COMPENDIUM OF MS4 PERMITTING APPROACHES

PART 6: GREEN INFRASTRUCTURE

Office of Wastewater Management
Water Permits Division
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Abbreviations

BMP	best management practice
BSD	better site design
EPA	U.S. Environmental Protection Agency
ESD	environmental site design
GIS	geographic information system
IAR	impervious area restoration
LID	low impact development
MEP	maximum extent practicable
MS4	municipal separate storm sewer system
MSD	Metropolitan Sewer District
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PCB	polychlorinated biphenyl
TDA	threshold disurbance area
TMDL	total maximum daily load
TSS	total suspended solids
WQV	water quality volume

1 Introduction

The U.S. Environmental Protection Agency (EPA) encourages the use of green infrastructure to manage stormwater discharges. While local codes, stormwater utilities, and other innovative financing mechanisms often create standards and incentives for green infrastructure, regulatory drivers such as permits can also provide an effective foundation for consistent implementation of green infrastructure at the local, state, or cross-jurisdictional level. This compendium presents a variety of existing permitting approaches that encourage or require green infrastructure in municipal separate storm sewer systems (MS4s); it also provides excerpts from current state and EPA MS4 permits and examples of how MS4 permittees implement green infrastructure permit requirements. These excerpts and examples can serve as a road map for permitting authorities and permittees that are interested in incorporating green infrastructure into permitting programs or identifying successful strategies to maintain compliance. To develop this compendium, EPA reviewed final individual and general National Pollutant Discharge Elimination System (NPDES) MS4 permits issued through August 2021.

This compendium is part of a series of compendia of MS4 permit excerpts and is intended to serve as a snapshot of permit provisions. As permits are reissued or revised, EPA may update this compendium to include more recent examples and new information. EPA also welcomes input on this compendium and expects to update it as appropriate based on the comments received. EPA notes that the inclusion of any particular permit example should not be read as an endorsement of the entire approach taken in that permit, nor should it be read as EPA's independent determination that the permit terms meet the Phase I and/or Phase II MS4 requirements.

In addition, this document does not impose any legally binding requirements on EPA, states, or the regulated community and does not confer legal rights or impose legal obligations upon any member of the public. EPA made every attempt to ensure the accuracy of the examples included in this document. In the event of a conflict or inconsistency between this compendium and any statute, regulation, or permit, it is the statute, regulation, or permit that governs, not this compendium. For more information about the NDPES Stormwater Program, visit www.epa.gov/npdes/stormwater.

1.1 Background

The Clean Water Act defines green infrastructure as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspirate stormwater and reduce flows to sewer systems or to surface waters" as per 33 U.S.C. 1362(27). Green infrastructure uses soils, vegetation, and other media to manage rainwater where it falls. Green infrastructure provides a wide variety of community benefits, including improving water and air quality, recharging groundwater, mitigating flooding, reducing urban heat island effects, creating habitats for pollinators and other wildlife, and providing aesthetic and recreational value to community residents. Green infrastructure approaches may also be less expensive to install and maintain than gray infrastructure alone (stormwater systems of gutters, detention ponds, pipes, and other hard structures to collect and store stormwater). Stormwater systems using a combination of green and gray infrastructure can enhance the overall resiliency and performance of an MS4. More information on green infrastructure is available at https://www.epa.gov/green-infrastructure.

MS4s may be regulated under Phase I or Phase II MS4 rules. Phase I MS4 permittees are typically covered by individual permits and can include multiple co-permittees. Most Phase II MS4 permittees are covered under general permits. Phase II permits must include "clear, specific, and measurable" requirements, per 40 CFR 122.34(a). Phase II permits must also include requirements related to the six

minimum control measures: public education and outreach, public participation and involvement, illicit discharge detection and elimination (IDDE), construction site stormwater control, post-construction stormwater control, and pollution prevention and good housekeeping. Occasionally, MS4s may have permit coverage under a watershed permit or cross-jurisdictional permit. A watershed permit is a general permit covering the geographic bounds of a watershed. In this compendium, there are examples of both Phase I and Phase II MS4 permittees with coverage under a watershed permit. A cross-jurisdictional permit is a term used in this compendium to describe an individual MS4 permit covering more than one municipality. The cross-jurisdictional permit examples in this compendium are for Phase I MS4s only.

EPA reviewed a sample of individual, general, cross-jurisdictional, and watershed MS4 permits from all 10 EPA Regions. The permit excerpts featured in this compendium (see Figure 1) include green infrastructure requirements that could satisfy the regulatory requirement for "clear, specific, and measurable" permit terms and conditions. These examples aim to showcase the diverse types of green infrastructure requirements in MS4 permits and serve as a reference for permit writers.

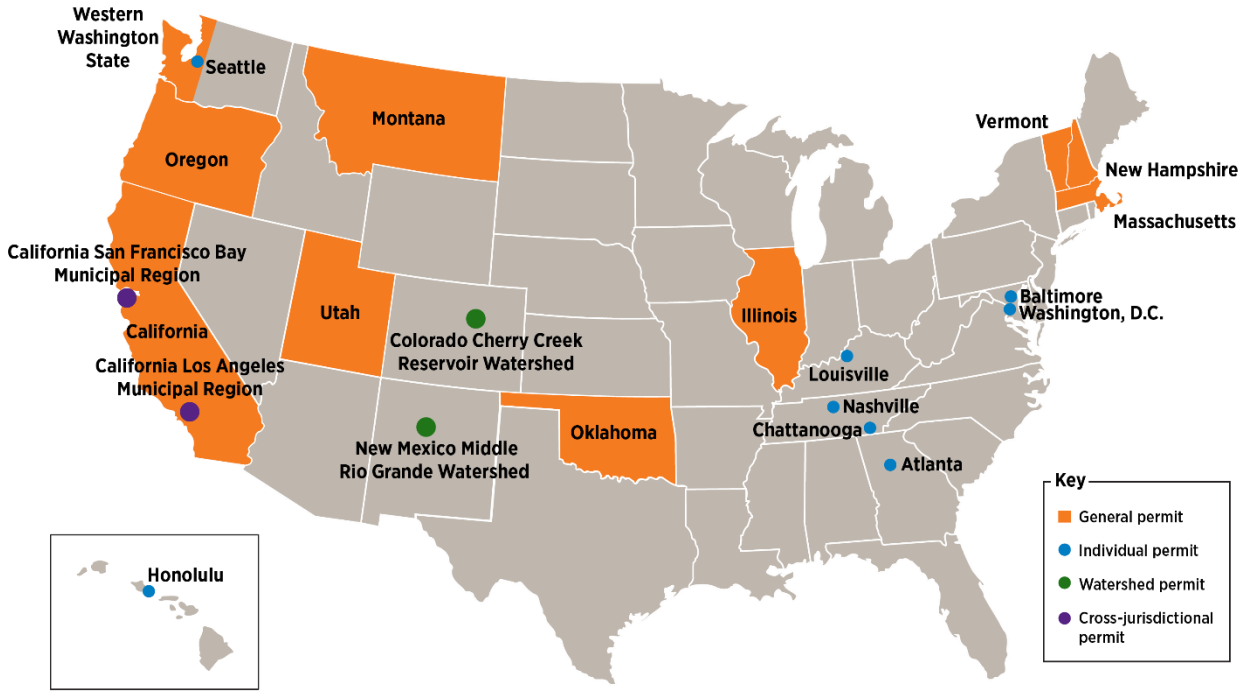

Figure 1. Map of permit excerpts included in the compendium.

During the review process, EPA found the following common green infrastructure requirements across many MS4 permits:

- Educate the general public and private industry on the benefits of green infrastructure.
- Establish regulatory mechanisms to promote or require the use of green infrastructure.
- Assess local codes and ordinances for barriers to green infrastructure implementation and identify strategies to remove those barriers.
- Consider and/or promote the use of green infrastructure as part of the new development or redevelopment approval processes.

- Establish post-construction stormwater volume control performance standards to reduce pollutants in stormwater.
- Use green infrastructure to meet specific pollutant reduction goals.

EPA did not identify many differences in green infrastructure permitting requirements specific to geographic region. However, EPA found that permittees on the West Coast often had very specific requirements for performance standards, types of green infrastructure that should be used, and compliance documentation. EPA also found that many permits in the Midwest and Southwest do not include post-construction stormwater performance standards or require the use of specific types of green infrastructure.

1.2 Getting Started

Each section of this compendium presents examples of how green infrastructure requirements are incorporated into permits and examples of how permittees are implementing those requirements. To make it easier for permit writers to find relevant material, permit examples are grouped by topic areas in the sections that follow:


Public Education and Outreach


Illicit Discharge Detection and Elimination (IDDE)


Post-Construction


Pollution Prevention


Monitoring


Specific Stormwater Pollutants

The topic areas discussed in Sections 2 through 5 align with four of the six Minimum Control Measures found in Phase II permits. However, the permit examples in these sections are not exclusive to Phase II permittees—examples from Phase I, cross-jurisdictional, and watershed permits are also included. Most green infrastructure permit language is associated with post-construction requirements, so the section on this topic has been further subdivided into the following categories: establishing regulatory mechanisms, assessing regulatory mechanisms, implementation plans (establishing baselines and retrofit plans), inspection and maintenance, performance standards, and green infrastructure plans.

Each section includes at least one example permit with green infrastructure requirements. Each example permit write-up (see general format in the box below) includes a summary of the permit type and conditions and a referenced excerpt of the permit language. It may also include a blue box with an implementation example, summarizing how the permittee complied with the permit requirements in the preceding excerpt.

1 Introduction

City, State Permit Type
Brief summary of permit.

Regulatory Reference

Direct excerpt of permit language.

Implementation Example:

Snapshot of how a/the permittee is implementing the above permit requirement.

The excerpt language is quoted directly and full text is available in the referenced permit. Note that some permits use alternate terms or multiple terms to reference green infrastructure. Terminology varies between permit-issuing agencies and has evolved over time. Implementation examples and explanatory text use the term "green infrastructure," and alternate terms are identified prior to each excerpt.

The compendium includes excerpts from the following MS4 permits:

MS4 Permit	Effective Date	Topics Covered
Region 1		
Massachusetts Phase II Permit	7/1/2018	• Assessing regulatory mechanisms
New Hampshire Phase II Permit	7/1/2018	• Green infrastructure implementation
Vermont Phase II Permit	7/27/2018	• Assessing regulatory mechanisms • Performance standards • Public education and outreach programs
Region 3		
Baltimore, Maryland, Phase I Permit	12/27/2013	• Green infrastructure implementation
Washington, District of Columbia, Phase I Permit	6/22/2018	• Establishing regulatory mechanisms • Green infrastructure implementation • Green infrastructure inspection and maintenance • Performance standards

MS4 Permit	Effective Date	Topics Covered
Region 4		
Atlanta, Georgia, Phase I Permit	6/11/2019	• Green infrastructure inspection and maintenance
Louisville, Kentucky, Phase I Permit	2/1/2017	• Mapping • Operation and maintenance procedures • Performance standards • Public education and outreach activities
Chattanooga, Tennessee, Phase I Permit	1/1/2011	• Assessing regulatory mechanisms • Performance standards
Nashville, Tennessee, Phase I Permit	2/1/2012	• Green infrastructure and monitoring
Region 5		
Illinois Phase II Permit	3/1/2016	• Green infrastructure inspection and maintenance
Region 6		
New Mexico Middle Rio Grande Watershed Permit	12/22/2014	• Establishing regulatory mechanisms
Oklahoma Phase II Permit	6/1/2021	• Assessing regulatory mechanisms
Region 8		
Colorado Cherry Creek Reservoir Watershed Permit	7/1/2016	• Performance standards
Montana Phase II Permit	1/1/2017	• Assessing regulatory mechanisms • Performance standards
Utah Phase II Permit	05/12/2021	• Green infrastructure implementation • Performance standards
Region 9		
California Los Angeles Municipal Regional Stormwater Permit	12/28/2012	• Establishing regulatory mechanisms • Performance standards
California Phase II Permit	7/1/2013	• Green infrastructure monitoring • Performance standards
California San Francisco Bay Municipal Regional Stormwater Permit	1/1/2016	• Green infrastructure plans • Specific stormwater pollutants • Performance standards

1 Introduction

MS4 Permit	Effective Date	Topics Covered
Honolulu, Hawaii, Phase I Permit	9/1/2020	• Green infrastructure inspection and maintenance
Region 10		
Oregon Phase II Permit	3/1/2019	• Performance standards
Seattle, Washington, Phase I Permit	8/1/2019	• Assessing regulatory mechanisms • Performance standards • Public education and outreach programs
Washington Phase II Western Permit	8/1/2019	• Assessing regulatory mechanisms • Public education and outreach programs

2 Public Education and Outreach

As demonstrated in the permit excerpts below, green infrastructure public education and outreach requirements often include educating private property owners and industry professionals involved in site development about green infrastructure benefits. This section also includes a permit excerpt with a requirement to promote a specific green infrastructure initiative. The highlighted implementation examples demonstrate how permittees met the requirements in the permit excerpts by establishing outreach programs, holding community demonstrations about green infrastructure installation, creating publicly available design resources, hosting educational seminars, and providing professional development programs on green infrastructure design and maintenance. Permittees publicized these programs through public events, newsletters, and digital media campaigns.

