, at iv, 2, 27. *See also* ECONorthwest (November 2007) *The Economics of Low-Impact Development: A Literature Review*.
[30] Letter from NRDC to Bruce Wolfe, San Francisco Regional Water Quality Control Board (July 17, 2007), at 6.