



Municipal Separate Storm Sewer Systems and Best Management Practices Guidebook

Greater Edwards Aquifer Alliance

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Purpose

This guidebook provides an overview of the history of Municipal Separate Storm Sewer regulations, the current regulatory framework governing MS4s in the State of Texas, the required provisions of the stormwater management programs associated with each MS4, and recommendations for creating more stringent, comprehensive stormwater management programs. The guidebook is primarily geared toward Phase II MS4s, but Phase I MS4 permittees are still encouraged to use the guidebook and incorporate the outlined recommendations. This guidebook should be utilized in addition to the Phase II MS4 General Permit and the Permit Fact Sheet issued by the Texas Commission on Environmental Quality, along with any other appropriate materials.

Acronyms and Abbreviations

BMP	Best Management Practice
CWA	Clean Water Act of 1972
EPA	Environmental Protection Agency
GSI	Green Stormwater Infrastructure
LID	Low Impact Development
MCM	Minimum Control Measures
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
SAWS	San Antonio Water System
SWMP	Stormwater Management Program
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TPDES	Texas Pollutant Discharge Elimination System
TxDOT	Texas Department of Transportation

I. Background

A. Definitions

Stormwater runoff is generated when water from precipitation events flows over land and impervious surfaces and does not soak into the ground. This allows the stormwater to pick up pollutants that can impair bodies of water, such as nitrogen, trash, sediment, chemicals, oils, and heavy metals, such as barium or arsenic.¹

A Municipal Separate Storm Sewer System is a means by which to transport and then discharge stormwater runoff into local water bodies. An MS4 is a conveyance or system of conveyances that is owned by a public entity; is used to collect or convey stormwater; is not a combined sewer system; and is not part of a sewage treatment plant or publicly owned treatment works.²

- “Municipal” – an MS4 is owned or operated by a public agency, such as a municipality, municipal utility district, county, state, or federal agency.
- “Separate Sewer System” – an MS4 does not connect to a wastewater collection system or a wastewater treatment plant, unlike a combined sewer system. There are no combined sewer systems designated by the EPA in Texas.³
- “Storm” – an MS4 comprises infrastructure which collects and conveys stormwater runoff, which includes, among other infrastructure, ditches, storm sewers, gutters, roads with drainage systems, and municipal streets.⁴

B. Context

On October 18, 1972, the United States Congress passed the Federal Water Pollution Control Amendments of 1972, otherwise known as the Clean Water Act, with the goal of restoring and maintaining “the chemical, physical, and biological integrity of the nation’s waters.”⁵ Even though the Clean Water Act has helped significantly improve the quality of many of our nation’s waterways, still over half of the rivers and streams in the country remain impaired.⁶ This result is because the CWA, through the Environmental Protection Agency, mainly regulates point source water pollution, or pollution from single and identifiable sources such as pipes from industrial and municipal facilities that discharge into local waters.⁷

Decades after the passage of the CWA, nonpoint source pollution has now become the largest threat to water quality, even though the CWA has expanded to include regulation of some nonpoint source pollution from urban stormwater runoff.⁸

The Clean Water Act only regulates stormwater that is “collected, transported, and discharged by an MS4.”⁹ It is important to note that the stormwater is not required to be treated before its discharge. Regulated runoff discharged through MS4s, unregulated agricultural runoff, and direct runoff all enter waters without being treated.¹⁰ When these sources contain pollutants, they contaminate water sources, “degrading water quality and rendering it toxic to humans and the environment.”¹¹

Many stormwater pollution sources are not regulated by the Clean Water Act. For example, stormwater runoff in localities not covered by an MS4 permit, stormwater that infiltrates the ground without entering a storm sewer system, and stormwater runoff that flows off agricultural fields into a water source are not regulated. It is thus vitally important that operators of MS4s do their utmost to prevent and control the pollution of stormwater within their service area. Since most types of nonpoint source pollution are not regulated by the CWA, a well-functioning MS4 represents one of the only regulatory mechanisms currently available to lessen the amount of nonpoint source pollution entering and contaminating local and downstream water sources.

II. Municipal Separate Storm Sewer Systems

A. MS4 Permitting

MS4s are permitted under the U.S. Environmental Protection Agency's National Pollutant Discharge Elimination System. Operators with NPDES permits are authorized by the 1972 Clean Water Act to regulate point sources that discharge pollutants to Waters of the United States and nonpoint source pollutants from urban stormwater runoff.¹² Certain operators of MS4s (the permittees) are required to obtain an NPDES (or state equivalent) permit. An NPDES MS4 permit requires permittees to develop and implement a stormwater management program. To illustrate what is covered under an MS4 permit, in San Antonio, all stormwater – including sheet flow from municipal streets – that flows into the city's storm sewer infrastructure, channels, creeks, streams, and other waterways is regulated as a potential nonpoint source pollutant through San Antonio's MS4 permit.¹³

Under Texas Water Code Section 26.121 it is unlawful to discharge pollutants into or adjacent to water in the state except as authorized by a rule, permit, or order issued by the Texas Commission on Environmental Quality.

