

The Right BMP at the Right Time



Robert Rodarte and Sue Stoffel
Green Infrastructure Program
OC Environmental Resources



Looking Beyond the “One-Size-Fits-All” BMP Strategy

- Discuss why BMP strategies must evolve with our projects
- What are we asking the BMP to do? (water quality vs. hydrologic control)
- Explore temporary vs. permanent (post-construction) BMPs
- O&M Planning
- Regulatory Compliance
- Cost & Performance
- The BMP Lifecycle

Think of BMPs as a system that transitions, not a collection of individual structures.

Why BMP Strategies Must Evolve

Projects are rarely static.

As development progresses:

- Drainage areas change
- Impervious surfaces increase
- Grading changes runoff patterns
- Construction activities shift
- Temporary BMPs become obsolete
- New phases come online
- Permanent BMPs are installed or
- Ownership and maintenance responsibilities change



“What are we asking the BMP to do?”

One BMP may accomplish multiple objectives, but don't assume it will.
Define the performance objective first. Then select the BMP.

Water Quality

BMPs may be designed to:

- Remove sediment
- Capture trash and debris
- Reduce nutrients
- Treat bacteria
- Remove metals and other pollutants
- Reduce runoff pollution before discharge

Hydrologic Performance

BMPs may also need to:

- Reduce peak flows
- Detain runoff
- Retain/infiltrate stormwater
- Reduce runoff volume
- Address hydromodification
- Protect downstream channels
- Cost & Performance

Temporary BMPs: Managing the Construction Phase

Purpose:

To prevent pollutants from leaving the job site.

Examples:

- Sediment Controls
 - Fiber rolls, silt fence, check dams, basins
- Erosion Controls
 - Hydraulic mulch, soil binders, compaction, scheduling
- Tracking Controls
 - Site access point
- Waste Management
 - Material storage, concrete washout, sanitary

Temporary doesn't mean unimportant. These BMPs are designed specifically for changing construction conditions and protect downstream resources.