Seattle, Washington, Phase I Permit

The Washington State Department of Ecology issued a Phase I MS4 individual permit that includes requirements to build awareness of low impact development (LID) principles and green infrastructure among the general public and private industries. Note that this permit refers to green infrastructure as "LID."

Section S5.C.11.a.i Excerpt

> To build general awareness, Permittees shall target the following audiences and subject areas:
>
> (a) Target Audiences: General Public (including school age children and overburdened communities), and businesses (including home-based and mobile business). Subject areas:
>
> - General impacts of stormwater on surface waters, including impacts from impervious surfaces and of the hazards associated with illicit discharges and improper disposal of waste.
> - LID principles and LID BMPs.
>
> (b) Target audiences: Engineers, contractors, developers, and land use planners.
>
> Subject areas: Technical standards for stormwater site and erosion control plans.
>
> - LID principles and LID BMPs.
> - Stormwater treatment and flow control BMPs/facilities.
>
> (c) Permittees shall provide subject area information to the target audience on an ongoing or strategic schedule.

Implementation Example: Seattle Educational Programs

The city of Seattle, Washington's 2020 *Stormwater Management Plan* includes programs that educate target audiences about LID principles, green infrastructure, and stormwater flow controls.

For example, RainWise is a community education and financial support program that promotes the installation of green infrastructure, including rain gardens and cisterns, on private property. The program targets the general public, property and business owners/managers, and landscaping contractors. Through the RainWise program, the city installs demonstration projects in the community, provides rain garden design resources, holds multilingual rain garden and rain barrel installation workshops, maps and highlights residential and commercial projects, and provides rebates to homeowners that install green infrastructure.

In addition, the city's sustainable landscaping professional development programs target engineers, contractors, developers, and land use planners and focus on technical standards for stormwater and erosion control plans. The programs also provide workshops for professionals, that cover site design, stormwater flow control, green infrastructure design and maintenance, native plant use and soil management, construction sediment control, and applicable regulations and codes. The city addresses barriers to participation by offering training materials in languages besides English.

2 Public Education and Outreach

Vermont Phase II Permit

The Vermont State Department of Environmental Conservation issued a Phase II MS4 general permit that includes requirements to help property owners implement green infrastructure. Note that this permit refers to green infrastructure as "low-impact BMPs."

Part 6.2.1.c.2 Excerpt

> c) The permittee shall include the following public education and outreach measures in its program:
>
> …
>
> > (2) Maintain on its own or in cooperation with other regulated small MS4s a program to identify opportunities for and provide technical assistance to landowners in the implementation by landowners of low impact BMPs such as maximizing disconnection, maximizing infiltration of stormwater runoff, preventing and eliminating soil erosion, and preventing and eliminating the delivery of pollutants to stormwater conveyances.

Implementation Example: Lake Champlain Regional Cooperation

Twelve Phase II MS4 permittees in Chittenden County, Vermont, created the Regional Stormwater Education Program (RSEP) in 2003. The participating permittees "pool resources to professionally engage the public in a one message, one outreach effort" to satisfy the public education and outreach permit requirements (*MS4 2019 Annual Report*). RSEP maintains a website, hosts educational seminars, conducts surveys, coordinates with other organizations, engages contractors, and manages educational media campaigns that include television, radio, YouTube, social media, and print content. The city of South Burlington's *Stormwater Management Plan* notes that "RSEP is able to distribute this information to a wider audience than any municipality could reasonably achieve on its own."

Washington Phase II Western Permit

The Washington State Department of Ecology issued an MS4 general permit that covers Phase II permittees in the western part of the State and includes requirements to identify and tailor stormwater education for a target audience. Note that this permit refers to green infrastructure as "LID BMP."

Section 5.C.2.a.i.a-b Excerpt

> To build general awareness, Permittees shall annually select at a minimum one target audience and one subject area from either (a) or (b):
>
> (a) Target audiences: General public (including overburdened communities, or school age children) or businesses (including home-based, or mobile businesses). Subject areas:
>
> - General impacts of stormwater on surface waters, including impacts from impervious surfaces.
> - Low impact development (LID) principles and LID BMPs.
>
> (b) Target audiences: Engineers, contractors, developers, or land use planners. Subject areas:
>
> - Technical standards for stormwater site and erosion control plants.
> - LID principles and LID BMPs.
> - Stormwater treatment and flow control BMPs/facilities.

Implementation Example: Kitsap County Rain Gardens

In Kitsap County, Washington, the Green Stormwater Solutions Program provides educational training programs and events. The program partners with local organizations and local master gardeners to enhance public education initiatives.

According to *Education and Outreach: 2019 Activities Report*, the program includes outreach events at libraries, festivals, and workshops to educate residents on the use of rain gardens. Rain garden resources for residents include a *Rain Garden Handbook for Western Washington* and master gardener volunteers. The county also offers a two-day Professional Rain Garden Workshop for contractors, Rain Garden Mentors, and government staff in the design, installation, and ongoing maintenance of rain gardens.

The rain garden education and outreach efforts in Kitsap County and the Puget Sound region are documented on the "12,000 Rain Gardens" webpage.

Louisville, Kentucky, Phase I Permit

The Kentucky Energy and Environment Cabinet issued a Phase I MS4 individual permit that includes requirements to promote a green infrastructure initiative at a specified frequency.

Section 2.7, Table 1 Excerpt (Partial Table)

Table 1. Public Education, Outreach, Participation, and Learning Experiences Con't

The city of St. Matthews has an inter-local agreement with MSD, the primary Co-Permittee on this MS4 permit; the responsibilities are divided according to Section 1.2.1.		
Element Task	**Frequency or Measure of Success**	**Activity Required**
Green-up Program	Permittee shall advertise the Green-up program at least four (4) times per year in Newsletter	The permittee shall continue its program to help eliminate asphalt or concrete parking pads/pull-offs located in existing right-of-ways. This program consists of residents who are willing to improve water quality can have the concrete parking pad/pull off removed and restored to natural turf at no expense to the property owner.

Implementation Example: St. Matthews Green-Up Program

The city of St. Matthews, Kentucky, is a co-permittee whose Green-Up program encourages residents to replace parking pads with grassy areas. This reduces impervious surfaces and the urban heat island effect while increasing infiltration of rainwater. Through this program, the city performs the asphalt pad removal and turf restoration free of charge. St. Matthews advertises the program in a quarterly newsletter distributed to all residential property owners. The Louisville County Metropolitan Sewer District (MSD) *MS4 Annual Report* (2017) states that three asphalt pads were removed during the reporting period, and 21 pads were removed to date.

3 Illicit Discharge Detection and Elimination (IDDE)

Photo by Pikrepo

IDDE is one of the six MS4 minimum control measures required by Phase II MS4 permits, and many MS4 permits include an IDDE requirement to map the storm sewer system. Very few MS4 permits include green infrastructure language in these requirements; however, the permit excerpt below from Louisville, Kentucky, requires the mapping of green infrastructure. As demonstrated in the subsequent implementation example, the Louisville MSD met this requirement by including green infrastructure data in a robust geographic information system (GIS) mapping program.

Louisville, Kentucky, Phase I Permit

The Kentucky Energy and Environment Cabinet issued a Phase I MS4 individual permit that includes requirements to map stormwater system features, including green infrastructure facilities.

Section 2.7, Table 2 Excerpt (Partial Table)

Table 2. Illicit Discharge Detection and Elimination (IDDE) Con't

IDDE 2 Management Activities		
Element Task	**Frequency or Measure of Success**	**Activity Required**
Mapping – Stormwater Infrastructure Inventory	Permittee shall maintain a storm sewer system map	The permittee shall continue to maintain the GIS Louisville and Jefferson County Information Center (LOJIC) layers constituting its storm sewer system map, showing the location of all known major outfalls, inlets, flood control basins, green infrastructure BMPs maintained by the permittee, and the names and location of all waters of the Commonwealth that receive discharges from those outfalls.

Implementation Example: Louisville MSD Mapping System

The MSD is part of the Louisville Jefferson County Information Consortium (LOJIC), which maintains a GIS. As reported in the *MS4 Annual Report* (2017), program staff have access to maps of the drainage system, including storm sewers, outfalls, streams, and other receiving waters. MSD also maps green infrastructure, including bioswales, green roofs, permeable pavement, and rain gardens. The data are updated weekly and, as the district grows and new regions are annexed, the permittee has prioritized mapping new regions.

4 Post-Construction

Image reproduced with permission from Montgomery County, Maryland Department of Environmental Protection

Green infrastructure is incorporated into post-construction requirements in numerous ways. As demonstrated in the excerpts below, many permits require permittees to establish new regulatory mechanisms (e.g., codes, ordinances, laws) to require the use of green infrastructure. Many permits require permittees to assess current regulatory mechanisms and identify implementation barriers or opportunities for improvement. Some permits also include requirements to install, inspect, and maintain green infrastructure. Permits may also require permittees to develop and/or implement post-construction stormwater discharge performance standards and green infrastructure plans.

4 Post-Construction

A number of the excerpts in sections 4.1 and 4.5 are also included in the *Post-Construction Standards* compendium, which presents permit requirements for post-construction stormwater discharges and focuses on numeric performance and/or design standards. The excerpts in the Post-Construction Standards compendium may apply to a variety of stormwater measures, whereas the following section focuses solely on green infrastructure.

The following permit excerpts demonstrate how MS4 permits require establishing post-construction programs that use green infrastructure to manage stormwater discharges from new development and redevelopment. These permits require permittees to establish rules that prioritize green infrastructure, adopt ordinances that are conducive to green infrastructure implementation, or require use of green infrastructure to meet post-construction performance standards. The cities highlighted in the implementation examples below met these requirements by updating their municipal codes to require irrigation systems to use reclaimed water or graywater and by establishing rules that require varying degrees of green infrastructure implementation depending on project type.

4.1 Establishing Regulatory Mechanisms

New Mexico Middle Rio Grande Watershed Permit

EPA Region 6 issued a watershed MS4 permit that covers Phase I and Phase II permittees and includes requirements to develop and enforce an ordinance to minimize post-construction stormwater through a variety of green infrastructure methods.

Part I.D.5.b.ii.b Excerpt

> (ii) The program must include the development, implementation, and enforcement of, at a minimum:
>
> …
> (b) An ordinance or other regulatory mechanism to address post-construction runoff from new development and redevelopment projects to the extent allowable under State, Tribal or local law. The ordinance or policy must:
>
> Incorporate a stormwater quality design standard that manages on-site the 90th percentile storm event discharge volume associated with new development sites and 80th percentile storm event discharge volume associated with redevelopment sites, through stormwater controls that infiltrate, evapotranspire the discharge volume, except in instances where full compliance cannot be achieved, as provided in Part I.D.5.b.(v). The stormwater from rooftop discharge may be harvested and used on-site for noncommercial use. Any controls utilizing impoundments that are also used for flood control that are located in areas where the New Mexico Office of the State Engineer requirements at NMAC 19.26.2.15 (see also Section 72-5-32 NMSA) apply must drain within 96 hours unless the state engineer has issued a waiver to the owner of the impoundment.

Options to implement the site design standard include, but not limited to: management of the discharge volume achieved by canopy interception, soil amendments, rainfall harvesting, rain tanks and cisterns, engineered infiltration, extended filtration, dry swales, bioretention, roof top disconnections, permeable pavement, porous concrete, permeable pavers, reforestation, grass channels, green roofs and other appropriate techniques, and any combination of these practices, including implementation of other stormwater controls used to reduce pollutants in stormwater (e.g., a water quality facility).

California Los Angeles Municipal Regional Stormwater Permit

The Los Angeles Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from the Los Angeles County Flood Control District, the County of Los Angeles, and the 84 incorporated cities within the coastal watersheds of Los Angeles County, excluding the city of Long Beach. The permit includes requirements to develop a local ordinance that allows the use of harvested rainwater for non-potable purposes.

Attachment H.4.f Excerpt

Project requirements shall address at a minimum the potential use of harvested rainwater for non-potable uses including toilet flushing, laundry, and cooling water makeup water. If the municipal, building or county health code(s) does not allow such use of harvested rainwater, each Permittee shall develop a model ordinance and submit it to the city council or County Supervisors for consideration within 24 months after the Order effective date. The model ordinances shall be based on the International Association of Plumbing and Mechanical Officials' (IAPMO's) Green Plumbing and Mechanical Code Supplement to the 2012 National Standard Plumbing Code, or similar guidance to ensure the safe and effective use of harvested rainwater, separate from the existing provisions, if any, for reclaimed wastewater. California is in the process of adopting its 2012 update to the Uniform Plumbing Code that incorporates the IAPMO Green Plumbing and Mechanical Code Supplement. If the State of California update incorporates the IAPMO Green Plumbing and Mechanical Code Supplement, Permittees are not required to adopt a model ordinance addressing the potential use of harvested rainwater for non-potable uses including toilet flushing, laundry, and cooling water makeup water.