Through an agreement with the EPA, Texas is authorized to implement the NPDES within the state through the Texas Pollutant Discharge Elimination System, which operates under the state's permitting authority, the TCEQ. The MS4 permit requirements in Texas occur in two phases:¹⁴

1. Phase I permits are required for large and medium MS4s.
 - a. Phase I MS4s serve an incorporated place or county with a population of 100,000 or more based on the 1990 Census.
 - b. All Phase I MS4s are already permitted; there are no new designations for Phase I MS4s.
2. Phase II permits are required for certain small MS4s.
 - a. Phase II MS4s either serve an urban area or are located outside an urban area but were designated by TCEQ.
 - i. An urban area, according to the US Census Bureau, will have a population of at least 50,000 according to the 2000, 2010, or 2020 US Census.¹⁵

- ii. Designated MS4s are evaluated on the location of the discharge with respect to Waters of the U.S., the size of the discharge, the quantity and nature of the pollutants discharged, and other relevant factors.
- b. Whether in an urban area or designated by TCEQ, small MS4s in Texas may discharge stormwater into surface water when entered into the Small MS4 General Permit, TPDES Permit No. TXR040000.

There is an additional way in which an operator may potentially participate in the MS4 permit program. Under the NPDES program, any person may petition the program director – for Texas, this would be the director of the TCEQ – for the designation of a large, medium, or small municipal separate storm sewer system. The Director must make decide on whether to designate the MS4 within 180 days of receiving the petition, otherwise that decision will fall to the U.S. Environmental Protection Agency.¹⁶

B. Phase II MS4 General Permit

Phase II MS4s in the State of Texas are largely governed by TPDES General Permit No. TXR040000, issued August 15, 2024, though small MS4 operators have the option to apply for an individual MS4 permit. The General Permit allows Phase II MS4s to discharge directly to surface water according to the requirements and conditions set forth in the general permit, TCEQ rules, and the laws of Texas. TCEQ recently renewed the 2019 permit, which was set to expire on January 24, 2024, but was extended until August 2024 due to a delayed rollout of the updated permit.¹⁷

The information contained here will be based on the newest permit, which began on August 15, 2024.¹⁸ The most recent General Permit adds more specific BMPs and measurable goals for each MCM than were present in the preceding General Permit. For more information on the changes made to the 2019 General Permit for the 2024 General Permit, see the Permit Fact Sheet.¹⁹

The General Permit groups small MS4s into four levels:

1. Level 1: Operators of traditional small MS4s that serve a population of less than 10,000 within an urban area;
2. Level 2:
 - a. Level 2a: Operators of traditional small MS4s that serve a population of at least 10,000 but less than 40,000 within an urban area;
 - b. Level 2b: Operators of all non-traditional small MS4s such as counties, drainage districts, transportation entities, military bases, universities, colleges, correctional institutions, municipal utility districts and other special districts regardless of population served within the urban area, unless the non-traditional MS4 can demonstrate that it meets the criteria for a waiver from permit coverage based on the population served;

3. Level 3: Operators of traditional small MS4s that serve a population of at least 40,000 but less than 100,000 within an urban area; and
4. Level 4: Operators of traditional small MS4s that serve a population of 100,000 or more within an urban area.²⁰

MS4 operators must submit to TCEQ an annual report by March 31 of each year for the previous calendar year. The annual report will describe, at minimum, the status of compliance with permit conditions; the activities conducted during the MS4's reporting year; a summary of results of information collected and analyzed; and a summary of actions taken to address discharge to impaired water bodies. The report will also describe any proposed changes to the SWMP. Other reporting requirements are outlined in the General Permit. The report must be submitted even if the SWMP has not yet been approved by TCEQ.²¹ The stormwater management plan is essentially the detailed blueprint that outlines how the permittee will comply with the requirements of its MS4 permit.

MS4 permits may be granted to co-permittees. Permittees participating in shared SWMPs must contribute to a system-wide report signed by each permittee.

C. Municipal Versus County Authority

Certain MS4 operators may have more authority than others to implement the regulatory requirements of an MS4 permit in Texas. Many municipalities in the state are granted the authority to create home rule charters, empowering them "to enact any ordinance not expressly forbidden by state or federal law."²² These municipalities may develop and implement any necessary ordinances, regulations, or controls to meet the requirements of the permit if they are not prohibited by state or federal law or regulation.

A municipality may choose to cover activities strictly within its corporate limits, within its corporate limits and the extraterritorial jurisdiction, or strictly within the boundary of the urban area with a population of at least 50,000.²³ It is up to the MS4 permittee to ensure it has all funding and resources necessary to meet permit requirements.

Counties, meanwhile, may only enact regulations expressly authorized by state law. Generally speaking, counties in Texas are not authorized to implement all of the regulatory requirements of the General Permit. Counties that enter the MS4 permit are generally only authorized to operate in the urban areas of the county, as classified by the latest census.

The exceptions to the general restrictions on counties are counties granted explicit legal authority to implement TPDES stormwater management and pollution prevention programs under Title 13 Chapter 573 of the Texas Local Government Code.²⁴ Under this provision, counties with a population of greater than 2.8 million; a population of greater than 1.3 million where the primary drinking water source is an aquifer; or a population of 800,000 or more and containing a portion of the Edwards Aquifer may:

- Develop and implement controls to reduce the discharge of pollutants from any conveyance or system of conveyance owned or operated by the county, district, or authority that is designed for collecting or conveying stormwater;
- Develop, implement, and enforce stormwater management guidelines, design criteria, or rules to reduce discharge of pollutants into any conveyance or system of conveyance owned or operated by the county, district, or authority that is designed for collecting or conveying stormwater;
- Assist residents with the proper management of used oil and toxic materials, including the holding of household hazardous waste collection events;
- Develop and provide educational tools and activities designed to reduce or lead to the reduction of the discharge of pollutants into stormwater; and
- Assess reasonable charges to fund the implementation, administration, and operation of the stormwater permitting program as necessary to comply with federal or state requirements.²⁵

At the time of publication, the only counties granted this exception were Bexar, Harris, and Travis counties. All other counties are restricted in their ability to enact all ordinances and regulations necessary to meet the MS4 permit requirements.