07/09/2024 09:59
+33.562653,-117.610278
203° SW







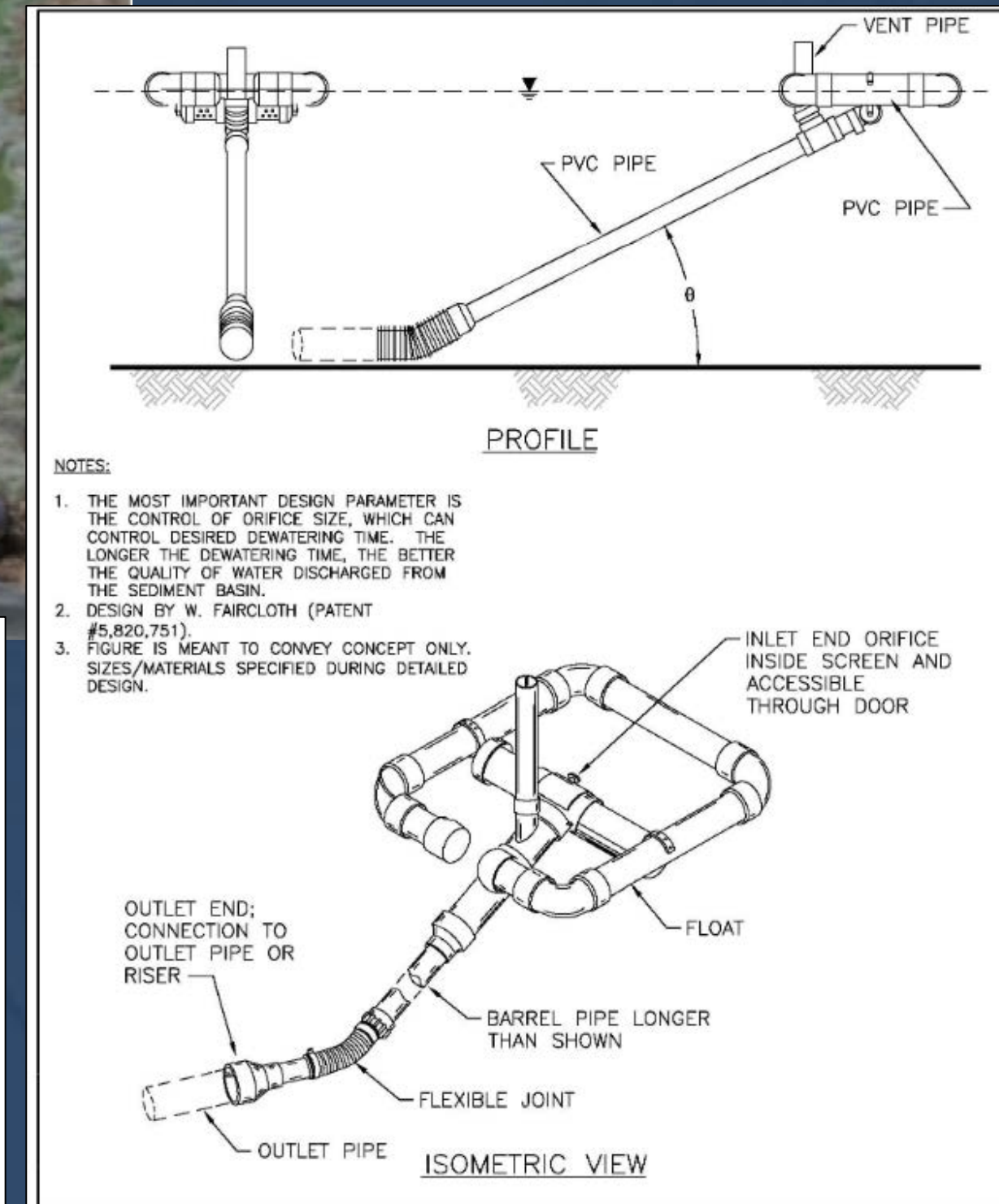
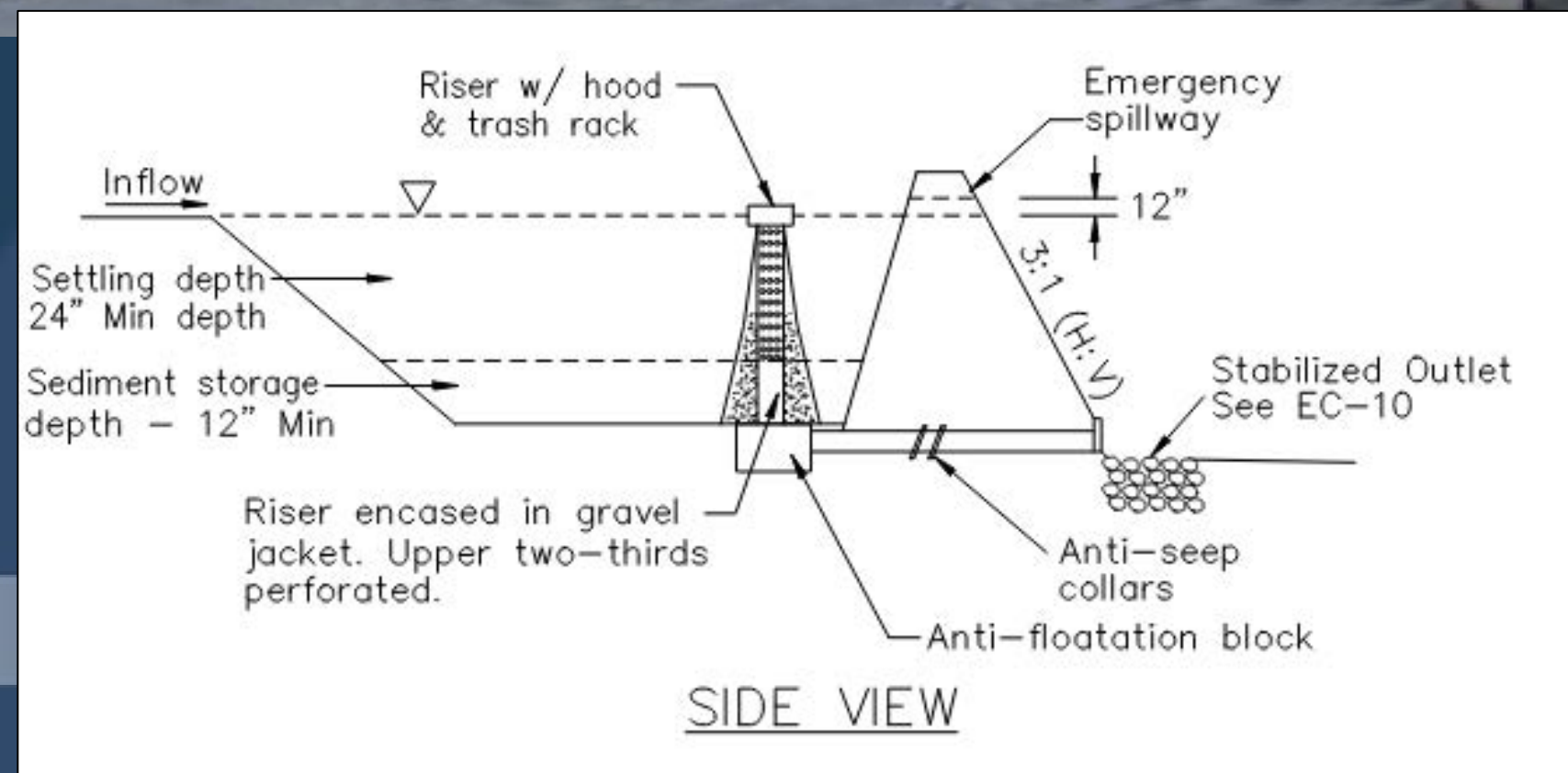
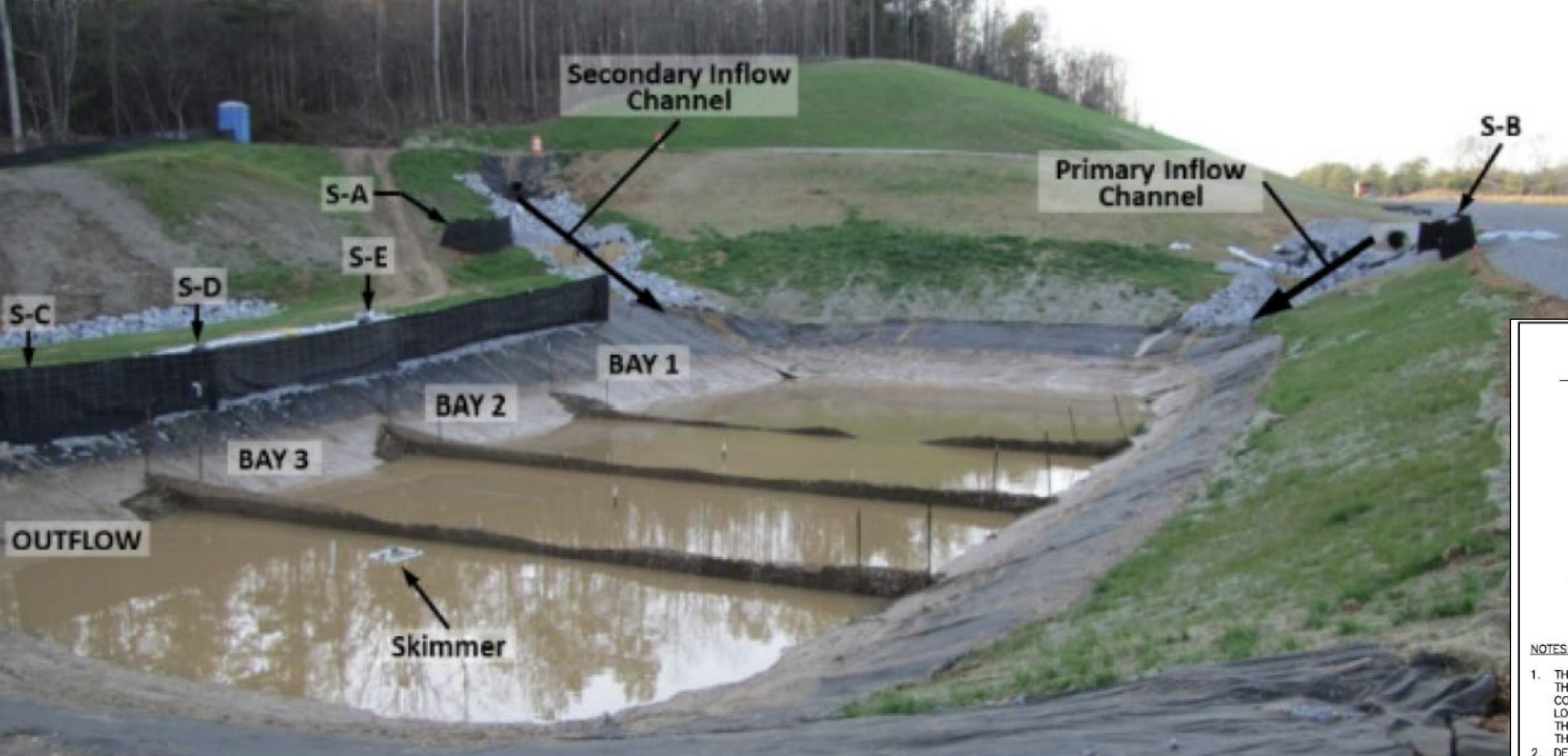