Implementation Example: Hermosa Beach Harvested Rainwater and Reclaimed Water

The city of Hermosa Beach, California's Municipal Code landscaping chapter (8.60.060.D.8) requires that irrigation systems use reclaimed or graywater whenever feasible and comply with the current edition of the California Building/Plumbing Code. The city uses a smart irrigation system in its parks that responds to weather conditions and uses 75 percent reclaimed water (2015 MS4 *Annual Report*).

The city also promotes water conservation through a variety of educational and financial incentive programs; it encourages on-site reuse of reclaimed water and graywater for non-potable purposes. The city developed guidance on designing rain barrels and cisterns, including the *Stormwater LID Guide* for developers and *Homeowner's Guide to Rainwater Harvesting*.

4.2 Assessing Regulatory Mechanisms

The excerpts presented below demonstrate how permits require permittees to review post-construction regulatory mechanisms for barriers to green infrastructure implementation. Some of the permit conditions also include developing a schedule to remove any identified barriers and assessing requirements that affect the creation of impervious cover. The implementation examples below demonstrate how permittees met these requirements by using the EPA Water Quality Scorecard to review local codes and ordinances, establishing milestones for assessing regulations, and developing reports on the assessment of regulations.

Massachusetts Phase II Permit

EPA Region 1 issued a Phase II MS4 general permit that includes requirements to review current regulations for barriers to using green roofs, infiltration practices and water harvesting, as well as requirements to plan the necessary regulatory modifications to make these practices allowable.

Part 2.3.6.c Excerpt

> Within four (4) years from the effective date of the permit, the permittee shall develop a report assessing existing local regulations to determine the feasibility of making, at a minimum, the following practices allowable when appropriate site conditions exist:
>
> i. Green roofs;
>
> ii. Infiltration practices such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; and
>
> iii. Water harvesting devices such as rain barrels and cisterns, and the use of stormwater for non-potable uses.
>
> The assessment should indicate if the practices are allowed in the MS4 jurisdiction and under what circumstances are they allowed. If the practices are not allowed, the permittee shall determine what hinders the use of these practices, what changes in local regulations may be made to make them allowable, and provide a schedule for implementation of recommendations. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The permittee shall report in each annual report on its findings and progress towards making the practices allowable. (Information available at: http://www.epa.gov/region1/npdes/stormwater/assets/pdf/AddressingBarrier2LID.pdf and https://www.mapc.org/resource-library/do-your-local-codes-allow-lid/)

Massachusetts Phase II Permit

EPA Region 1 issued a Phase II MS4 general permit that includes requirements to assess the rules and design guidelines that affect the creation of impervious cover and to identify and pursue opportunities to reduce impervious surfaces associated with parking areas and street design. Note that this permit refers to green infrastructure as "low impact design."

Part 2.3.6.b Excerpt

> Within four (4) years of the effective date of this permit, the permittee shall develop a report assessing current street design and parking lot guidelines and other local requirements that affect the creation of impervious cover. This assessment shall be used to provide information to allow the permittee to determine if changes to design standards for streets and parking lots can be made to support low impact design options. If the assessment indicates that changes can be made, the assessment shall include recommendations and proposed schedules to incorporate policies and standards into relevant documents and procedures to minimize impervious cover attributable to parking areas and street designs. The permittee shall implement all recommendations, in accordance with the schedules, contained in the assessment. The local planning board and local transportation board should be involved in this assessment. This assessment shall be part of the SWMP. The permittee shall report in each annual report on the status of this assessment including any planned or completed changes to local regulations and guidelines.

Chattanooga, Tennessee, Phase I Permit

The Tennessee Department of Environment and Conservation issued a Phase I MS4 individual permit that includes requirements to review and update regulations using the EPA Water Quality Scorecard.

Section 3.2.5.3 Excerpt

> Within two years of the permit effective date, the permittee shall review local codes and ordinances using the EPA Water Quality Scorecard (the scorecard). A completed copy of the scorecard shall be submitted with the subsequent annual report.
>
> The permittee shall update codes and ordinances, if necessary, within 4 years of permit effective date. The permittee shall continue to implement existing permanent Stormwater Management Program until the codes and ordinances review and update is completed.

Implementation Example: Scorecard Success in Chattanooga

Chattanooga, Tennessee completed its review of local codes and ordinances using the EPA Water Quality Scorecard within two years of the permit effective date, as required. The results of the scorecard review process led the city to:

- Rewrite the Stormwater Management Code and update other municipal policies and codes to remove language that conflicted with stormwater goals.
- Develop a city-specific *Rainwater Management Guide* and adopt the guide in the stormwater management code.

Montana Phase II Permit

The Montana Department of Environmental Quality issued a Phase II MS4 general permit that includes requirements to review regulatory barriers to the use of green infrastructure. Note that this permit refers to green infrastructure as "LID infrastructure."

Part II.A.5.d.i Excerpt

- Convene appropriate staff and conduct a discussion to evaluate existing barriers to implementing LID infrastructure in the permittee's codes, ordinances and policies.
- The outcome of this discussion must identify opportunities for change and address the potential inconsistencies between policies.
- Appropriate staff must include member(s) of various departments, some of which may include:
    - Parks and Recreation;
    - Public Works;
    - Planning;
    - Environmental Protection;
    - Utilities; and
    - Transportation.
- Submit a summary of the discussion outcomes with the 4th Annual Report.

Oklahoma Phase II Permit

The Oklahoma Department of Environmental Quality Water Quality Division issued a Phase II MS4 general permit that includes requirements to review regulations for barriers to the use of green infrastructure, to develop a schedule to remove those barriers, and implement identified opportunities. Note that this permit refers to green infrastructure as "LID."

Part IV.C.5.a.iii Excerpt

> Review local ordinances, regulations, and engineering plans or specifications to identify any legal/regulatory barriers to LID as well as opportunities to promote LID. Develop a schedule to remove those barriers and implement identified opportunities. If a barrier is not removed or an opportunity is not implemented, provide a justification. You may use the EPA Water Quality Scorecard as a guide.

Vermont Phase II Permit

The Vermont State Department of Environmental Conservation issued a Phase II MS4 general permit that includes requirements to determine whether changes can be made to regulations to support green infrastructure goals. Note that this permit refers to green infrastructure as "low impact design."

Part 6.2.5.d Excerpt

> In conjunction with the review required by Subpart 6.2.4, the permittee shall review existing policies, planning, zoning and subdivision regulations, and ordinances to:
>
> (1) Determine their effectiveness in managing stormwater runoff from new development and redevelopment projects to prevent adverse impacts to water quality;

(2) Determine their consistency with the requirements of the Secretary's rules and general permits regulating post-construction stormwater runoff;

(3) Assess whether changes can be made to such policies, regulations, and ordinances in order to support low impact design options (e.g. green roofs; infiltration practices, such as rain gardens, curb extensions, planter gardens, porous and pervious pavements, and other designs to manage stormwater using landscaping and structured or augmented soils; water harvesting devices, such as rain barrels and cisterns; and the use of stormwater for non-potable uses); and

(4) Assess whether changes can be made to current street design and parking lot guidelines and other local requirements that affect the creation of impervious surfaces to support low impact design options.

If the permittee's review indicates that its policies are inconsistent with the Secretary's permits, the permittee shall amend its policies to complement, at a minimum, or be more stringent than the requirements of the Secretary.

Implementation Example: Burlington Regulatory Review Timeline

According to Burlington, Vermont's updated *Stormwater Management Plan*, the city plans to evaluate its zoning bylaw, site plan and subdivision rules and regulations, street opening and utility connection rules and regulations, and other relevant bylaws and regulations over the course of its permit term. The city identified the following milestones:

- By permit year 2 (2020), finish reviewing the city's post-construction ordinance and modify the stormwater bylaws to:
  - Meet the permit's phosphorous removal and retention or treatment requirements.
  - Require as-built drawings within two years of project completion to ensure long-term operation and maintenance.
- By permit year 4 (2022):
  - Identify five permittee-owned properties that could be modified or retrofitted with stormwater controls to reduce impervious area.
  - Develop a *Street Design and Parking Lot Guidelines* report to assess requirements that affect the creation of impervious cover. Determine if changes to design standards for streets and parking lots can be modified to support green infrastructure options.
  - Develop a *Green Infrastructure Report* to assess regulations. Determine the feasibility of making green infrastructure practices allowable.
- By 2025, complete implementing recommendations from the *Street Design and Parking Lot Guidelines* and *Green Infrastructure Report.*

Seattle, Washington, Phase I Permit

The Washington State Department of Ecology issued a Phase I MS4 individual permit that includes requirements to identify and remove regulatory barriers to the use of LID principles and green infrastructure. Note that this permit refers to green infrastructure as "LID BMPs."

Section S5.C.6.c.i.a Excerpt

> Annually, each Permittee shall assess and document any newly identified administrative or regulatory barriers to implementation of LID Principles or LID BMPs since local codes were updated in accordance with the 2013 Permit, and the measures developed to address the barriers. If applicable, the report shall also describe mechanisms adopted to encourage or require implementation of LID Principles or LID BMPs.

Washington Phase II Western Permit

The Washington State Department of Ecology issued an MS4 general permit that covers Phase II permittees in the western part of the State and includes requirements to assess and document regulatory barriers affecting LID principles and green infrastructure. Note that this permit refers to green infrastructure as "LID BMPs."

Section S5.C.1.c.i Excerpt

> Permittees shall continue to require LID Principles and LID BMPs when updating, revising, and developing new local development-related codes, rules, standards, or other enforceable documents, as needed.
>
> The intent shall be to make LID the preferred and commonly-used approach to site development. The local development-related codes, rules, standards, or other enforceable documents shall be designed to minimize impervious surfaces, native vegetation loss, and stormwater runoff in all types of development situations, where feasible.
>
> (a) Annually, each Permittee shall assess and document any newly identified administrative or regulatory barriers to implementation of LID Principles or LID BMPs since local codes were updated in accordance with the 2013 Permit, and the measures developed to address the barriers. If applicable, the report shall describe mechanisms adopted to encourage or require implementation of LID principles or LID BMPs.

Implementation Example: Kitsap County Water Policy

In 2016, Kitsap County, Washington, reaffirmed its Water Is a Resource policy, which provides guiding principles for groundwater use, sewer and stormwater management, pollutant control, and land use. As part of its ongoing effort to promote green infrastructure, which it calls Green Stormwater Solutions, the county is updating its Stormwater Code and *Stormwater Design Manual* and continues to look for green infrastructure retrofit opportunities. The county is also beginning to develop a Comprehensive Plan for stormwater, which will facilitate better coordination between all departments with a role in stormwater management.

Washington Phase II Western Permit

The Washington State Department of Ecology issued an MS4 general permit that covers Phase II permittees in the western part of the State and requires each new permittee to conduct a review of regulations, incorporate LID principles and green infrastructure, and report on progress. Note that this permit refers to green infrastructure as "LID BMP."

Section S5.C.1.c.ii Excerpt

> By December 31, 2023, New Permittees shall review, revise, and make effective their local development-related codes, rules, standards, or other enforceable documents to incorporate and require LID principles and LID BMPs. New Permittees shall conduct a similar review and revision process, and consider the range of issues, outlined in the following document: Integrating LID into Local Codes: A Guidebook for Local Governments (Puget Sound Partnership, 2012).
>
> New Permittees shall submit a summary of the results of the review and revision process with the annual report due no later than March 31, 2024. This summary shall be in the required format described in Appendix 5 and include, at a minimum, a list of the participants (job title, brief job description, and department represented), the codes, rules, standards, and other enforceable documents reviewed, and the revisions made to those documents which incorporate and require LID principles and LID BMPs. The summary shall include existing requirements for LID principles and LID BMPs in development-related codes. The summary must be organized as follows:
>
> (a) Measures to minimize impervious surfaces.
>
> (b) Measures to minimize loss of native vegetation.
>
> (c) Other measures to minimize stormwater runoff.

4.3 Green Infrastructure Implementation

The excerpts below exemplify permits that require implementing green infrastructure by establishing a baseline for restoration efforts, creating an inventory of existing infrastructure that could be retrofitted, and developing a retrofit plan for existing sites owned by the permittee. An implementation example from Baltimore, Maryland, demonstrates how this permittee met its permit requirements by performing an existing impervious area assessment.