When a non-traditional permittee – such as a county, military base, or university – lacks the authority to develop required ordinances or to implement enforcement actions, it still must enact its required enforcement authority over the facilities, employees, contractors, and any other entities over which it has operational control. When the permittee is unable to meet the goals of this general permit through its own enforcement authority and powers, it must perform the following actions:

- Enter into interlocal agreements with municipalities where the MS4 is located that state the extent to which the municipality will be responsible for meeting permit requirements; or
- When unable to do so, notify the TCEQ Regional Office to report discharges and incidents when it does not have enforcement authority.²⁶

D. The Edwards Aquifer Recharge Zone and Endangered Species Provisions

Small MS4s in Bexar, Comal, Hays, Kinney, Medina, Travis, Uvalde, and Williamson Counties may be required to meet further regulations regarding stormwater discharges due to their location on or near the Edwards Aquifer Recharge Zone. Regulated Phase II MS4s may not discharge stormwater in instances where those discharges are prohibited by 30 Texas Administrative Code Chapter 213 (30 TAC 213 or Edwards Aquifer Rule).

New discharges located within the Edwards Aquifer Recharge or Contributing Zones must meet all applicable requirements of the Edwards Aquifer Rule as well as the requirements of the General Permit. Existing discharges must meet the requirements of a TCEQ-approved Water Pollution Abatement Plan under the Edwards Aquifer Rule and the requirements of the General

Permit. More detailed guidance and requirements for Phase II MS4s are outlined in the General Permit.²⁷

Federal requirements related to endangered species apply to all TPDES permitted discharges. Discharges that would adversely affect a listed endangered or threatened species or its habitat are not authorized under the Small MS4 General Permit. To ensure the protection of endangered or threatened species, site-specific controls may be required under the General Permit.

III. Phase II MS4 Stormwater Management Program

While all permitted Phase II MS4s are governed by the General Permit, each MS4 must still develop, implement, and enforce their own stormwater management program. The SWMP must, to the maximum extent practicable, protect water quality and satisfy the water quality requirements of the federal Clean Water Act and the Texas Water Code. Permittees that implement their best management practices in accordance with the General Permit and their SWMP are deemed in compliance by TCEQ with the stormwater management program section of the General Permit.²⁸

The stormwater management program will describe the stormwater control practices the operator will implement consistent with their permit requirements to minimize pollutant discharge to the maximum extent practicable. The SWMP must include pollution prevention measures; treatment or removal techniques; monitoring; use of legal authority; and other appropriate measures to control the quality of discharged stormwater.²⁹

For traditional small MS4s, the permittee must review and revise its relevant ordinances and regulatory mechanisms and determine if new ordinances are needed that would provide appropriate legal authority for the permittee to meet the MS4 permit requirements.

Phase II MS4s must develop and submit to TCEQ a stormwater management program that includes at least the following six minimum control measures and an optional seventh and eighth MCM:

- MCM 1: *Public Education and Outreach*
- MCM 2: *Public Involvement/Participation*
- MCM 3: *Illicit Discharge Detection and Elimination*
- MCM 4: *Construction Site Stormwater Runoff Control*
- MCM 5: *Post-Construction Stormwater Management in New Development and Redevelopment*
- MCM 6: *Pollution Prevention and Good Housekeeping for Municipal Operations*
- MCM 7: *Industrial Stormwater Sources* (generally optional, only required if the Small MS4 serves a population greater than 100,000)
- MCM 8: *MS4-Operated Construction Sites* (optional, alternative to seeking coverage under TPDES CGP TXR150000 for each construction activity)³⁰

If the optional eighth MCM is not chosen, the small MS4 operator must obtain separate authorization for the construction site under the TPDES construction general permit or an individual TPDES permit.

Each MCM may be achieved through best management practices that are detailed in the stormwater management program. Each MCM must have measurable goals, interim milestones, the frequency of each action, and the months and years in which the permittee will undertake the required actions. Additional requirements and guidance for the SWMP are outlined in the General Permit and its associated Fact Sheet.³¹

Complete implementation of the provisions in the SWMP is required no later than five years from the date of issuance of the General Permit. Existing permittees with SWMPs that were approved under the 2019 Small MS4 General Permit must continue to implement their SWMP and will have five years to implement any updated portions of their program.

A. Pollutants of Concern

The General Permit requires permit holders to control the discharge of pollutants of concern to both impaired waters and waters with approved total maximum daily loads and to assess their progress in controlling those pollutants. The SWMP and annual reports must outline the targeted controls (or BMPs) used to reduce these pollutants in impaired waters; create measurable goals and implementation schedules; identify benchmarks; provide an annual report on the effectiveness of the BMPs; and provide an assessment of progress.