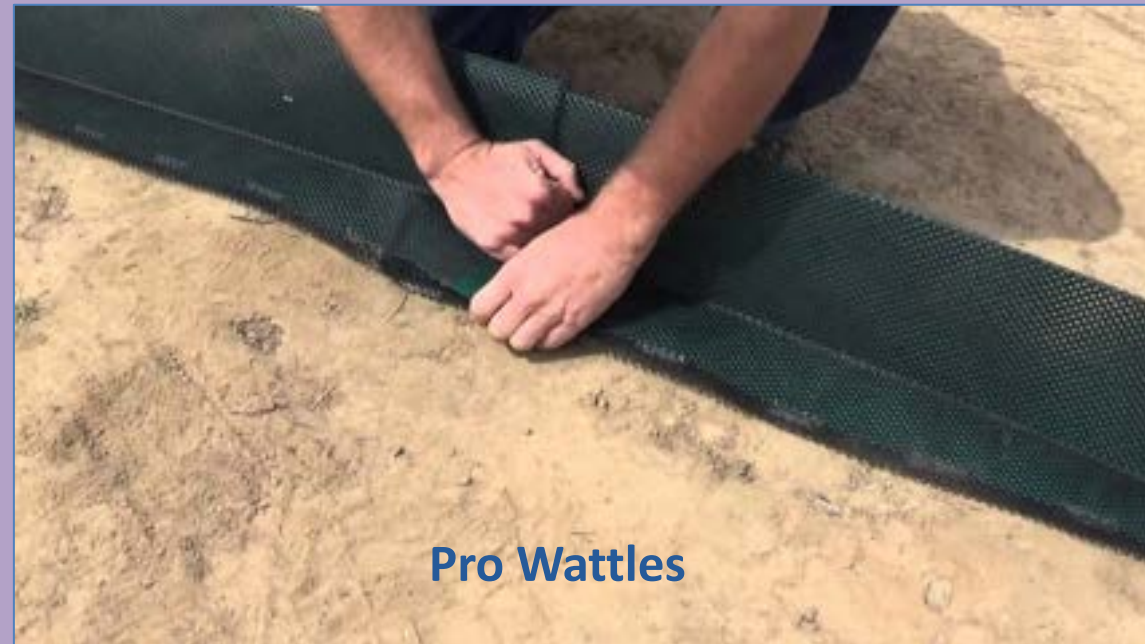
NOTES:

1. THE MOST IMPORTANT DESIGN PARAMETER IS THE CONTROL OF ORIFICE SIZE, WHICH CAN CONTROL DESIRED DEWATERING TIME. THE LONGER THE DEWATERING TIME, THE BETTER THE QUALITY OF WATER DISCHARGED FROM THE SEDIMENT BASIN.
2. DESIGN BY W. FAIRCLOTH (PATENT #5,820,751).
3. FIGURE IS MEANT TO CONVEY CONCEPT ONLY. SIZES/MATERIALS SPECIFIED DURING DETAILED DESIGN.