Baltimore, Maryland, Phase I Permit

The Maryland Department of the Environment issued a Phase I MS4 individual permit that includes requirements to perform a baseline impervious surface area assessment as part of restoration efforts.

Part IV.E.2.a Excerpt

> Within one year of permit issuance, Baltimore City shall submit an impervious surface area assessment consistent with the methods described in the MDE document "Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated, Guidance for National Pollutant Discharge Elimination System Stormwater Permits" (MDE, June 2011 or subsequent versions). Upon approval by MDE, this impervious surface area assessment shall serve as the baseline for the restoration efforts required in this permit.
> …

Implementation Example: Restoring Baltimore

Baltimore, Maryland performed an existing impervious area assessment based on aerial imagery to determine the amount of impervious area within the city's MS4. The resulting amount of impervious acres serves as the city's baseline and was used to calculate the city's impervious area restoration (IAR) requirement. The city presented a summary of the analysis and IAR requirement in its 2015 annual MS4 report. Required restoration efforts must be achieved by implementing environmental site design practices in accordance with *Maryland Stormwater Design Manual*.

New Hampshire Phase II Permit

EPA Region 1 issued a Phase II MS4 general permit that includes requirements to inventory permittee-owned property and existing infrastructure to identify potential stormwater retrofit opportunities.

Section 2.3.6.e Excerpt

> Within four (4) years from the effective date of this permit, the permittee shall complete an inventory and priority ranking of permittee-owned property and existing infrastructure that could be retrofitted with BMPs designed to reduce the frequency, volume and pollutant loads of stormwater discharges to its MS4 through the mitigation of impervious area. Properties and infrastructure for consideration shall include those with the potential for mitigation of on-site impervious area, as well as those that could provide mitigation of off-site impervious area. At a minimum, permittees shall consider municipal property with significant impervious area (including parking lots, buildings, and maintenance yards) that could be mitigated, and open space and undeveloped land available to mitigate impervious area and associated stormwater from proximate offsite properties. MS4 infrastructure to be considered includes existing street right-of-ways, outfalls and conventional stormwater conveyances and controls (including swales and detention practices) that could be readily modified to provide reduction in frequency, volume or pollutant loads of such discharges through the mitigation of impervious cover. The permittee may also include in its inventory properties and infrastructure that are privately-held or that do not contribute stormwater to its MS4.

Utah Phase II Permit

The Utah Department of Environmental Quality issued a Phase II MS4 general permit that includes requirements to develop a retrofit plan for existing properties that emphasizes the use of stormwater controls that infiltrate, evapotranspire, or harvest and reuse stormwater.

Section 4.2.6.9 Excerpt

> The Permittee must develop a plan to retrofit existing developed sites that the Permittee owns or operates that are adversely impacting water quality. The retrofit plan must be developed to emphasize controls that infiltrate, have evapotranspiration, or harvest and use storm water discharges. The plan must include a ranking of retrofit sites based on the following criteria:
>
> - Proximity to waterbody
> - Current assessment of waterbody with goal to improve impaired waterbodies and protect unimpaired waterbodies
> - Hydrologic condition of the receiving waterbody
> - Proximity to sensitive ecosystem or protected area
> - Any upcoming sites that could be further enhanced by retrofitting storm water controls

Washington, District of Columbia, Phase I Permit

EPA Region 3 issued a Phase I MS4 individual permit that includes a requirement to plant trees in the MS4 area.

Part 1.5.3.1 Excerpt

> …
>
> The Permittee shall achieve a minimum net increase of 33,525 trees in the MS4 Permit Area by the end of this permit term. The Permittee shall use a benchmark annual average tree planting rate of 6,705 plantings within the MS4 Permit Area.
>
> …

Washington, District of Columbia, Phase I Permit

EPA Region 3 issued a Phase I MS4 individual permit that includes a requirement to install green roofs in the MS4 area.

Part 3.2.9 Excerpt

> The Permittee shall ensure the installation of a minimum of 350,000 square feet of new green roofs in the MS4 Permit Area as a total over the five-year permit term.

4.4 Green Infrastructure Inspection and Maintenance

The following excerpts demonstrate language that requires permittees to inspect green infrastructure, develop a database that documents inspection and maintenance of green infrastructure, and train staff who conduct green infrastructure maintenance. The implementation examples for a subset of permittees demonstrate how they included these requirements in their programs.

Atlanta, Georgia, Phase I Permit

The Georgia Environmental Protection Division issued a Phase I MS4 individual permit that includes requirements to inspect all non-residential green infrastructure facilities at least once every five years. Note that this permit refers to green infrastructure as "GI/LID."

Part 3.3.11.b, Table 3.3.11(b)(2) Excerpt (Partial Table)

Table 3.3.11(b)(2).

GI/LID Program Elements	Measurable Goals
4. Inspection and Maintenance Program	4.a. Conduct inspections on 100% of the total privately owned non-residential (e.g., mixed use development, commercial, etc.) and permittee-owned GI/LID structures, included in the inventory created in 3 above, within the 5-year permit term. For permittees with five or more GI/LID structures included on the inventory, at a minimum, the permittee must conduct inspections on 5% of the structures each reporting period, or if inspections are done by geographical area, then one entire area or sector must be inspected each reporting period. If a low percentage of inspections is conducted during one reporting period, then the permittee must increase the inspection frequency in subsequent reporting periods to ensure that 100% of the GI/LID structures are inspected within the 5-year permit term. Provide the number and/or percentage of the total structures inspected and documentation of the inspections conducted during the reporting period in each annual report.

Implementation Example: Inspecting Green Infrastructure in Atlanta

In the 2019–2020 permit year, the city of Atlanta, Georgia, inspected 391 green infrastructure practices (370 of these were privately owned and non-residential practices). This represents 36 percent of all privately owned, non-residential practices and 19 percent of the publicly owned green infrastructure practices in Atlanta's inventory.

Honolulu, Hawaii, Phase I Permit

The Hawaii Department of Health Clean Water Branch issued a Phase I MS4 individual permit that includes requirements to create a post-construction stormwater facility database that tracks green infrastructure and inspections. Note that this permit refers to green infrastructure as "LID."

Part D.1.e.(3) Excerpt

> The Permittee shall further develop and implement an effective system to compile a database of post-construction BMPs and the frequency of maintenance and inspection of the BMPs. The database shall include both public and private activities or projects which initially discharge into the Permittee's MS4 and shall begin in the plan review stage with a database or geographic information system (GIS). The Permittee shall also map post-construction BMPs on the GIS. In addition to the standard information collected for all projects (e.g., project name, owner, location, start/end date, etc.), the tracking system shall also include, at a minimum:
>
> - Type and number of LID practices
> - Type and number of Source Control BMPs
> - Type and number of Treatment Control BMPs
> - Latitude/Longitude coordinates of controls using Global Positioning Systems (GPS) and NAD83 Datum
> - Photographs of controls
> - Operation and maintenance requirements, including frequency of inspections

Implementation Example: Honolulu Post-Construction Stormwater Facility Database

The city of Honolulu, Hawaii, maintains a database of post-construction stormwater facilities, including green infrastructure, totaling 2,736 facilities as described in the *Fiscal Year 2019 Annual Report*. Capturing all stormwater facilities constructed is a collaborative, multi-department effort. The Department of Planning and Permitting tracks private projects and the Department of Facility Maintenance Storm Water Quality Branch (DFM-SWQ) tracks public projects and manages the database.

All stormwater facilities are mapped in GIS using the Honolulu Land Information System (HoLIS). An asset management system tracks stormwater facility details and inspection schedules and operation and maintenance (O&M) schedules. DFM-SWQ employees perform inspections of stormwater controls and record observations using tablets that sync information to the database. The information in the database is used to monitor stormwater facilities and ensure that they comply with city regulations.

Illinois Phase II Permit

The Illinois Environmental Protection Agency issued a Phase II MS4 general permit that includes requirements to develop a post-construction stormwater program that incorporates annual training for individuals that conduct maintenance on green infrastructure.

Part IV.B.5.d Excerpt

> 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, evapotranspiration, and reuse of storm water. The program shall include, but not be limited to the following elements:
>
> i. Annual Training for all MS4 employees who manage or are directly involved in (or who retain others who manage or 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; and
>
> ii. Annual 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.

Implementation Example: Green Infrastructure Education in Lake County

Lake County, Illinois, established an Employee Stormwater Training Program that educates staff on managing and maintaining greening infrastructure. The county provides training through seminars, webinars, and procedure demonstrations. New employees receive training materials as part of their orientation. The Employee Stormwater Training Program is described in the *Lake County Stormwater Management Program Plan*.

Washington, District of Columbia, Phase I Permit

EPA Region 3 issued a Phase I MS4 individual permit that includes a requirement for facilities with Stormwater Pollution Prevention Plans (SWPPP) to conduct self-inspections. A subsequent permit excerpt (3.3.2.5) further specifies that the term "facilities" includes green infrastructure practices.

Part 3.3.2.3 Excerpt

> The Permittee shall ensure that facilities with SWPPPs conduct quarterly self-inspections, with more frequent inspections for facilities with high levels and likelihood of contributing to stormwater pollution. Inspections shall consist of walking the site to investigate potential sources of pollution and completing a facility checklist.

4.5 Performance Standards

As demonstrated in the excerpts below, permits can promote green infrastructure through post-construction performance standards. These standards require the use of green infrastructure to meet on-site retention requirements. These permits require the use of specific green infrastructure practices depending on project type. They also call for the development of an incentive program to allow flexibility in meeting design requirements. The implementation examples demonstrate how these cities and towns met their permit requirements by establishing stormwater requirements, developing stormwater design manuals, and creating incentive programs.

California Los Angeles Municipal Regional Stormwater Permit

The Los Angeles Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from the Los Angeles County Flood Control District, the County of Los Angeles, and the 84 incorporated cities within the coastal watersheds of Los Angeles County, excluding the city of Long Beach. The permit includes post-construction stormwater on-site retention requirements for all new development and redevelopment projects.

Section VI.D.7.c.i Excerpt

> (1) Each Permittee shall require all New Development and Redevelopment projects (referred to hereinafter as "new projects") identified in Part VI.D.7.b to control pollutants, pollutant loads, and runoff volume emanating from the project site by: (1) minimizing the impervious surface area and (2) controlling runoff from impervious surfaces through infiltration, bioretention and/or rainfall harvest and use.
>
> (2) Except as provided in Part VI.D.7.c.ii. (Technical Infeasibility or Opportunity for Regional Ground Water Replenishment), Part VI.D.7.d.i (Local Ordinance Equivalence), or Part VI.D.7.c.v (Hydromodification), below, each Permittee shall require the project to retain on-site the Stormwater Quality Design Volume (SWQDv) defined as the runoff from:
>
> (a) The 0.75-inch, 24-hour rain event or
>
> (b) The 85th percentile, 24-hour rain event, as determined from the Los Angeles County 85th percentile precipitation isohyetal map, whichever is greater.
>
> (3) Bioretention and biofiltration systems shall meet the design specifications provided in Attachment H to this Order unless otherwise approved by the Regional Water Board Executive Officer.
>
> (4) When evaluating the potential for on-site retention, each Permittee shall consider the maximum potential for evapotranspiration from green roofs and rainfall harvest and use.

California Los Angeles Municipal Regional Stormwater Permit

The Los Angeles Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from the Los Angeles County Flood Control District, the County of Los Angeles, and the 84 incorporated cities within the coastal watersheds of Los Angeles County, excluding the city of Long Beach. The permit includes requirements for on-site biofiltration[1] if a new development or redevelopment project is unable to fully retain the post-construction stormwater on-site.

Section VI.D.7c.iii.1 Excerpt

> iii. When a Permittee determines a project applicant has demonstrated that it is technically infeasible to retain 100 percent of the SWQDv on-site, or is proposing an alternative offsite project to replenish regional ground water supplies, the Permittee shall require one of the following mitigation options:
>
> (1) On-site Biofiltration
>
> (a) If using biofiltration due to demonstrated technical infeasibility, then the new project must biofiltrate 1.5 times the portion of the SWQDv that is not reliably retained on-site, as calculated by Equation 1 below.
>
> Equation 1:
>
> $B_v = 1.5 * [SWQ–_v - R_v]$
>
> Where:
>
> Bv = biofiltration volume
>
> SWQDv = the storm water runoff from a 0.75 inch, 24-hour storm or the 85th percentile storm, whichever is greater.
>
> Rv = volume reliably retained on-site
>
> (b) Conditions for On-site Biofiltration
>
> > (i) Biofiltration systems shall meet the design specifications provided in Attachment H to this Order unless otherwise approved by the Regional Water Board Executive Officer.
> >
> > (ii) Biofiltration systems discharging to a receiving water that is included on the Clean Water Act section 303(d) list of impaired water quality-limited water bodies due to nitrogen compounds or related effects shall be designed and maintained to achieve enhanced nitrogen removal capability. See Attachment H for design criteria for underdrain placement to achieve enhanced nitrogen removal.