If a pollutant of concern in an impaired water is bacteria, the MS4 permittee is required to implement, as appropriate, BMPs for sanitary sewer systems, on-site sewage facilities, illicit discharges and dumping, animal sources, and residential education.³²

The MS4 permittee is required to develop a Monitoring or Assessment Plan to track progress in achieving set benchmarks and to determine the effectiveness of the implemented BMPs. This Plan must be included in the SWMP. To evaluate progress, the permittee may either evaluate program implementation measures (i.e., assessing number of sources eliminated, reduction in sanitary sewer overflows, decrease in illegal dumping, etc.) or assess improvements in water quality. The results of either of these assessments must be included in the annual report. If no progress has been made by the end of the third permit year, alternative BMPs should be identified and included in the SWMP.

B. Minimum Control Measures and Best Management Practices

BMPs are targeted controls that help the permittee achieve the minimum control measures outlined in their SWMP. Each BMP or set of BMPs chosen needs to achieve the minimum control measure under which it falls. This section will focus on just the required six minimum control measures; the seventh and eighth MCMs are optional. The Phase II MS4 General Permit and Fact Sheet have further detail and requirements for each MCM.³³ The six required MCMs are as follows:

MCM 1: *Public Education and Outreach*

- a) Roadway and residential activities are leading causes of trash and litter in waterways and of urban runoff pollution, with automotive fluids, fertilizer, pet waste, microplastics, etc. contributing significantly to runoff pollution.³⁴ Public education can increase support for funding pollution prevention initiatives and can help the public become aware of the actions they can take to protect receiving waterbodies.³⁵
- b) Phase II MS4s are required to educate the community on the pollution of common activities. These efforts should increase awareness of the links between activities, runoff, storm drains, and local water bodies.
- c) Education and outreach programs must contain clear guidance on actions that can reduce stormwater pollution potentials while following all public notice requirements when implementing these programs.
- d) MCM 1 can be achieved through many different BMPs, including, but not limited to, classroom education, municipal outreach programs, promotional giveaways, vehicle maintenance education, and lawncare education.

MCM 2: *Public Involvement/Participation*

- a) Increasing community participation builds community capital, helps spread the message about the importance of preventing stormwater pollution, and creates opportunities for direct action. These activities allow the operator to meet legal public notice requirements. Public involvement can help the permittee gain public support for and community investment in the SWMP and gain greater insight into effective messaging.³⁶
- b) Phase II MS4s are required to follow all local, state, tribal, and federal public notice requirements when implementing the SWMP.
- c) Public involvement and participation programs must create opportunities for residents and others to become involved with the development of the SWMP and in the SWMP efforts, support activities coordinated by citizen groups, and demonstrate improved water quality outcomes.
- d) MCM 2 can be achieved through many different BMPs, including, public meetings, volunteer water quality monitoring programs, stream clean-up programs, or tree planning events.

MCM 3: *Illicit Discharge Detection and Elimination*

- a) Illicit discharges release untreated wastewater and pollutants into the MS4, leading to pollutants such as heavy metals, toxics, bacteria, solvents, oils, and greases entering the receiving waters. This release can degrade water quality and threaten aquatic species, wildlife, and human health and safety.³⁷
- b) Phase II MS4s are required to develop a program to detect illicit discharges and eliminate them.
- c) The illicit discharge program must be reactive in addressing spills and other illicit discharges, including illegal dumping, to the storm drain system and proactive in preventing and eliminating these discharges through education, training and enforcement.

- d) MCM 3 can be achieved through many different BMPs, including, but not limited to, ordinances, community hotlines, storm system sewer maps, education programs, and septic system maintenance and education.

MCM 4: *Construction Site Stormwater Runoff Control*

- a) Sediment is a source of pollution in water and enters water sources through erosion and runoff. Erosion from construction sites is often an order of magnitude larger than agricultural erosion and several orders larger than erosion in forests. Construction activity is “the largest direct source of human-made sediment load” and can also result in increased runoff.³⁸ Furthermore, construction work is often associated with increased levels of pollutants such as chemicals, debris, fertilizers, spills, littering, concrete washouts, and metals.³⁹
- b) Phase II MS4s are required to develop, implement, and enforce a program to reduce pollutants from specific construction activities.⁴⁰
- c) This program should include developing an ordinance to address construction runoff, requirements to implement erosion and sediment control BMPs, requirements to control other waste at the site, procedures for reviewing construction site plans, procedures to receive and consider information submitted by the public, and procedures for inspections and enforcement of stormwater requirements at construction sites.
- d) MCM 4 can be achieved through many different BMPs, including, but not limited to, contractor training and certification, municipal construction inspection programs, and erosion and runoff control.

MCM 5: *Post-Construction Stormwater Management in New Development and Redevelopment*

- a) New development sites and redevelopment projects can cause natural landscapes – traditionally sites of runoff absorption or filtration – to be replaced with impervious cover such as parking lots, roads, and sidewalks, leading to increases in stormwater runoff volume (i.e., floods) and pollutant loads.⁴¹
- b) Phase II MS4s are required to develop, implement, and enforce a program to reduce pollutants in stormwater discharged into the storm sewer system from specific post-construction activities.
- c) The program should include developing an ordinance to address post-construction runoff, ensuring adequate long-term operation and maintenance of BMPs, and strategies to implement a combination of structural and non-structural BMPs.
- d) MCM 5 can be achieved through many different BMPs, including, but not limited to, post-construction plan reviews, conservation easements, green infrastructure or low impact development, and protection of natural features and open space.