FIGURE 3: TYPICAL SKIMMER
NOT TO SCALE

Sustainable BMP Options

- New/Reusable Products
- Compost/Mulch
- Gravel/Rock



Pro Wattles



SILTRON
Advanced Silt Fence



Sustainable BMP Options



SB 1383

Compliance Process

California Department of Resources Recycling and Recovery

CalRecycle



COMPOST AND MULCH

OC Waste & Recycling compost and mulch is manufactured through the controlled aerobic, biological decomposition of biodegradable materials. The product has undergone mesophilic and thermophilic temperatures to reduce pathogens and weed.



COMPOST



MULCH

Certified[®] Compost

STA | Seal of Testing Assurance

US Composting Council[®]





Temporary BMPs

- Erosion Controls
 - Hydro-mulch
 - Jute netting
 - Visqueen
- Sediment Controls
 - Fiber rolls
 - Silt Fence
 - Check Dams

Hydraulic Mulch

EC-3



Categories		
EC	Erosion Control	☒
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☒ Primary Category
☒ Secondary Category

Targeted Constituents

Sediment	☒
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

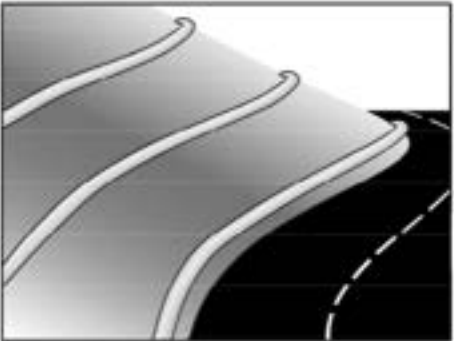
Potential Alternatives

- EC-4 Hydroseeding
- EC-5 Soil Binders
- EC-6 Straw Mulch
- EC-7 Geotextiles and Mats
- EC-8 Wood Mulching
- EC-14 Compost Blanket
- EC-16 Non-Vegetative Stabilization

Copyright 2024 by the California Stormwater Quality Association

Fiber Rolls

SE-5



Categories		
EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☒ Primary Category
☒ Secondary Category

Targeted Constituents

Sediment	☒
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

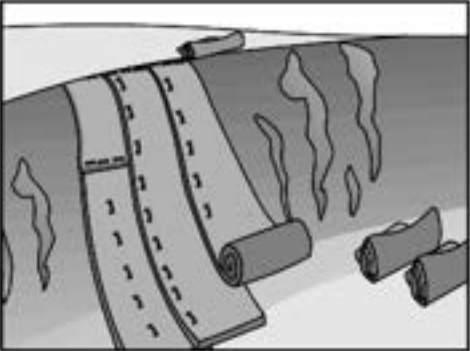
Potential Alternatives

- SE-1 Silt Fence
- SE-4 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-12 Manufactured Linear Sediment Controls
- SE-13 Compost Socks and Berms
- SE-14 Siltifier Bags

Copyright 2024 by the California Stormwater Quality Association

Geotextiles and Mats

EC-7



Categories		
EC	Erosion Control	☒
SE	Sediment Control	
TC	Tracking Control	
WE	Wind Erosion Control	☒
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☒ Primary Category
☒ Secondary Category

Targeted Constituents

Sediment	☒
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

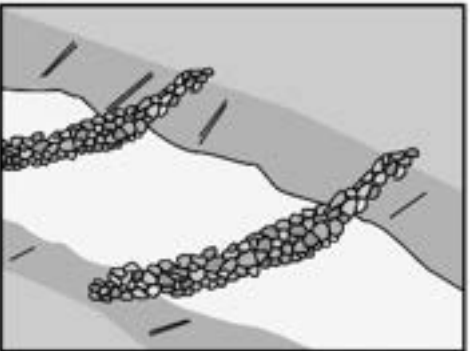
Potential Alternatives

- EC-3 Hydraulic Mulch
- EC-4 Hydroseeding

Copyright 2024 by the California Stormwater Quality Association

Check Dams

SE-4



Categories		
EC	Erosion Control	☒
SE	Sediment Control	☒
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☒ Primary Category
☒ Secondary Category

Targeted Constituents

Sediment	☒
Nutrients	
Trash	
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

- SE-5 Fiber Rolls
- SE-4 Gravel Bag Berm
- SE-8 Sandbag Barrier
- SE-12 Manufactured Linear Sediment Controls
- SE-14 Buffer Bags

Copyright 2024 by the California Stormwater Quality Association



BMPs aren't just for Construction ...