[1] As defined by the permit, biofiltration is a "BMP that reduces storm water pollutant discharges by intercepting rainfall on vegetative canopy, and through incidental infiltration and/or evapotranspiration, and filtration."

California Phase II Permit

The California State Water Resources Control Board issued a Phase II general permit that includes requirements to regulate new development, redevelopment, roadway and utility projects that create and/or replace 5,000 square feet or more of impervious surface.

Section E.12.c Excerpt

> 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 Regulated 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.
>
> …
> (c) Road Projects and Linear Underground/Overhead Projects–(LUPs) - Any of the following types of road projects and LUPs 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 Section E.12.e. Low Impact Development Standards except that treatment of runoff of the 85th percentile that cannot be infiltrated onsite shall follow U.S. EPA 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.
>
> > a) 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.
> >
> > b) 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) Construction of linear underground/overhead projects (LUPs)
>
> 4) 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 stormwater 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) Trenching, excavation and resurfacing associated with LUPs; pavement grinding and resurfacing of existing roadways and parking lots; construction of new sidewalks, pedestrian ramps, or bike lanes on existing roadways; or routine replacement of damaged pavement such as pothole repair or replacement of short, non-contiguous sections of roadway.

Implementation Example: Paso Robles Prioritizes Stormwater Manangement

The city of Paso Robles, California separates post-construction stormwater management requirements into tiers depending on the size of the project. The tiers and performance requirements are replicated below from the city's "Post-Construction Stormwater Runoff Management" website.

Type of Project	Performance Requirements
Tier 1: Project including single-family homes, that create or replace 2,500 square feet (SF) or more of impervious surface.	**Implement LID Measures:** • Limit disturbance of natural drainage features. • Limit clearing, grading, and soil compaction. • Minimize impervious surfaces. • Minimize runoff by dispersing runoff to landscape or using permeable pavements. **Applications completeness:** Submit a Stormwater Control Plan for Small (Tier 1)—Projects (Single Family Residence Site Plan).
Tier 2: Projects, other than single-family homes, that create or replace 5,000 SF or more of net impervious surface. Detached single-family homes that create or replace 15,000 SF or more of net impervious surface.	**Tier 1 requirements, plus:** Treat runoff with an approved and appropriately sized LID treatment system prior to discharge from the stie. **Application completeness:** Submit a Stormwater Control Plan that addresses Site Design (Tier 1), runoff treatment and source control measures (Tier 2).
Tier 3: Projects including single-family homes that create or replace 15,000 SF or more of impervious surface.	**Tier 2 requirements, plus:** Prevent offsite discharge from events up to the 95th percentile rainfall event using Stormwater Control Measures. **Application completeness:** Submit a Stormwater Control Plan that addresses Site Design [Tier 1, runoff treatment and source control measures (Tier 2), and stormwater retention (Tier 3)].
Tier 4: Projects that create or replace 22,500 SF or more of impervious surface (collectively over the entire project site).	**Tire 3 requirements, plus:** Post-development peak flows discharged from the site must not exceed pre-project peak flows for 2-year through 10-year storm events. This requirement is not applicable in Watershed Management Zone 4 (on the west side of Paso Robles).

California San Francisco Bay Municipal Regional Stormwater Permit

The San Francisco Bay Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo and Santa Clara counties, as well as the communities of Fairfield, Suisun City and Vallejo. The permit includes requirements for regulated projects to use green infrastructure practices to mimic the pre-development conditions of each site. Note that this permit refers to green infrastructure as "LID."

Section C.3.c Excerpt

> The goal of LID is to reduce runoff and mimic a site's predevelopment hydrology by minimizing disturbed areas and impervious cover and then infiltrating, storing, detaining, evapotranspiring, and/or biotreating stormwater runoff close to its source. LID employs principles such as preserving and recreating natural landscape features and minimizing imperviousness to create functional and appealing site drainage that treats stormwater as a resource, rather than a waste product. Practices used to adhere to these LID principles include measures such as rain barrels and cisterns, green roofs, permeable pavement, preserving undeveloped open space, and biotreatment through rain gardens, bioretention units, bioswales, and planter/tree boxes.
>
> **Task Description**
>
> i. The Permittees shall, at a minimum, implement the following LID requirements:
> …
> (2) **Site Design and Stormwater Treatment Requirements**
>
> (a) Require each Regulated Project to implement at least the following design strategies onsite:
>
> (i) Limit disturbance of natural water bodies and drainage systems; minimize compaction of highly permeable soils; protect slopes and channels; and minimize impacts from stormwater and urban runoff on the biological integrity of natural drainage systems and water bodies;
>
> (ii) Conserve natural areas, including existing trees, other vegetation, and soils;
>
> (iii) Minimize impervious surfaces;
>
> (iv) Minimize disturbances to natural drainages; and
>
> (v) Minimize stormwater runoff by implementing one or more of the following site design measures:
>
> - Direct roof runoff into cisterns or rain barrels for reuse.
> - Direct roof runoff onto vegetated areas.
> - Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
> - Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
> - Construct sidewalks, walkways, and/or patios with pervious pavement systems.
> - Construct driveways, bike lanes, and/or uncovered parking lots with pervious pavement systems.
>
> (b) Permittees shall collectively, on a regional or countywide basis, develop and adopt design specifications for pervious pavement systems, subject to the Executive Officer's approval. If

countywide design specifications have been adopted and are contained in countywide stormwater handbooks, Permittees may reference these documents in the Annual Reports.

(c) Require each Regulated Project to treat 100% of the amount of runoff identified in Provision C.3.d for the Regulated Project's drainage area with LID treatment measures onsite or with LID treatment measures at a joint stormwater treatment facility.

(i) LID treatment measures are harvesting and use, infiltration, evapotranspiration, and biotreatment.

(ii) Biotreatment (or bioretention) systems shall be designed to have a surface area no smaller than what is required to accommodate a 5 inches/hour stormwater runoff surface loading rate, infiltrate runoff through biotreatment soil media at a minimum of 5 inches per hour, and maximize infiltration to the native soil during the life of the Regulated Project. The soil media for biotreatment (or bioretention) systems shall be designed to sustain healthy, vigorous plant growth and maximize stormwater runoff retention and pollutant removal. Permittees shall ensure that Regulated Projects use biotreatment soil media that meet the minimum specifications set forth in Attachment L of the previous permit (Order No. R2-2009-0074), dated November 28, 2011. Permittees may collectively (on an all-Permittee scale or countywide scale) develop and adopt revisions to the soil media minimum specifications, subject to the Executive Officer's approval.

(iii) Green roofs may be considered biotreatment systems that treat roof runoff only if they meet certain minimum specifications. Permittees shall ensure that green roofs installed at Regulated Projects meet the following minimum specifications:

(i) The green roof system planting media shall be sufficiently deep to provide capacity within the pore space of the media for the required runoff volume specified by Provision C.3.d.i.(1).

(ii) The green roof system planting media shall be sufficiently deep to support the long-term health of the vegetation selected for the green roof, as specified by a landscape architect or other knowledgeable professional.

(d) Require any Regulated Project that does not comply with Provision C.3.c.i.(2)(c) above to meet the requirements established in Provision C.3.e for alternative compliance.

Chattanooga, Tennessee, Phase I Permit

The Tennessee Department of Environment and Conservation issued a Phase I MS4 individual permit that includes requirements to develop post-construction stormwater standards that require the first inch of rainfall to be infiltrated, evapotranspirated, harvested, or used. Additionally, the permittee must develop a green infrastructure incentive program.

Section 3.2.5.2.1 Excerpt

> Within 24 months of the effective date of the permit, the permittee shall develop site design standards for all new development and redevelopment. These standards shall 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 discharge to surface waters. For all new and redevelopment on private property, the permittee may opt to have controls installed on that private property, in the public right-of-way, or a combination of both. While developing the site design standards, the permittee may identify one or more sub-basins within its corporate boundary as a designated green infrastructure area to demonstrate a wide variety of green infrastructure solutions. The projects would show the feasibility of green infrastructure within a geographically and geologically diverse region.
>
> Additionally, no later than two years following permit issuance, the permittee shall develop and include in the plan an incentive program to increase the use of green infrastructure while allowing flexibility for developers and designers to meet development standards. The Incentive Program could use methods such as a scoring system, credit system or other similar methods to encourage green technology practices such as bioretention areas, permeable paving, green roofs, vegetated walls, preservation of existing trees, and covering paged surfaces with vegetation.
>
> 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 permittee may identify one or more sub-basins within its corporate boundary as a designated green infrastructure solution zone to demonstrate a wide variety of green infrastructure solutions. The projects would show the feasibility of green infrastructure within a geographically and geologically diverse region.

Implementation Example: Capturing Rainfall in Chattanooga

The City of Chattanooga, Tennessee's stormwater management ordinance was in effect December 2014 and the City revised it in November 2017. The ordinance requires projects larger than an acre to manage the first inch of every rainfall event on site, without a discharge to surface waters. The ordinance adopted the *City of Chattanooga Rainwater Management Guide* (RMG) and the *Tennessee Permanent Stormwater Management and Design Guidance Manual*. The RMG provides design criteria and O&M requirements for green infrastructure, as well as guidance on the site design process. For more information, visit the Resource Rain program site.

Additionally, the city developed a *Credits and Incentives Manual* (CIM) that guides the Credit and Incentive Program and promotes the implementation of green infrastructure on non-residential sites through fee reductions and credits. The CIM is intended to be used in conjunction with the RMG, as the RMG provides the technical basis for determining credits and incentives.

Louisville, Kentucky, Phase I Permit

The Kentucky Energy and Environment Cabinet issued a Phase I MS4 individual permit that includes requirements for new development and redevelopment projects to implement stormwater controls to infiltrate, evapotranspirate, harvest, or reuse stormwater from an 80th percentile storm event.

Section 2.2.5.4 Excerpt

> The permittee shall continue to conduct site plan reviews for compliance with stormwater management requirements including the on-site stormwater runoff treatment standard. This standard requires all new development and redevelopment projects to, in combination or alone, implement management measures that are designed, built, and maintained to infiltrate, evapotranspire, harvest and reuse stormwater runoff produced from an 80th percentile precipitation event.

Colorado Cherry Creek Reservoir Watershed Permit

The Colorado Department of Public Health and Environment issued a watershed permit that covers Phase II MS4 permittees and includes requirements to reduce post-construction stormwater from constrained redevelopment by 30 percent (compared to an unmanaged site) through on-site infiltration, evaporation, and evapotranspiration.

Part I.E.4.b.iv.F.2.c Excerpt

> 2) Constrained Redevelopment Sites Design Standard: The control measure(s) is designed to meet one of the following:
>
> …
> (c) Infiltrate, evaporate, or evapotranspirate, through practices such as green infrastructure, a quantity of water equal to 30% of what the calculated WQCV would be if all impervious area for the applicable redevelopment site discharged without infiltration.

Colorado Cherry Creek Reservoir Watershed Permit

The Colorado Department of Public Health and Environment issued a watershed permit that covers Phase II MS4 permittees and includes requirements to reduce post-construction stormwater from new development by 60 percent (compared to an unmanaged site) through on-site infiltration, evaporation, or evapotranspiration.

Part I.E.4.b.iv.C Excerpt

> Runoff Reduction Standard: The control measure(s) is designed to infiltrate into the ground where site geology permits, evaporate, or evapotranspire a quantity of water equal to 60% of what the calculated WQCV would be if all impervious area for the applicable development site discharged without infiltration. This base design standard can be met through practices such as green infrastructure. "Green infrastructure" generally refers to control measures that use vegetation, soils, and natural processes or mimic natural processes to manage stormwater. Green infrastructure can be used in place of or in addition to low impact development principles.

Montana Phase II Permit

The Montana Department of Environmental Quality issued a Phase II MS4 general permit that includes requirements to manage the first 0.5 inches of rainfall on site with practices that infiltrate, evapotranspirate, or capture stormwater for reuse.

Part II.A.5.b.iii Excerpt (Partial Table)

Table 11.A.5.b.iii.

	Minimum Measure	Permittee	Required BMP	Deadline/ Implementation Schedule
5. POST-CONSTRUCTION. SITE STORM WATER MANAGEMENT IN NEW AND REDEVELOPMENT The permittee shall develop, implement, and enforce a program to address 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, that discharge into the permitted Small MS4. This program must ensure that controls are in place that would prevent or minimize water quality impacts.				
b.	Require that all regulated development projects submit a site MS4s plan which is consistent with state and local post-construction requirements which incorporates consideration of potential water quality impacts including	All	iii. Require that all regulated projects implement post-construction storm water management controls that are designed to infiltrate, evapotranspire, and/or capture for reuse the post-construction runoff generated from the first 0.5 inches of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation. For	End of 1st Permit Year

	Minimum Measure	Permittee	Required BMP	Deadline/ Implementation Schedule
	appropriate post-construction storm water management controls.		projects that cannot meet 100% of the runoff reduction requirement, the remainder of the runoff from the first 0.5 inches of rainfall must be either: a. Treated onsite using post-construction storm water management control(s) expected to remove 80 percent total suspended solids (TSS); b. Managed offsite within the same subwatershed using post-construction storm water management control(s) that are designed to infiltrate, evapotranspire, and/or capture for reuse; or c. Treated offsite within the same subwatershed using post-construction storm water management control(s) expected to remove 80 percent TSS.	