MCM 6: *Pollution Prevention and Good Housekeeping for Municipal Operations*

- a) The maintenance of parks, medians, roadsides, and greenspaces can contribute harmful chemicals and high levels of nutrients from pesticides and fertilizers to local water sources, especially when applied at improper times like just before a precipitation event. Improperly maintained landfills, storage sites, recycling centers, fleet

maintenance centers, or similar sites can allow stormwater to carry pollutants from these sites to bodies of water.⁴²

- b) Phase II MS4s must implement a program for staff to prevent and reduce pollutants in stormwater from activities such as maintaining the MS4 infrastructure, construction, park maintenance, and fleet maintenance. Level 3 and 4 permittees have additional requirements under this MCM.
- c) The program should include developing a training program, developing standard operating procedures, establishing safe disposal procedures, and developing inspection and maintenance schedules for implementing BMPs.
- d) MCM 6 can be achieved through many different BMPs, including, but not limited to, municipal employee training, hazardous materials storage regulations, parking lot and street cleaning procedures, and storm drain system cleaning.⁴³

The EPA recommends MCM 7, *Industrial Stormwater Sources*, be included in Phase II permits; TCEQ requires it for Phase II MS4s with a population of greater than 100,000. MCM 7 requires permittees to identify and control pollutants from industrial or commercial stormwater discharges that could contribute a substantial pollutant loading to the MS4.

MCM 8, *Authorization for Construction Activities Where the MS4 is the Site Operator*, may be used by permittees who maintain operational control over construction sites and may replace the requirement to obtain separate permit coverage for each construction activity conducted by the MS4 operator, though only for those construction activities located in the regulated area. This MCM can replace the requirement to obtain separate coverage under a TPDES individual permit or TPDES Construction General Permit TXR150000 but does not preclude an MS4 operator from still doing so.

C. Difference in Requirements for Phase I and Phase II Permits

Phase I MS4s are typically located in larger, more densely populated areas than Phase II MS4s and have additional obligations under their permits. In addition to the six requirements for small MS4s, large and medium MS4 operators must include the following three minimum control measures:

- *MS4 Maintenance Activities*
 - Implement an operations and maintenance program to reduce discharge of pollutants by maintaining the MS4, reducing floatables, reducing erosion, and maintaining public streets and roads.
- *Industrial and High-Risk Runoff*
 - Implement or improve programs to identify and control pollutants from industrial and commercial stormwater discharges that pose a high-risk to the MS4 and stormwater quality.
 - This MCM may be required for a Phase II MS4 if the permittee serves a population greater than 100,000.

- *Monitoring, Evaluation, and Reporting*
 - Implement and update monitoring and screening programs such as dry weather screening, wet weather screening, industrial and high-risk runoff monitoring, storm event discharge monitoring, and floatable debris monitoring.

These additional obligations are not federally required to be included in Phase II MS4s, but are not prohibited and may be included if the permittee and permitting authority so choose.⁴⁴ This guidebook recommends their inclusion in SWMPs.

IV. Recommendations

While the MS4 permit will outline what is required for the fulfillment of that permit, it is still recommended that operators go beyond these requirements in the development of their stormwater management programs. Operators may include stricter requirements than those outlined in the permit.

There are many different BMPs from which MS4 operators can choose when developing their stormwater management programs. To do so, MS4 operators should review resources (Appendix A) such as:

- Well-developed existing SWMPs;
- EPA’s National Menu of Best Management Practices for Stormwater;
- EPA Phase II Minimum Control Measure Fact Sheets; or
- BMP databases, such as:
 - The National Municipal Stormwater Alliance MS4 Resource,
 - The North Central Texas Council of Governments’ BMP Library, or
 - The Water Research Foundation’s International BMP Database.

When developing the SWMP, the permittee should provide a description of how they identified the BMPs included in the program.

Ultimately, it is up to the operator to choose the BMPs that best fit the characteristics and needs of the MS4 and its service area while ensuring all requirements of the permit are met. When feasible, enforceable municipal ordinances or regulations are recommended as BMPs, to better ensure compliance by municipal employees, private industry, and the public.

Stormwater management programs (or the most recent Annual Report if the SWMP was not publicly available) from a variety of MS4 operators, including cities, counties, college campuses, and consortiums of participating groups were used as case studies for this analysis:

- Texas Phase II MS4s: Hays County, Texas State University, City of New Braunfels, Bexar County, City of Helotes, Lower Rio Grande Valley Stormwater Task Force
- Texas Phase I MS4s: City of San Antonio, City of Dallas, City of Austin, City of Fort Worth
- National Phase I and II MS4s (Western U.S.): City of Albuquerque, City of Tucson, City of Phoenix, Oklahoma City, Tulsa County, City of Flagstaff, City of Boise, City of Omaha

The recommendations outlined in this guidebook are either pulled from these SWMPS, various BMP databases and libraries, and EPA guidance, or are provided to cover gaps in the analyzed literature.

In addition to incorporating these recommendations, operators should ensure their SWMP meets permit requirements. As much detail as possible for effective implementation should be provided, along with clear, quantifiable goals for each BMP. SWMPS should go above and beyond the requirements set forth in the associated MS4 permit. The following recommendations, if implemented in whole or in part, will help ensure the MS4 operator has a more effective and enforceable SWMP.