- Industrial
- Commercial
- Municipal
- Post-Construction



SC-30 Outdoor Loading and Unloading

Description

The loading and unloading of materials usually occurs outdoors on docks or terminals. If materials are spilled, leak, or are lost during those activities, they may collect in the soil or on other surfaces and have the potential to be carried away by wind or stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move the materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading and unloading of materials.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and best management practice (BMP) implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ❑ Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- ❑ Limit exposure of material to rainfall whenever possible.
- ❑ Prevent stormwater run-on.
- ❑ Check equipment regularly for leaks.



Good Housekeeping

- ❑ Develop an operations plan that provides procedures for loading and unloading activities.
- ❑ Conduct loading and unloading activities in dry weather if possible.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Substitute Products

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	

Minimum BMPs Covered

- Good Housekeeping
- Preventative Maintenance
- Spill and Leak Prevention and Response
- Material Handling & Waste Management
- Erosion and Sediment Controls
- Employee Training Program
- Quality Assurance and Record Keeping



December 2019

California Stormwater BMP Handbook
Industrial and Commercial
www.casqa.org

SC-11 Spill Prevention, Control, and Cleanup

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for these spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill cleanup equipment and materials. The plan should include steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills. An adequate supply of spill cleanup materials must be maintained on-site.

Approach

General Pollution Prevention Protocols

- ❑ Develop procedures to prevent/mitigate spills to storm drain systems.
- ❑ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ❑ Establish procedures and/or controls to minimize spills and leaks. The procedures should provide the following:
 - ✓ A description of the facility, owner and address, activities, chemicals, and quantities present

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Substitute Products

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered

- Good Housekeeping
- Preventative Maintenance
- Spill and Leak Prevention and Response
- Material Handling & Waste Management
- Erosion and Sediment Controls
- Employee Training Program
- Quality Assurance and Record Keeping



December 2019

California Stormwater BMP Handbook
Industrial and Commercial
www.casqa.org

1 of 11

Post-Construction (Permanent) BMPs: Designing for the Long Haul

Purpose:

- ✓ Provide long-term water quality and/or hydrologic management.
- ✓ Designed to remain after construction is complete.

Examples:

- Infiltration Basins
- Permeable Pavements
- Bioretention Basins
- Vegetated Swales
- Proprietary Treatment Controls

Infiltration Basin TC-11



Design Considerations

- Soil for infiltration
- Slope
- Aesthetics

Targeted Constituent	Removal
Sediment	High
Nutrients	High
Trash	High
Metals	High
Bacteria	High
Oil and Grease	High
Organics	High
Flow Control	High

Description

An infiltration basin is a relatively large impoundment designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the groundwater. This practice removes surface flow and associated pollutants through infiltration and can also help recharge groundwater, helping to maintain low flows in stream systems. Infiltration can be challenging to apply on many sites, however, because some studies have shown relatively high failure rates compared to other practices.

California Experience

Infiltration basins have a long history of use in California. Basins located in Fresno were among those initially evaluated in the California Stormwater BMP Program and were found to be effective at reducing the volume of runoff. This practice is crucial as underscored by the experience of California. The basin with marginal separation from groundwater immediately and could never be rehabilitated. The Water Board (2010) performed in the Los Angeles region showed no net infiltration of stormwater through infiltration practices treated from 0.5 acres to 7.4 acres.

Infiltration basins have been shown to be effective at reducing runoff by the State and Regional Water Boards. Additionally, the California Stormwater BMP Program (2021) found that infiltration basins are effective at reducing runoff.

June 2021 California Stormwater BMP Handbook Development www.casqa.org

Vegetated Swale TC-30



Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Targeted Constituent	Removal
Sediment	Med
Nutrients	Low
Trash	High
Metals	High
Bacteria	Med
Oil and Grease	Med
Organics	Low
Flow Control	Med

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff by filtering through vegetation in the channel, the subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales typically provide conveyance and can serve as part of a drainage system to replace curbs, gutters and storm sewer systems in certain applications. Vegetated swales can also serve as treatment control BMPs such as bioretention areas.

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. The swales were generally effective in reducing the volume and mass of pollutants in areas where the annual rainfall was only about 10 inches/yr, the vegetation required additional irrigation. One factor that strongly affected performance was the presence of gophers at most of the sites. The gophers created mounds, which generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, swales can serve as an aesthetic, potentially inexpensive, and effective stormwater management measure with significant benefits.

June 2021 California Stormwater BMP Handbook Development www.casqa.org

Pervious Pavement TC-13



Design Considerations

- Accumulation of Metals
- Clogged Soil Outlet Structures

Targeted Constituent	Removal
Sediment	High
Nutrients	Low
Trash	High
Metals	High
Bacteria	Med
Oil and Grease	Med
Organics	Low
Flow Control	Med

Description

Pervious (Permeable) Pavement describes a system which combines a load-bearing, durable surface with an underlying layered storage structure. Stormwater is temporarily stored prior to infiltration or discharge through an underdrain to a controlled outlet. The system can infiltrate water across the entire surface or through the spaces between permeable blocks. Pervious paving may permit groundwater recharge where appropriate, or if unsuitable may be lined to discharge to an underdrain.

California Experience

Pervious pavement has been widely implemented across California in a variety of configurations to meet a full suite of regulatory requirements including in the Los Angeles Zoo parking lot (image above), incorporated in a green street in San Diego (Figure 1), and to create permeable plazas in San Francisco (Figure 2).