Implementation Example: Missoula Stormwater Management

The city of Missoula, Montana, enacted a stormwater management ordinance that requires post-construction stormwater management controls to infiltrate, evapotranspire, and/or capture for reuse the post-construction stormwater generated from the first 0.5 inches of rainfall from a 24-hour storm. The ordinance also includes the same requirements as the permit for projects that cannot meet 100 percent of the stormwater reduction requirements.

Oregon Phase II Permit

The Oregon Department of Environmental Quality issued a Phase II MS4 general permit that includes requirements to treat stormwater that cannot be managed on site with a practice that removes at least 80 percent of total suspended solids, prioritizing green infrastructure.

Schedule A.3.e.iv.B Excerpt

> For projects that are unable to fully meet the retention requirement, the remainder of the rainfall/runoff associated with this retention requirement must be treated prior to discharge with a structural stormwater control. This stormwater structural control must be designed to remove, at minimum, 80 percent of the total suspended solids. In treating the stormwater discharge offsite, the permit registrant must give priority to using green infrastructure before considering other structural stormwater controls. This runoff discharged offsite must target natural surface or predevelopment hydrologic function.

Seattle, Washington, Phase I Permit

The Washington State Department of Ecology issued a Phase I MS4 individual permit that includes requirements to enforce the use of practices that infiltrate, disperse, and retain stormwater on site. Note that this permit refers to green infrastructure as "LID."

Appendix 1 Section 4.5 Excerpt

> The Permittee must require Stormwater Management BMPs in accordance with the following thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff on site to the extent feasible without causing flooding or erosion impacts.
>
> ***Compliance Options by Project Type***
>
> All projects that require Minimum Requirement #5 (as detailed in Section 3: Applicability of the Minimum Requirements) must employ Stormwater Management BMPs as detailed below. The compliance options for the project depend on the amount of improvements proposed, location of the project, size of the parcel the project is on, and whether or not the project is Flow Control exempt.
>
> Note that the site may contain multiple parcels. The designer may choose different compliance methods for different parcels, depending on the proposed design and options for each parcel as detailed below.
>
> ***Projects that Trigger Only Minimum Requirements #1 - #5***
>
> Projects that are not Flow Control exempt that trigger only Minimum Requirements #1 through #5 (per Section 3: Applicability of the Minimum Requirements) shall either:
>
> - Use the LID BMPs from List #1 for all surfaces within each type of surface in List #1;
>
>   ***or***
>
> - Use any Flow Control BMP(s) desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth.

Projects that Trigger Minimum Requirements #1 - #9

Projects that are not Flow Control exempt that trigger Minimum Requirements #1 through #9 (per Section 3: Applicability of the Minimum Requirements) have the compliance options shown in Table 1: Minimum Requirement, #5 Compliance Options for Projects Triggering Minimum Requirements #1 - #9.

Table 1. Minimum Requirement #5 Compliance Options for Projects Triggering Minimum Requirements #1 - #9

Project Location and Parcel Size	Minimum Requirement #5 Compliance Options
Projects inside the UGA, on any size parcel	• Use the LID BMPs from List #2 for all surfaces within each type of surface in List #2; or • Use any Flow Control BMPs desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth.
Projects outside the UGA, on a parcel smaller than 5 acres	
Projects outside the UGA, on a parcel 5 acres or larger	Use any Flow Control BMPs desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth.

Note: This text refers to the Urban Growth Area (UGA) as designated under the Growth Management Act (GMA) (Chapter 36.70A RCW) of the State of Washington. If the project is located in a county that is not subject to planning under the GMA, the city limits shall be used instead.

Flow Control Exempt Projects

Projects qualifying as Flow Control exempt in accordance with the threshold disturbance area (TDA) Exemption in 4.7 Minimum Requirement #7: Flow Control shall either:

- Use the LID BMPs from List #3 for all surfaces within each type of surface in List #3;
  or
- Use any Flow Control BMP(s) desired to achieve the LID Performance Standard, and apply BMP T5.13: Post-Construction Soil Quality and Depth.

If the project has multiple TDAs, all TDAs must be Flow Control exempt per the TDA Exemption in 4.7 Minimum Requirement #7: Flow Control for the project to use the options listed here.

Compliance Methods

LID Performance Standard

The LID Performance Standard compliance method for Minimum Requirement #5 requires modeling the proposed Flow Control BMPs to demonstrate the flow reduction as described below.

Stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year peak flow to 50% of the 2-

year peak flow. Refer to the Flow Control Performance Standard Section in 4.7 Minimum Requirement #7: Flow Control, for information about the assignment of the pre-developed condition. Project sites that must also meet 4.7 Minimum Requirement #7 must match flow durations between 8% of the 2-year flow through the full 50-year flow.

Designers selecting this option cannot use BMP T5.14A: Rain Gardens to achieve the LID Performance Standard. They may choose to use BMP T7.30: Bioretention to achieve the LID Performance Standard.

The List Approach

The List Approach compliance method for Minimum Requirement #5 requires evaluating the BMPs in Table 2: The List Approach for MR5 Compliance.

For each surface, evaluate the feasibility of the BMPs in the order listed, and use the first BMP that is considered feasible. The designer must document the site conditions and infeasibility criteria used to deem BMPs infeasible. Once a BMP is deemed feasible and used for a surface, no other BMP from the list is necessary for that surface.

If all BMPs in the list are infeasible, then the designer must document the site conditions and infeasibility criteria used to deem each BMP infeasible. This documentation will demonstrate compliance with Minimum Requirement #5.

Feasibility shall be determined by evaluation against:

- Design criteria, limitations, and infeasibility criteria identified for each BMP in Volume V of the SWMMWW; and
- Competing Needs Criteria as listed in I-3.4.5 MR5: On-Site Stormwater Management in the SWMMWW

Table 2. The List Approach for Minimum Requirement #5 Compliance

List #1 (For MR #1 - #5 Projects That Are Not Flow Control Exempt)	List #2 (For MR #1 - #9 Projects That Are Not Flow Control Exempt)	List #3 (For Flow Control Exempt Projects)
Surface Type: Lawn and Landscaped Areas		
BMP T5.13: Post-Construction Soil Quality and Depth	BMP T5.13: Post-Construction Soil Quality and Depth	BMP T5.13: Post-Construction Soil Quality and Depth
Surface Type: Roofs		
1. BMP T5.30: Full Dispersion or BMP T5.10A: Downspout Full Infiltration	1. BMP T5.30: Full Dispersion or BMP T5.10A: Downspout Full Infiltration	1. BMP T5.10A: Downspout Full Infiltration
2. BMP T5.14A: Rain Gardens or	2. BMP T7.30: Bioretention Cells, Swales, and Planter Boxes	2. BMP T5.10B: Downspout Dispersion Systems

List #1 (For MR #1 - #5 Projects That Are Not Flow Control Exempt)	List #2 (For MR #1 - #9 Projects That Are Not Flow Control Exempt)	List #3 (For Flow Control Exempt Projects)
BMP T7.30: Bioretention Cells, Swales, and Planter Boxes		
3. BMP T5.10B: Downspout Dispersion Systems	3. BMP T5.10B: Downspout Dispersion Systems	3. BMP T5.10C: Perforated Stub-out Connections
4. BMP T5.10C: Perforated Stub-out Connections	4. BMP T5.10C: Perforated Stub-out Connections	
Surface Type: Other Hard Surfaces		
1. BMP T5.30: Full Dispersion	1. BMP T5.30: Full Dispersion	1. BMP T5.12: Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion
2. BMP T5.15: Permeable Pavements or BMP T5.14A: Rain Gardens or BMP T7.30: Bioretention Cells, Swales, and Planter Boxes	2. BMP T5.15: Permeable Pavements	
3. BMP T5.12: Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion	3. BMP T7.30: Bioretention Cells, Swales, and Planter Boxes	
	4. BMP T5.12: Sheet Flow Dispersion or BMP T5.11: Concentrated Flow Dispersion	

Notes for using the List Approach:

1. Size BMP T5.14A: Rain Gardens and BMP T7.30: Bioretention used in the List Approach to have a minimum horizontal projected surface area below the overflow which is at least 5% of the area draining to it.

2. When the designer encounters BMP T5.15: Permeable Pavements in the List Approach, it is not a requirement to pave these surfaces. Where pavement is proposed, it must be permeable to the extent feasible unless BMP T5.30: Full Dispersion is employed.

Implementation Example: Seattle Design Standards

Seattle, Washington's Stormwater Code Chapter 22.805.070 requires new development and redevelopment projects to comply with either the On-site Performance Standards or the On-site Lists.

The On-site Performance Standards require sites that discharge to a listed creek and have less than 35 percent existing impervious surface to match the pre-development forested condition for 8 to 50 percent of the 2-year peak flow. All other projects choosing to comply with the On-site Performance Standards must match the pre-development pasture condition for discharge rates between the 1 and 10 percent exceedance values.

Developers choosing instead to comply with the On-site Lists must locate the table of On-Site BMPs for their project type and surface (e.g., a roof at a single-family residential home). The table lists green infrastructure stormwater controls, categorized by priority. The developer must assess the feasibility of each green infrastructure stormwater control in Category 1. If any of the options are feasible, at least one must be used. If none of the Category 1 options are feasible, the developer must repeat this process with each subsequent category until a feasible green infrastructure stormwater control has been identified and applied. This process is repeated for *each* surface to apply the highest-priority green infrastructure feasible. Assessment and feasibility criteria are defined in the Stormwater Code or in rules and guidance from the Director.

Utah Phase II Permit

The Utah Department of Environmental Quality issued a Phase II MS4 general permit that includes requirements to develop stormwater volume calculation methods and to use those methods to enforce on-site retention standards for new development and redevelopment projects of an acre or more.

Section 4.2.5.1.2 Excerpt

> Retention Requirement. The Permittee must develop and define a specific hydrologic method or methods for calculating runoff volumes and flow rates to ensure consistent sizing of structural BMPs in their jurisdiction and to facilitate plan review.
>
> New development projects that disturb land greater than or equal to one acre, including projects that are part of a larger common plan of development or sale which collectively disturbs land greater than or equal to one acre must manage rainfall on-site, and prevent the off-site discharge of the precipitation from all rainfall events less than or equal to the 80th percentile rainfall event or a predevelopment hydrologic condition, whichever is less. This objective must be accomplished by the use of practices that are designed, constructed, and maintained to infiltrate, have evapotranspiration, and/or harvest and reuse rainwater. The 80th percentile rainfall event is the event whose precipitation total is greater than or equal to 80 percent of all storm events over a given period of record.
>
> Redevelopment projects that disturb greater than or equal to one acre, including projects less than an acre that are part of a larger common plan of development or sale which collectively disturbs land greater than or equal to one acre must provide a site-specific and project-specific plan aimed at net gain to onsite retention or a reduction to impervious surface to provide similar water quality benefits. If a redevelopment project increases the impervious surface by greater than 10%, the project shall manage rainfall on-site, and prevent the off-site discharge of the net increase in the volume associated with the precipitation from all rainfall events less than or equal to the 80th percentile rainfall event. This objective must be accomplished by the use of practices that are designed, constructed, and maintained to infiltrate, have evapotranspiration, and/or harvest and reuse rainwater.

Implementation Example: Riverton Design Standards

The city of Riverton, Utah has incorporated stormwater design standards into the city Standards Specifications and Plans. The standards outline design storm frequencies and require that stormwater from the 80th percentile rainfall event be retained on site; this is equivalent to a 0.5-inch rain event. The MS4 permit is treated as an extension of the standard and therefore projects in the city must manage stormwater from 0.5 inch or less rainfall events on site.

Vermont Phase II Permit

The Vermont State Department of Environmental Conservation issued a Phase II MS4 general permit that includes requirements to construct road shoulders that distribute stormwater flow to pervious areas.

Part 8.3.C.3.a.ii Excerpt

> Roadway runoff shall flow in a distributed manner to grass or a forested area by lowering road shoulders or conversely by elevating the travel lane level above the shoulder. Road shoulders shall be lower than travel lane elevation. If distributed flow is not possible, roadway runoff may enter a drainage ditch, stabilized as follows…

Implementation Example: Road to Success in Williston

The Town of Williston, Vermont completed and manages a Road Erosion Inventory (REI) with support from the Chittenden County Regional Planning Commission. The REI contains all hydrologically connected road segments and allows the town to identify which segments are out of compliance with road stormwater management standards. The town's *Stormwater Management Plan* states that all segments found to be out of compliance will be required to upgrade stormwater controls identified in the MS4 permit.