BMPs required by the relevant MS4 permit may not be outlined below, and the BMPs that are listed are not in order of recommended importance. Each of the referenced SWMP examples may be found in Appendix C.

A. Municipal Operations

The MS4 operator should create a Watershed Protection Department (WPD) or a SWMP Implementation Team to be the main department within the municipality responsible for the development and maintenance of the SWMP. For an example, see the City of Austin's 2022 Stormwater Management Program and the City of Phoenix's 2023 SWMP.

Implementation of the SWMP should be a collaborative effort across the MS4, even if overseen by the WPD or similar department. For example, all staff of the MS4 operator should be trained in spill prevention and response, proper storage, and reporting spills and suspicious flows. See the City of Tucson's 2023 Stormwater Management Program. The roles and responsibilities for each department or agency involved in the implementation or development of the SWMP should be detailed in the SWMP. See the City of Albuquerque's 2019 Stormwater Management Program for an example.

To ensure the long-term effectiveness of implemented stormwater controls, the operator should establish a designated location, point of contact, or department that holds and makes available all stormwater infrastructure operations and maintenance manuals, standard operating procedures, and relevant contracts.

If the MS4 operator has the authority to pass ordinances or regulations, the operator should pass a Watershed Protection Ordinance to improve creek and floodplain protection. The ordinance should address, at minimum, impervious cover regulations, erosion and sedimentation controls, water quality controls, development and redevelopment regulations, and storm sewer discharges. If a vulnerable watershed exists within the MS4's boundaries (such as an aquifer recharge zone), the watershed protection ordinance for that watershed should require stricter standards. For an example of this type of ordinance, see the City of Austin's 2022 Stormwater Management Program.

If the MS4 operator has the authority to pass ordinances or regulations, the operator should ensure there are legal water quality and watershed protection regulations. These regulations or ordinances should be stringent enough that violations result in effective citations, fines, or prosecution. For an example of this authority, see the City of Austin’s 2022 Stormwater Management Program.

The MS4 operator should create and use an Environmental Integrity Index (EII) to monitor and assess the ecological integrity and the degree of impairment of creeks within the relevant watersheds. The operator should use data collected on chemical, physical, and biological parameters to assess the integrity of waterways and assign EII scores. For an example of the EII, see the City of Austin’s 2022 Stormwater Management Program. This data can be used to refine the implementation of the SWMP. Where available, the MS4 operator should join conservation or watershed protection plan programs. For example, the Edwards Aquifer Habitat Conservation Plan includes a water quality protection component which requires activities aimed at protecting water quality and minimizing pollutant loading. See the City of New Braunfels’ 2019 Stormwater Management Program.

To ensure the operator has appropriate stormwater ordinances or regulatory mechanisms, the MS4 operator should “obtain and review model stormwater pollution codes from other permitted MS4s and agencies; compare model building and zoning codes to existing local codes and ordinances and make modifications to local codes; if needed, adopt a new local code or modify an existing code to address illicit discharge detection and elimination; and periodically evaluate code effectiveness and make changes when needed to the illicit discharge codes.”⁴⁵ To see an example of this provision in an SWMP, see the Tulsa County 2017 Stormwater Management Program.

The MS4 operator should establish detailed Standard Operating Procedures (SOPs) for spill response investigations and for verifying whether best management practices are being installed and maintained in perpetuity. See the City of Austin’s 2022 Stormwater Management Program and the City of Omaha’s 2022 Stormwater Management Program Annual Report.

B. Low Impact Development/Green Stormwater Infrastructure

To better understand the effect low impact development or green stormwater infrastructure practices could have on the operation of the MS4, the operator should provide in their annual report an estimation of the number of acres of impervious area and directly connected impervious areas (the portion of impervious area with direct hydraulic connection to the MS4). See the City of Albuquerque’s 2019 Stormwater Management Program. Based on this analysis, the operator should consider implementing impervious cover limits, especially over hydrologically or environmentally sensitive areas.

To increase the implementation of LID/GSI practices during development and re-development, the operator should require all permittees to “assess all existing codes, ordinances, planning documents and other applicable regulations, for impediments to the use of GI/LID/Sustainable

Practices and develop a report of the assessment findings to provide information to promote necessary changes and allow implementation of GI/LID/Sustainable Practices.”⁴⁶ The operator could also host a LID/GSI workshop for the development community to encourage implementation throughout the service area. See the City of Albuquerque’s Stormwater Management Program.

The MS4 operator should also review local codes and ordinances and identify any barriers to the implementation of LID or GSI practices and develop a schedule to remove those barriers that prohibit these practices within the MS4 area; changes should be made within 5 years of the analysis. The operator should also create and implement a program that requires long-term operation and maintenance of LID/GSI best management practices at both the public and private level. See the Tulsa County 2017 Stormwater Management Program for an example of this provision. The operator should either require private developers to implement LID/GSI practices in new construction or redevelopment projects or provide incentives for the implementation of these practices by private developers when infeasible to require them.

The MS4 operator should continuously evaluate LID/GSI practices to assess the feasibility of incorporating additional measures into the operator’s practices and assess how these practices could contribute to reducing pollutants in the stormwater discharge. The operator should submit the findings of these assessments in its annual report. For an example of this measure, see the City of Tucson’s 2023 Stormwater Management Program. The operator should also require consistent and rigorous inspections of the operations and maintenance of its LID/GSI practices to ensure these systems are operating as designed and permitted.