Figure 1: Pervious concrete parking lot in San Diego. Figure 2: P2CP plaza in San Francisco.

June 2021 California Stormwater BMP Handbook Development www.casqa.org 5-110



+33.825767,-117.851756

299° NW

07/08/2025 16:15





03/28/2022 12:47
+33.826508,-117.851335





01/22/2024 08:46
+33.826355,-117.851298
110° E



01/22/2024 07:40
+33.826335,-117.851243
8° N



03/26/2025 10:19
+33.560865,-117.607290
244° SW





Basin Strategies: Construction → Interim → Permanent

- Post-construction BMPs must be protected during construction!



Basin Strategies: Construction → Interim → Permanent

Project Phase	Potential Basin Role	Primary Considerations
Construction	Trap sediment / detention basin	Sediment, erosion, capacity, maintenance
Interim	Transitional stormwater facility	Changing drainage areas, phased construction
Permanent/Post-Construction	Stormwater Detention / Retention / treatment	Long-term performance, access, O&M

BMP Basin Decision Tree

A Simple Framework for Choosing & Sizing the Right Basin

Right BMP. Right Size.
Right Site. Right Lifecycle.



Choose based on the problem. Size based on the water. Check based on the site. Design for the lifecycle.

Operations & Maintenance: The BMP After the Ribbon Cutting

Key Question:

Who is responsible for this BMP five, ten, or twenty years from now?

- Identifying responsible parties
- Ownership and maintenance agreements
- Inspection schedules
- Maintenance triggers
- Vegetation management
- Sediment and debris removal
- Inlet/outlet maintenance
- Access requirements
- Equipment and safety considerations
- Recordkeeping and documentation

Table 1. Typical maintenance activities for bioretention practices (consult local stormwater manuals for specific considerations).

Activity	Frequency	Maintenance Notes
Pruning	1 to 2 times per year	Vegetation often grows vigorously during rainy seasons. Prune vegetation to maintain capacity and flow rates.
Mowing	2 to 12 times per year	Frequency depends on location and desired aesthetic appeal. Providing clarity as to the timing is important so that maintenance staff do not include these areas as part of more regular mowing procedures.
Watering	Once every 2 to 3 days for first 1 to 2 months; sporadically after establishment	If drought conditions exist, plants may need watering after the initial year. Native vegetation may flourish without watering.
Fertilization	Once initially	One-time spot fertilization for <i>first-year</i> vegetation.
Dead plant removal and replacement	Once per year	Within the first year, 10 percent of plants can die. Survival rates increase with time. Removing dead plants also removes nutrients that would otherwise enter the system.
Inlet inspection	Once after first rain of the season, then monthly during the rainy season	Check for sediment accumulation to ensure that flow into the bioretention practice is as designed. Remove any accumulated sediment.
Outlet inspection	Once after first rain of the season, then monthly during the rainy season	Check for erosion at the outlet, and remove any accumulated mulch or sediment.
Miscellaneous upkeep	Once per month	Tasks include collecting trash, checking plant health, spot weeding, removing invasive species and removing mulch from the overflow device.
Replacement of top few inches of filter media	If ponding occurs for more than 48 hours	Replace top few inches of filter media. Sediment accumulation reduces the bioretention practice's performance and the facility's ability to drain.

Sources: Tetra Tech, Inc., 2011; MDE, 2009

O&M Planning Designed for Maintenance

A BMP that can't be maintained can't reliably perform.

Consider:

- Vehicle and equipment access
- Safe access for inspectors
- Confined space considerations
- Maintenance clearances
- Drainage and dewatering
- Sediment removal
- Replacement of media or vegetation
- Easements and access agreements
- Clearly identifying BMP components
- Preventing landscaping or future development from blocking access

Before approving a BMP, ask: “Show me how you will maintain it.”