Washington, District of Columbia, Phase I Permit

EPA Region 3 issued a Phase I MS4 individual permit that includes requirements for development projects that disturb greater than or equal to 5,000 square feet to retain 1.2 inches of stormwater on site through evapotranspiration, infiltration, and/or stormwater harvesting and use.

Part 3.2.2 Excerpt

> The Permittee shall continue to require the design, construction, and maintenance of stormwater controls to achieve on-site retention of 1.2" of stormwater from a 24-hour storm with a 72-hour antecedent dry period through evapotranspiration, infiltration, and/or stormwater harvesting and use for all public and private development and redevelopment projects that disturb greater than or equal to 5,000 square feet of land area. This requirement shall continue to be implemented in concert with the off-site mitigation program to compensate for any portion of the 1.2" volume to be retained off-site…

Washington, District of Columbia, Phase I Permit

EPA Region 3 issued a Phase I MS4 individual permit that includes requirements for substantial improvement projects that disturb greater than or equal to 5,000 square feet to retain 0.8 inches of stormwater on site through evapotranspiration, infiltration, and/or stormwater harvesting and use.

Part 3.2.5 Excerpt

> The Permittee shall continue to require the design, construction and maintenance of stormwater controls to achieve on-site retention of 0.8" of stormwater from a 24-hour storm with a 72-hour antecedent dry period through evapotranspiration, infiltration and/or stormwater harvesting and use for all development projects where less than 5,000 square feet of soil is disturbed, but where the combined footprint of improved building and land-disturbing activities is greater than or equal to 5,000 square feet and which are undergoing substantial improvement. "Substantial improvement," consistent with District regulations at 21 DCMR § 599, means any repair, alteration, addition, or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started…

4.6 Green Infrastructure Plans

The following excerpts from this California permit require the creation of green infrastructure plans that detail how green infrastructure will be implemented to meet total maximum daily load (TMDL) wasteload allocations. The conditions also include mapping and tracking projects with potential for incorporating green infrastructure. The implementation example provided demonstrates how one permittee met the permit requirements by developing a green infrastructure plan that details how green infrastructure will be used to meet mercury and polychlorinated biphenyl (PCB) pollutant reduction targets.

California San Francisco Bay Municipal Regional Stormwater Permit

The San Francisco Bay Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as the communities of Fairfield, Suisun City, and Vallejo. The permit includes requirements to develop a green infrastructure plan that calls for mapping areas for potential green infrastructure projects.

Section C.3.j.i.1-2.a Excerpt

> Each Permittee shall:
>
> (1) Prepare a framework or workplan that describes specific tasks and timeframes for development of its Green Infrastructure Plan. This framework or workplan shall be approved by the Permittee's governing body, mayor, city manager, or county manager by June 30, 2017. At a minimum, the framework or workplan shall include a statement of purpose, tasks, and timeframes to complete the elements listed in Provision C.3.j.i.(2) below.
>
> (2) Prepare a Green Infrastructure Plan, subject to Executive Officer approval, that contains the following elements:
>
> (a) A mechanism (e.g., SFEI's GreenPlanIT tool or another tool) to prioritize and map areas for potential and planned projects, both public and private, on a drainage-area-specific basis, for implementation over the following time schedules, which are consistent with the timeframes for assessing load reductions specified in Provisions C.11. and C.12:
>
> (i) By 2020;
>
> (ii) By 2030; and
>
> (iii) By 2040.
>
> The mechanism shall include criteria for prioritization (e.g., specific logistical constraints, water quality drivers (e.g., TMDLs), opportunities to treat runoff from private parcels in retrofitted street right-of-way) and outputs (e.g., maps, project lists) that can be incorporated into the Permittee's long-term planning and capital improvement processes.

Implementation Example: Going Green in Lafayette

The city of Lafayette, California is located in Contra Costa County and is covered by the San Francisco Bay Municipal Regional Stormwater Permit. To comply with permit requirements for post-construction stormwater management, Lafayette has developed a *Green Infrastructure Plan* intended to guide a shift from conventional stormwater management towards green infrastructure. The city's stormwater management ordinance already requires green infrastructure for private development projects. Therefore, the *Green Infrastructure Plan* focuses on retrofitting existing stormwater infrastructure with green infrastructure facilities constructed within the public right-of-way.

The city and its fellow Contra Costa permittees have required pollutant reductions for mercury and PCBs that must be met using green infrastructure by 2020, 2030, and 2040. As part of planning to meet reductions, the city tracks green infrastructure implemented on private development through the Contra Costa Clean Water Program's (CCCWP) green infrastructure tracking tool. The city also coordinated with the CCCWP to model map areas for potential development through 2040. The results of this modeling effort were then used to estimate the amount of impervious surface that could be treated with green infrastructure to reduce pollutant loads. Public opportunities were evaluated through a GIS analysis of publicly owned parcels of land and a feasibility analysis of installing green infrastructure facilities on those parcels.

California San Francisco Bay Municipal Regional Stormwater Permit

The San Francisco Bay Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as the communities of Fairfield, Suisun City, and Vallejo. The permit includes requirements to track upcoming green infrastructure projects and projects with potential for incorporating green infrastructure.

Section C.3.j.ii Excerpt

> Each Permittee shall:
>
> (1) Prepare and maintain a list of green infrastructure projects, public and private, that are already planned for implementation during the permit term and infrastructure projects planned for implementation during the permit term that have potential for green infrastructure measures.
>
> (2) … For any public infrastructure project where implementation of green infrastructure measures is not practicable, submit a brief description of the project and the reasons green infrastructure measures were impracticable to implement.

California San Francisco Bay Municipal Regional Stormwater Permit

The San Francisco Bay Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as the communities of Fairfield, Suisun City, and Vallejo. The permit includes requirements to track and report the implementation of green infrastructure, including treated area and connected or disconnected impervious area.

Section C.3.j.iv Excerpt

> (1) The Permittees shall, individually or collectively, develop and implement regionally-consistent methods to track and report implementation of green infrastructure measures including treated area and connected and disconnected impervious area on both public and private parcels within their jurisdictions. The methods shall also address tracking needed to provide reasonable assurance that wasteload allocations for TMDLs, including the San Francisco Bay PCBs and mercury TMDLs, and reductions for trash, are being met.
>
> (2) In each Annual Report, Permittees shall report progress on development and implementation of the tracking methods.
>
> (3) In the 2019 Annual Report, Permittees shall submit the tracking methods and report implementation of green infrastructure measures including treated area, and connected and disconnected impervious area on both public and private parcels within their jurisdictions.

5 Pollution Prevention

There is one excerpt for pollution prevention within the compendium. The excerpt presented below requires the permittee to provide pollution prevention training that covers green infrastructure O&M. The implementation example demonstrates how the Phase I permittee met this requirement by developing a design manual that includes O&M guidance.

Louisville, Kentucky Phase I Permit

The Kentucky Energy and Environment Cabinet issued a Phase I MS4 individual permit that includes requirements to provide annual pollution prevention training to maintenance staff. The training must include O&M of green infrastructure.

Section 2.7, Table 6 Excerpt (Partial Table)

Table 6. Good Housekeeping/Pollution Prevention (GH/P2) Programs for Municipal Facilities

MSD is the primary co-permittee and has an inter-local agreement with its co-permittees; the responsibilities are divided according to Section 1.2.1.		
GH/P2 Plan Maintenance and Update		
Element Task	**Frequency or Measure of Success**	**Activity Required**
Maintenance Staff Training on Pollution Prevention	Permittee shall report the number of staff attending related training and include in the annual report	The permittee shall provide training to key maintenance staff on good housekeeping activities related to stormwater quality in MSD operations including but not limited to: green infrastructure operation and maintenance, fleet and building maintenance, and stormwater conveyance/drainage system maintenance.

Implementation Example: MSD Green Infrastructure O&M Guidance

The Louisville and Jefferson County *MSD Design Manual,* Chapter 18, includes a section called "Operations & Maintenance Guidance" that provides maintenance considerations and a schedule of maintenance activities for many types of green infrastructure. MSD also provides green infrastructure inspection checklists. Additionally, MSD developed an online "Qualified Post Construction Inspection of Green Infrastructure" course and videos to help private property owners learn how to maintain their rain gardens and permeable pavers.

6 Monitoring

The two excerpts below exemplify evaluating the effectiveness of green infrastructure through monitoring. Both permits require monitoring receiving water quality to assess the impact of green infrastructure; however, they focus on watersheds of different sizes. The highlighted implementation example demonstrates how one permittee met the requirements by establishing permanent monitoring points in an area of urban development.

Nashville, Tennessee Phase I Permit

The Tennessee Department of Environment and Conservation issued a Phase I MS4 individual permit that requires the permittee to assess the effectiveness of a variety of post-construction stormwater controls, including green infrastructure, through monitoring and data analysis.

Section 3.3.8 Excerpt

> The permittee shall design and implement a post-construction BMP monitoring program for purposes of assessing the pollution reduction effects of post-construction BMPs and will include and least one bioretention, dry detention, proprietary water quality unit, green roof, wet pond, and pervious pavement site. At a minimum, analytical data should be collected on each type of post-construction BMP at least 5 times prior to the end of Year 5 of the permit term. Minimum parameters to collect shall include TSS, nutrients, and oil and grease collected at the inlet and outfall. It is understood that green roofs and pervious pavement pose a more difficult BMP to sample so flow reduction may be calculated in lieu of standard chemical analysis. As a component of the BMP monitoring plan, all post-construction BMPs shall be mapped to their respective watersheds.

Implementation Example: Nashville Stormwater Discharge Sampling

In accordance with the Phase I MS4 permit, Nashville performs stormwater discharge sampling of post-construction stormwater controls. Rainfall volume and stormwater monitoring data is submitted to the Tennessee Department of Environment and Conservation.

The *Metro Nashville/Davidson County Annual MS4 Report* (2017) includes monitoring data from six bioretention cells, four green roofs, four pervious pavement sites, five dry ponds, four wet ponds, and three water quality units. For each stormwater control, stormwater discharge monitoring includes grab samples of influent, effluent, or both. Stormwater is sampled for Total Suspended Solids, oil and grease, Total Kjeldahl Nitrogen, Ammonia as N, Nitrate/Nitrite, total Phosphorous, dissolved Phosphorus, total Coliform, and total *E. coli*.

In the 2017 application for re-issuance of the MS4 permit, the Metro Water Services (MWS) estimated that the level of "staff resource dedication per year" is approximately 8 hours per event totaling 128 staff hours annually. MWS also requests the opportunity to develop an alternative customized monitoring plan in the next permit that allows MWS to analyze potential retrofit opportunities with pre- and post-storm event sampling.

California Phase II Permit

The California State Water Resources Control Board issued a Phase II general permit that includes requirements to develop a water quality monitoring program for receiving waters in areas of development, with data collection upstream and downstream of the project area. Note that this permit refers to green infrastructure as "LID."

Part E.13.d.1 Excerpt

> (i) Task Description – Within the second year of the effective date of the permit, the Permittee shall develop and implement a receiving water monitoring program to Monitor receiving water quality at upstream location in an area undergoing development and evaluate changes in

receiving water quality over time, and Monitor receiving water quality at a downstream location in an urban area and evaluate changes in receiving water quality over time. Permittees may, to the extent allowed by law, establish a monitoring fund into which all new development contributes on a proportional basis (% development fee, size/number of lots, etc.). Monitoring funding may be overseen by municipalities or coalition of municipalities.

(ii) Implementation Level – By the first year of the permit, the Permittee shall select one urban/rural interface monitoring site to monitor receiving water quality at an upstream location in an area undergoing development and evaluate changes in receiving water quality over time, and; one (1) urban area monitoring site to monitor receiving water quality at a downstream location in an urban area and evaluate changes in receiving water quality over time. Site selection shall include the following:

(a) Urban/Rural Interface. Identify one characteristic waterway at the top, or upstream, of a HUC 12 level watershed planned for development in the near future that traverses an urban/rural interface, using the 2010 Census Data and urban area maps, and establish a permanent monitoring location at the identified urban/rural interface. Monitoring at the urban/rural interface shall address the question: Does receiving water quality change as LID BMPs are integrated into new development?

Implementation Example: Mojave River Watershed Monitoring

Several MS4 communities in the Mojave River Watershed—including the town of Apple Valley, the cities of Hesperia and Victorville, and the county of San Bernardino—formed the Mojave River Watershed Group (MRWG) to collaborate on cross-jurisdictional water quality standards.