As a means of ensuring wider implementation of LID/GSI, all new capital improvement projects by the MS4 operator, including transportation and public construction projects, should be required to have LID/GSI practices as stormwater quantity and quality control strategies. For an example of this measure, see the City of Phoenix’s 2023 Stormwater Management Program.

For new flood management projects, the operator should implement standard operating procedures to assess the project’s design and determine whether a LID/GSI feature could be constructed downstream of the outlet, whether the project could incorporate greater pervious surface, or whether the outlet flow could be diverted to a more pervious area. These procedures may first be applied to public projects, but should be expanded to privately owned projects within a few years. As an example of this provision, see the Tulsa County 2017 Stormwater Management Program.

The operator should actively encourage and support LID, conservation development practices, and sustainable development practices, and track the implementation of LID/GSI installation annually. See the City of New Braunfels’ 2019 Stormwater Management Program.

To spur greater use of LID/GSI as a stormwater control practice, the operator may develop a priority ranking of property within the MS4 with the potential to be retrofitted with LID/GSI measures. The department responsible for the implementation of the SWMP should publish

recommendations on how to identify and preserve, protect, or restore environmentally and ecologically sensitive areas within the MS4 that serve critical watershed functions along with requirements to protect soils within the MS4. For an example of this provision, see the City of Albuquerque’s 2019 Stormwater Management Program.

The operator may also implement a “Recognition of Outstanding Facilities” program that presents construction, post-construction, municipal, and industrial facilities with a “Certificate of Excellence” if the facility can demonstrate they have installed all required BMPs, have considered extra BMPs, have incorporated GSI practices, and are environmentally conscientious. See the City of Tucson’s 2023 Stormwater Management Program.

C. Municipal Planning and Guidelines

Traditional municipal operators of MS4s may bolster their stormwater management efforts by addressing stormwater in additional municipal planning documents and guidelines. For a more robust stormwater management system, the municipal operator should draft and implement documents such as watershed protection plans, habitat conservation plans, “green” construction codes, water harvesting manuals, GSI or LID manuals, Complete Streets guidelines, and stormwater ordinances (this last measure is required). See the City of Phoenix’s 2023 Stormwater Management Plan and the City of New Braunfels’ 2019 Stormwater Management Program. In addition to including stormwater best management practices as applicable, these additional planning and policy documents and codes should incorporate LID/GSI practices and encourage their use.

The operator should ensure planning documents and guidelines are not in conflict with one another or with relevant codes or ordinances. These plans, guidelines, manuals, and codes should be outlined in the stormwater management program and in the associated annual reports as part of the operator’s legal authority, where relevant, and as part of the operator’s efforts to attain the minimum control measures.

D. MS4 Oversight

Evaluation of the MS4 from the operator can help improve the program and increase coordination amongst all involved parties. Even for the first iteration of a SWMP, an annual evaluation of the program can help correct deficiencies before the implementation of future iterations and can ensure proper record-keeping and transparency. To help with this oversight, the BMPs in the stormwater management program should include quantifiable activities that can be tracked and criteria against which progress towards desired outcomes can be measured.⁴⁷

The appropriate entity in an MS4 regulatory area should set a Total Maximum Daily Load for those pollutants in the area’s waterbodies without existing TMDLs, such as floatables. This effort will allow MS4 operators to have a measurable and quantifiable goal for these pollutants, facilitating more effective cleanup of this source of water quality degradation.⁴⁸ The process for setting a TMDL for pollutants also allows the MS4 operator to engage with other agencies and

departments and with the community to understand the impact of the pollutant on water quality and the scope of the issue.

It is important for MS4 operators to recognize that the Texas Department of Transportation has its own MS4 permit and SWMP for the TxDOT right-of-way within Phase II urbanized areas or Phase I areas. TxDOT is the designated entity for implementation of its MS4 permit, though the agency has an Interagency Cooperation Contract with TCEQ to mitigate potential pollutant discharges to surface waters and to environmentally sensitive areas. Under this contract, TxDOT must:

- Notify the adjacent landowner upon detection of illicit discharge or illicit connection in order to mitigate;
- If adjacent landowner does not cooperate, notify the adjacent MS4 operator within 48 hours of discharge; and
- Notify the TCEQ if the adjacent landowner does not respond within the set timeframe.

Due to the scope of TxDOT right-of-way within other MS4 operators' service areas and the process for illicit discharge or connection mitigation, operators should maintain close coordination with TxDOT.⁴⁹

The MS4 operator should also encourage community oversight of the program as part of its public engagement and involvement efforts. Citizen scientist efforts such as the Texas Stream Team groups or the Oklahoma Department of Environmental Quality Blue Thumb program should be encouraged and supported, as these programs can help the operator monitor and measure water quality in the MS4. Community organizations are engaged at the ground level and can share data collected with the agencies and departments which are connected to MS4 operations and have certified personnel. For example, in San Antonio, River Aid San Antonio shares litter data with the San Antonio River Authority. The operator may also engage and contract with local non-profits for programs such as creek cleanups, structural control beautification, habitat and creek restoration, and community education.

E. State Level Recommendations

The majority of counties in Texas are highly limited in their ability to undertake the necessary enforcement actions or implement the necessary ordinances and regulations to properly enforce all measures of the Phase II General Permit. In the Edwards and Trinity karst aquifer region, especially, this limited authority potentially endangers the quality of the water supply of millions of people.