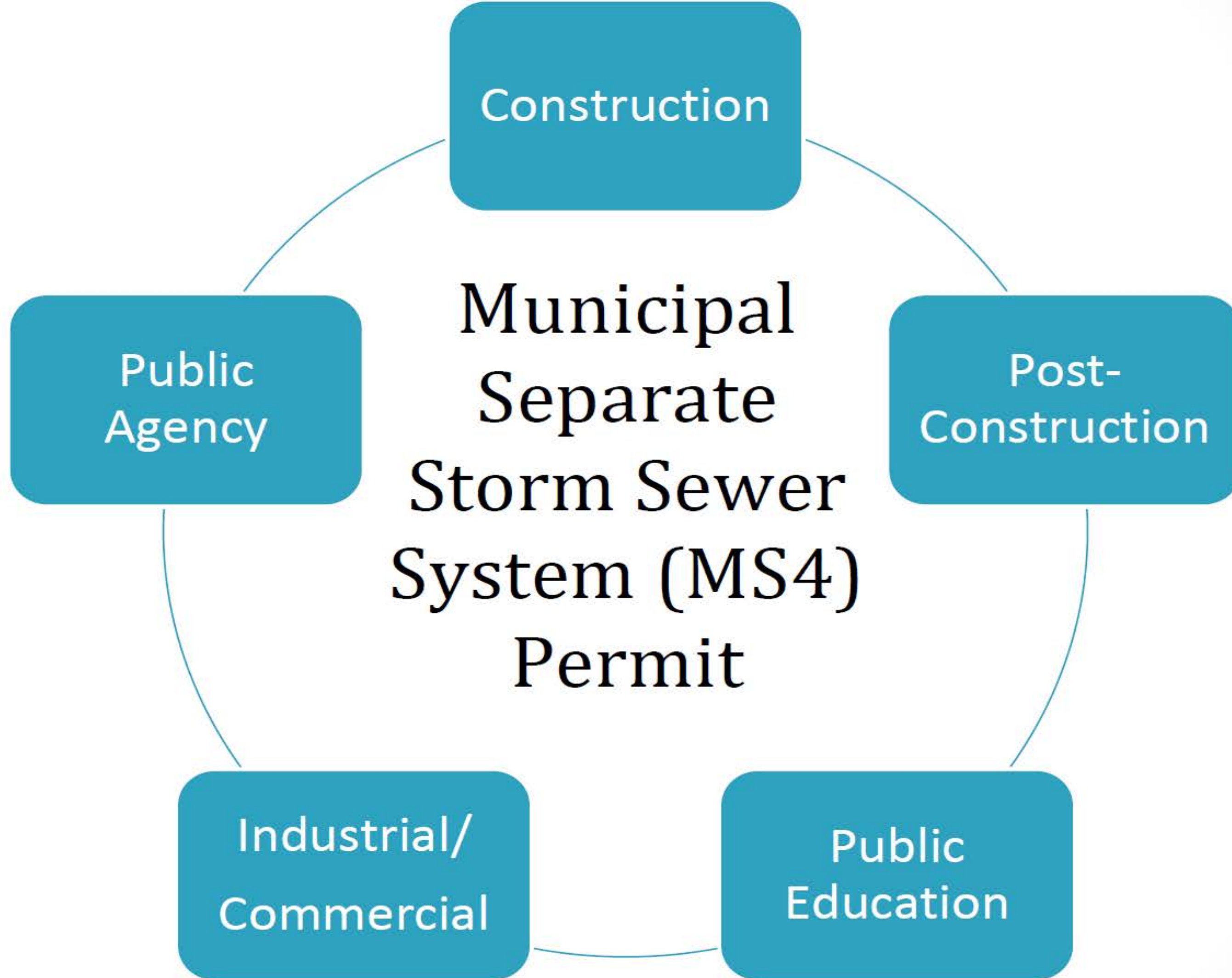
Regulatory Compliance: Keeping BMPs Working and Compliant

Regulatory requirements are another reason that BMP strategies cannot be one-size-fits-all.

Consider:

- . MS4 & CGP requirements (differ by state/region)
- . Permit-driven BMP requirements
- . Water quality and hydromodification requirements
- . BMP verification
- . As-built documentation
- . O&M plans
- . Inspection records
- . Maintenance documentation
- . Responsible party identification
- . Changes to BMP configuration during phased development
- . Maintaining documentation throughout the project lifecycle

**If it isn't
documented, it
can be difficult to
demonstrate
compliance**



Managing Environmental Risk and Liability

(2020) Portola Center South Construction Site – \$9.1 Million - Direct discharge to High Risk Receiving Water

(2021) Orange County: Exeter Property Group – Approved \$565,304 penalty. Deficient SWPPP and failure to implement BMPs.

(2022) Orange County: Baldwin & Sons – Approved \$6.6 million penalty. Repeated discharge of untreated stormwater and failure to implement BMPs. 95-acre site.

(9/9/2022) Los Angeles: Garvey Garden Plaza, LLC – Proposed \$1.9 million penalty for CGP violations. No QSP, ineffective perimeter controls, failure to maintain SWPPP. 1.1-acre site.

(2022) San Diego: Quality Investors LLC – Proposed \$411,475 penalty for sediment-laden discharge. 3-acre site.



Building the BMP Is Only the Beginning: Planning for Lifecycle Cost & Performance



Initial construction costs



Long-term O&M costs



Access and equipment costs



Maintenance frequency



Replacement costs



Potential regulatory costs



Resilience and adaptability

Where Do I Start?

National Pollutant Discharge Elimination System (NPDES)

About NPDES ▾

All NPDES Program Areas ▾

National Menu of Best Management Practices (BMPs) for Stormwater–Post–Construction

Infiltration trenches

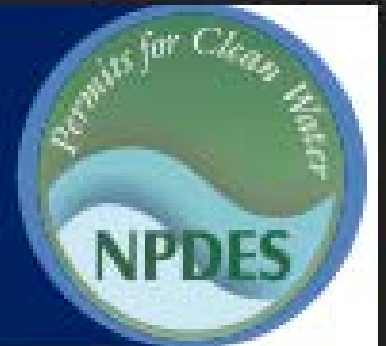
Typical construction costs, including contingency and design costs, can range from \$60,000 to \$70,000 per acre of impervious surface treated (King & Hagan, 2011). In general, maintaining them costs an estimated 5 to 20 percent of their construction cost. More realistic values are probably closer to the 20 percent range to ensure long-term functionality.

www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater-post-construction



Stormwater Best Management Practice Infiltration Trench

Minimum Measure: Post-Construction Stormwater Management in New Development and Redevelopment
Subcategory: Infiltration



Description

An infiltration trench typically consists of a gravel-filled trench that allows stormwater to soak into the ground. Various infiltration trench designs exist; a design may include an overflow, an underdrain or vegetation. To reduce clogging, design engineers often use settling basins or other pretreatment components in conjunction with the infiltration trench.