The MRWG identified characteristic waterways for the Mojave River watershed and established a monitoring program. The *Receiving Water Monitoring Program (RWMP) Plan* (2014) established a permanent upstream urban/rural interface (MR-URI) monitoring location and a permanent urban downstream (MR-UD) monitoring location at the Mojave River Narrows. Each monitoring point is near a United States Geological Survey gauge station that provides high-quality stream flow data. The MR-URI is in Mojave River Forks Regional Park and the area upstream is mostly undeveloped, allowing the MRWG to "evaluate the water quality from natural, undisturbed drainage areas" upstream of the MRWG municipalities. The MR-UD is in Rockview Nature Park and is downstream of the MRWG municipalities, allowing the MRWG to monitor and "evaluate water quality improvements as a result of pollution source control and public education efforts." The RWMP also established monitoring parameters and frequency, sampling protocol, analytical methods, and data evaluation and reporting procedures.

7 Specific Stormwater Pollutants

The excerpts presented below are different sections of a permit that requires permittees to implement green infrastructure to reduce mercury and PCB loads. The requirements include developing monitoring programs to determine the impact of green infrastructure on mercury and PCB loads.

One implementation example that is relevant to all permit excerpts is provided at the end of this section. A consortium of permittees in the Santa Clara Valley demonstrate how they met the permit requirements by taking a cross-jurisdictional approach to implementing green infrastructure and quantifying pollutant reductions achieved through green infrastructure.

California San Francisco Bay Municipal Regional Stormwater Permit

The San Francisco Bay Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as the communities of Fairfield, Suisun City, and Vallejo. The permit includes requirements to develop a mercury load-reduction monitoring program to assess the impact of various stormwater controls, including green infrastructure.

Section C.11.b.i Excerpt

> The Permittees shall develop and implement an assessment methodology and data collection program to quantify in a technically sound manner mercury loads reduced through implementation of pollution prevention, source control, and treatment control measures, including mercury source control, stormwater treatment, green infrastructure, and other measures. The Permittees shall use the assessment methodology to demonstrate progress toward achieving the load reductions required in this Permit term and the program area wasteload allocations.

California San Francisco Bay Municipal Regional Stormwater Permit

The San Francisco Bay Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as the communities of Fairfield, Suisun City, and Vallejo. The permit includes requirements to reduce mercury loads through green infrastructure projects to achieve cross-jurisdictional mercury reduction benchmarks in 2020, 2030, and 2040.

Section C.11.c.i-iii Excerpt

> i. Task Description – Permittees shall implement green infrastructure projects during the term of the Permit to achieve the mercury load reductions performance criteria in Table 11.1. Green infrastructure projects on both public and private land can serve to achieve this load reduction requirement. Additionally, Permittees shall prepare a reasonable assurance analysis (see below and Fact Sheet) to demonstrate quantitatively that mercury load reductions of at least 10 kg/yr will be achieved by 2040 through implementation of green infrastructure throughout the permit-area.
>
> ii. Implementation Level
>
> (1) The Permittees shall implement sufficient green infrastructure projects so that mercury loads are collectively reduced by 48 g/yr by June 30, 2020, which shall be extended to December 31, 2020, if the Permittees provide documentation that control measures that will attain the load reduction will be implemented by December 31, 2020. Permittees shall demonstrate achievement of these load reductions by using the accounting methods approved under provision C.11.b.iii(1). Load reductions from green infrastructure projects implemented prior to the effective date of this Permit may be counted toward the required green infrastructure reductions of this Permit term if these projects were established and implemented during the Previous Permit term, but load reductions from the activity were not realized or credited during the Previous Permit term.
>
> The Permittees may meet the load reduction as a group. The load reduction requirements summed over all Permittees within each county are set forth in Table 11.1. If neither the permit-

area-wide total load reduction nor the county-specific load reduction is achieved, Permittees shall achieve load reductions consistent with their share of the county total. The individual Permittee share of the county load reduction is the proportion of county population in each municipality.

If all the Permittees in a county wish to use an alternative method of distributing the county load reductions, these Permittees shall report through their countywide stormwater programs on their alternative method (if different from default population-based method) for assigning Permittee specific load fractions in the 2017 Annual Report. This can be determined by the Permittees within the counties and may be different from one county to the next, but all Permittees within a county shall use the same method of distributing the county load reductions. Any acceptable alternative load reduction criteria must be approved through an amendment of this Permit.

Table 11.1. Mercury Load Reduction Performance Criteria via Green Infrastructure Implementation by County

County Permittees	Mercury Load Reduction (g/yr) by June 30, 2020, through green infrastructure
Alameda Permittees	15
Contra Costa Permittees	9
San Mateo Permittees	6
Santa Clara Permittees	16
Solano Permittees: Suisun City, Vallejo, Fairfield	2
Totals	**48**

(2) Permittees shall prepare a reasonable assurance analysis of future mercury load reductions by doing the following:

a. Quantify the relationship between areal extent of green infrastructure implementation and mercury load reductions. This quantification should take into consideration the scale of contamination of the treated area as well as the pollutant removal effectiveness of likely green infrastructure strategies.

b. Estimate the amount and characteristics of land area that will be treated through green infrastructure by 2020, 2030, and 2040.

c. Estimate the amount of mercury load reductions that will result from green infrastructure implementation by 2020, 2030, and 2040.

d. Quantitatively demonstrate that mercury reductions of at least 10 kg/yr will be realized by 2040 through implementation of green infrastructure projects.

e. Ensure that the calculation methods, models, model inputs, and modeling assumptions used to fulfill C.11.c.ii(2)(a-d) have been validated through a peer review process.

iii. Reporting

(1) The Permittees shall submit in their 2018 Annual Report, as part of reporting for C.11.b.iii(2), the quantitative relationship between green infrastructure implementation and mercury load reductions. This submittal shall include all data used and a full description of models and model inputs relied on to establish this relationship.

(2) The Permittees shall submit in their 2020 Annual Report an estimate of the amount and characteristics of land area that will be treated through green infrastructure implementation by 2020, 2030, and 2040. This submittal shall include all data used and a full description of models and model inputs relied on to generate this estimate.

(3) The Permittees shall submit in their 2020 Annual Report a reasonable assurance analysis to demonstrate quantitatively that mercury reductions of at least 10 kg/yr will be realized by 2040 through implementation of green infrastructure projects. This submittal shall include all data used and a full description of models and model inputs relied on to make the demonstration and documentation of peer review of the reasonable assurance analysis.

(4) The Permittees shall submit as part of reporting for C.11.b.iii(2), beginning with their 2019 Annual Report, an estimate of the amount of mercury load reductions resulting from green infrastructure implementation during the term of the Permit. This submittal shall include all data used and a full description of models and model inputs relied on to generate this estimate.

California San Francisco Bay Municipal Regional Stormwater Permit

The San Francisco Bay Regional Water Quality Control Board issued a cross-jurisdictional Phase I MS4 individual permit covering stormwater discharges from municipalities and local agencies in Alameda, Contra Costa, San Mateo, and Santa Clara counties, as well as the communities of Fairfield, Suisun City, and Vallejo. The permit includes requirements to reduce PCB loads through green infrastructure projects to achieve cross-jurisdictional PCB reduction benchmarks in 2020, 2030, and 2040.

Section C.12.c.i-iii Excerpt

i. Task Description – Permittees shall implement green infrastructure projects during the term of the Permit to achieve PCBs load reduction performance criteria in Table 12.2 in furtherance of meeting the 3000 g/year load reduction criteria required in C.12.a.ii.(4) and Table 12.1. Green infrastructure projects on both public and private land can serve to achieve this load reduction requirement. Additionally, Permittees shall prepare a reasonable assurance analysis (see below and the Fact Sheet) to demonstrate quantitatively that PCBs load reductions of at least 3 kg/yr will be achieved by 2040 through implementation of green infrastructure throughout the permit-area.

Table 12.2. PCBs Load Reduction Performance Criteria via Green Infrastructure Implementation by County

County Permittees	PCBs Load Reduction (g/yr) by June 30, 2020, through green infrastructure
Alameda Permittees	37
Contra Costa Permittees	23
San Mateo Permittees	15
Santa Clara Permittees	37
Solano Permittees: Suisun City, Vallejo, Fairfield	8
Totals	**120**

ii. Implementation Level

(1) The Permittees shall implement green infrastructure projects so that PCBs loads are collectively reduced by 120 g/yr by June 30, 2020, which shall be extended to December 31, 2020, if the Permittees provide documentation that control measures that will attain the load reduction will be implemented by December 31, 2020. Permittees shall demonstrate achievement of these load reductions by using the accounting methods approved under provision C.12.b.iii(1). Load reductions from green infrastructure projects implemented prior to the effective date of this Permit may be counted toward the required green infrastructure reductions of this Permit term if these projects were established and implemented during the Previous Permit term, but load reductions from the activity were not realized or credited during the Previous Permit term.

The Permittees may meet the load reduction as a group. The load reduction requirements summed over all Permittees within each county are set forth in Table 12.2. If neither the permit-area-wide total load reduction nor the county-specific load reduction is achieved, Permittees shall achieve load reductions consistent with their share of the county total under provision C.12.a.ii(4).

(2) Permittees shall prepare a reasonable assurance analysis that demonstrates how green infrastructure will be implemented in order to achieve a PCBs load reduction of 3 kg/yr across the permit-area by 2040. This analysis shall include the following:

a. Quantify the relationship between areal extent of green infrastructure implementation and PCBs load reductions, taking into consideration the scale of contamination of the treated area as well as the pollutant removal effectiveness of likely green infrastructure strategies;

b. Estimate the amount and characteristics of land area that will be treated through green infrastructure by 2020, 2030, and 2040;

c. Estimate the amount of PCBs load reductions that will result from green infrastructure implementation by 2020, 2030, and 2040;

d. Quantitatively demonstrate that PCBs reductions of at least 3 kg/yr will be realized by 2040 through implementation of green infrastructure projects; and

e. Ensure that the calculation methods, models, model inputs and modeling assumptions used to fulfill C.12.c.ii(2)a-d have been validated through a peer review process.

iii. Reporting

(1) The Permittees shall submit in their 2018 Annual Report, as part of reporting for C.12.b.iii(3), the quantitative relationship between green infrastructure implementation and PCBs load reductions. This submittal shall include all data used and a full description of models and model inputs relied on to establish this relationship.

(2) The Permittees shall submit in their 2020 Annual Report an estimate of the amount and characteristics of land area that will be treated through green infrastructure implementation by 2020, 2030, and 2040. This submittal shall include all data used and a full description of models and model inputs relied on to generate this estimate.

(3) The Permittees shall submit in their 2020 Annual Report a reasonable assurance analysis to demonstrate quantitatively that PCBs reductions of at least 3 kg/yr will be realized by 2040 through implementation of green infrastructure projects. This submittal shall include all data used and a full description of models and model inputs relied on to make the demonstration and documentation of peer review of the reasonable assurance analysis.

(4) The Permittees shall submit as part of reporting for C.12.b.iii(4), beginning with their 2019 Annual Report an estimate of the amount of PCBs load reductions resulting from green infrastructure implementation during the term of the Permit. This submittal shall include all data used and a full description of models and model inputs relied on to generate this estimate.

Implementation Example: Santa Clara Valley Mercury and PCB Plans

The 15 jurisdictions that form the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) jointly address stormwater pollution in the Santa Clara Basin and the San Francisco Bay. According to its *Stormwater Resource Plan*, SCVURPPP is planning and constructing green infrastructure to reduce the amount of PCBs and mercury in stormwater.

The program uses a combination of public and private projects to reduce the load of PCBs and mercury in cross-jurisdictional stormwater. These projects use green infrastructure that infiltrates (e.g., pervious pavers and infiltration trenches), filters and retains (e.g., green roofs), or both infiltrates and filters (e.g., green streets and rain gardens) to reduce the pollutant load in stormwater reaching surface waters. SCVURPPP maintains a map of its implemented green infrastructure projects.

SCVURPPP's *Stormwater Control Measures Plan for PCBs and Mercury: Version 3.0 (2016–2020)* reports that between 2013 and 2018, over 2,250 acres of new development and redevelopment were treated by green infrastructure. Public green street and cross-jurisdictional retrofit projects also implemented green infrastructure during this time frame, but to a much smaller degree. Combined, these public and private green infrastructure projects accounted for 70 grams/year of PCB load reduction and 853 grams/year of total mercury load reduction between 2013 and 2018. Though public green streets and cross-jurisdictional retrofit projects accounted for less than 1 percent of the PCB and mercury load reduction achieved between 2013 and 2018, SCVURPPP expects green streets and cross-jurisdictional retrofit projects to increase over the next decade. These projects often serve as demonstration projects and several have been recognized with awards. Examples of public green infrastructure projects include a green alley in the Martha Gardens neighborhood of San Jose, pervious pavement on Charcot Avenue and Berger Drive in Santa Clara County, and green streets on Hacienda Avenue in the city of Campbell and the Southgate neighborhood of Palo Alto.