At best, the Texas State Legislature should expand county authority to grant counties explicit legal authority to implement TPDES stormwater management and pollution prevention program requirements set in the Phase II General Permit. At minimum, to protect the karst aquifer groundwater supplies in Central Texas, which are extremely vulnerable to pollution, the

Texas State Legislature should amend Chapter 573.001¹ to expand which counties are granted enhanced authority to meet the requirements of the MS4 permit. The legislature could amend Section 573.001(4) as follows: “a county ~~with a population of 800,000 or more~~ that contains a portion of the Edwards Aquifer or is within the geographic boundaries of Groundwater Management Area 9.”

While federal code sets forth a general description on how MS4 operators can petition to join a state MS4 permit, TCEQ either does not provide this information or any further detail or does not make it easily accessible. TCEQ should develop language detailing the process for how operators can petition to join the General Permit and provide this language on the *General Permit TXR040000 for Phase II (Small) MS4s* webpage where all other permit information is available.

¹ 13 Texas Local Government Code Chapter 573. <https://statutes.capitol.texas.gov/docs/lg/htm/lg.573.htm>

Appendix A

Sources for technically sound, required, or recommended best management practices for Phase II MS4 stormwater management programs:

- TPDES Phase II MS4 General Permit: [2024 TXR04 General Permit \(texas.gov\)](https://www.texas.gov)
- TPDES General Permit Fact Sheet: [2024 TXR04 Fact Sheet 8.15.2024 \(texas.gov\)](https://www.texas.gov)
- EPA Phase II Fact Sheets: [Stormwater Phase II Final Rule Fact Sheet Series | US EPA](https://www.epa.gov)
- EPA National BMP Menu (Toolbox): [National Menu of Best Management Practices \(BMPs\) for Stormwater | US EPA](https://www.epa.gov)
- National Stormwater Alliance Resources: [MS4 Resource – Just another WordPress site \(nationalstormwateralliance.org\)](https://www.nationalstormwateralliance.org)
- Stormwater Solutions BMPs Research: [BMPs | Stormwater Solutions](https://www.stormwatersolutions.com)
- NCTCOG BMP Library: [North Central Texas Council of Governments - BMP Library \(nctcog.org\)](https://www.nctcog.org)
- Water Research Foundation BMP Database: [INT'L STORMWATER BMP DBASE \(bmpdatabase.org\)](https://www.wrfoundation.org)

Appendix B

Sources for understanding funding opportunities for the development, implementation, or continuation of practices in stormwater management programs:

- EPA Stormwater Smart: [Resources to Get Started on Your Municipal Separate Storm Sewer System \(MS4\) Program](#)
- National Stormwater Alliance Resources:
 - [Funding Source Options – MS4 Resource \(nationalstormwateralliance.org\)](#)
 - [Revenue, Funding, and Financing Sources and Strategies – MS4 Resource \(nationalstormwateralliance.org\)](#)
- EPA Water Financing Clearinghouse: [Water Finance Clearinghouse Funds \(epa.gov\)](#)
- EPA Metropolitan Area Planning Council Guide: [Smart Growth & Regional Collaboration, Funding Stormwater Management, Strategies to support stormwater management at the municipal level \(epa.gov\)](#)
- EPA Green Infrastructure Funding:
 - [Green Infrastructure Funding Opportunities | US EPA](#)
 - [Navigating Federal Funding for Green Infrastructure and Nature-Based Solutions \(epa.gov\)](#)
 - [Green Infrastructure Municipal Handbook | US EPA](#)
- National Wildlife Federation Nature Based Solutions Funding Database: [Home - National Wildlife Federation Nature-based Funding Database \(nwf.org\)](#)
- US Bureau of Reclamation WaterSMART: [WaterSMART | Bureau of Reclamation \(usbr.gov\)](#)
- EPA Sewer Overflow and Stormwater Reuse Municipal Grants Program: [Sewer Overflow and Stormwater Reuse Municipal Grants Program - Grant Implementation Document \(epa.gov\)](#)
- Natural Resources Conservation Service Watershed and Flood Prevention Operations Program: [Watershed and Flood Prevention Operations \(WFPO\) Program | Natural Resources Conservation Service \(usda.gov\)](#)
- Center for Watershed Protection Technical and Financial Assistance: [Technical Assistance for Local Governments and Non-Profits - Center for Watershed Protection \(cwp.org\)](#)
- Online Watershed Library Database: [owl.cwp.org](#)
- Water Finance Exchange: [WFX-CommRes-GI_SRF.pdf \(waterfx.org\)](#)
- Texas Water Development Board Funding Information: [Clean Water State Revolving Fund | Texas Water Development Board](#)

Appendix C

Sources for highlighted case studies from Recommendations section:

- City of Albuquerque: [2019 Stormwater Management Program](#)
- City of Austin: [2022 Stormwater Management Program](#)
- City of New Braunfels: [2019 Stormwater Management Program](#)
- City of Omaha: [2022 Stormwater Management Program Annual Report](#)
- City of Phoenix: [2023 Stormwater Management Plan](#)
- City of San Antonio: [2022 Stormwater Management Program](#)
- City of Tucson: [2022 Stormwater Management Program](#)
- Tulsa County: [2017 Stormwater Management Program](#)

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