Applicability

Infiltration trenches are appropriate for most regions of the country, but site-specific conditions—such as soil type, water table, drainage area and slope—may restrict their use. Also, infiltration may be less feasible in tidal areas (due to high water tables) or in karst regions (due to concerns with sinkhole formation).

Urban Areas

Infiltration trenches are sometimes suitable for the urban environment, particularly when paired with other stormwater controls. Two site characteristics that can restrict their use are the potential for infiltrated water to interfere with existing infrastructure and the relatively poor infiltration capacity of most urban areas. Additionally, infiltration trenches may need more frequent maintenance in urbanized areas, where they can become clogged with trash and debris.

Stormwater Hot Spots

Infiltration trenches should not receive discharge from stormwater hot spots, unless another stormwater control has already treated the stormwater. Direct infiltration of discharge from stormwater hot spots may lead to groundwater contamination.

Siting and Design Considerations

Design engineers need to site infiltration trenches carefully. They should ensure that the soils on-site are appropriate for infiltration and that there is minimal



Infiltration trenches at Einstein Hospital in East Norriton.
Photo Credit: Montgomery County Planning Commission/Plickr CC

potential for groundwater contamination and long-term maintenance problems.

Design engineers generally use infiltration trenches for drainage areas smaller than 5 acres and with relatively high impervious cover (MDE, 2009). For larger applications, designers should consider infiltration basins. An infiltration trench should be on flat ground, but the slopes of the site draining to the trench can be as steep as 15 percent.

Common Terms

Stormwater hot spots are areas where land use or activities generate highly contaminated stormwater discharges, with concentrations of pollutants exceeding those typically found in stormwater. Examples include gas stations, vehicle repair areas and waste storage areas.

Soils are a strongly limiting factor in the siting of infiltration trenches. Soils that infiltrate too rapidly may not provide sufficient treatment, creating the potential for groundwater contamination. The infiltration rate should

Construction & Installation BMP Costs:

- **Rain gardens (residential under 0.5 acres):** \$3 to \$6 per square foot (often suitable for DIY).
- **Bioswales (linear drainage):** \$15 to \$50 per linear foot (requires professional design).
- **Underground detention systems:** \$8.50 to \$17.00 per cubic foot of storage for installed commercial configurations.



Basin BMP Maintenance Costs:

- **Routine maintenance tasks:**
Average \$375 per task (such as minor clearing or inspections), with basin BMPs running higher at roughly \$400 per task.
- **Non-routine maintenance tasks:**
Average \$812 to \$1,123 per task, with infiltration practices (permeable pavement, bioretention) sitting at the higher end of repair complexity.
- **Major structural repairs:**
Can reach approximately \$63,000 per isolated major failure event.

[Urban Stormwater
BMP Database](#)[DOT Portal to
BMP Database](#)[Urban BMP
Cost Database](#)[National Stormwater
Quality Database](#)[Agricultural
BMP Database](#)[Stream Restoration
Database](#)

National Stormwater Quality Database

The National Stormwater Quality Database (NSQD) is an urban stormwater runoff characterization database that was initially developed in 2001 and updated periodically through 2015. Version 4.02 contains data from more than 9,000 runoff events from about 200 municipalities throughout the country representing multiple land uses. The NSQD is an

Downloads

[NSQD Version 4.02 Excel Spreadsheet \(original format\)](#)[NSQD Version 4.02 Access Database \(new format\)](#)[NSQD Data Element Summary](#)

The overall purpose of the project is to provide scientifically sound information to improve the design, selection and performance of urban stormwater BMPs. Continued population of the database and assessment of its data will ultimately lead to a better understanding of factors influencing BMP performance and help to promote improvements in BMP design, selection and implementation.

<https://bmpdatabase.org/urban-bmp-cost>

The BMP Database project began in 1996 under a cooperative agreement between the American Society of Civil Engineers (ASCE) and the US Environmental Protection Agency (EPA). In 2004, the project transitioned to a more broadly supported coalition of partners now led by The Water Resource Foundation (WRF).



Los Angeles Regional Water Quality Control Board

TO: Los Angeles Regional Water Board Staff

FROM: Megan Kung
Economist
Los Angeles Regional Water Board

DATE: February 6, 2024

SUBJECT: Costs and Implications of CII Permit Options

www.waterboards.ca.gov/losangeles/water_issues/programs/stormwater/Commercial_Industrial_and_Institutional/cii_cost_analysis_memo.pdf?utm_source=chatgpt.com

(2023) The LA Regional Water Board estimated BMP costs between \$285,000–\$325,000 per acre-inch of treatment capacity for a combination of BMPs. The estimate includes soft costs, but did not include O&M.

They estimated annual O&M at approximately 1.5% of capital cost, or:

- Capital: \$285,000–\$325,000/ac-in
- Annual O&M: \$4,275–\$4,875/ac-in
- 20-year undiscounted capital + O&M: \$366,225–\$417,625/ac-in

After reviewing BMP costs from various municipalities, staff arrived at an average of annualized BMP cost between \$21,107 to \$24,069/ac-in.

Table 6: BMP costs of representative commercial site in Dominguez Channel Watershed

CNT Green Values Stormwater Management Calculator

Dominguez Channel Parcel BMPs	Capital	Annual O&M
Rain Garden	\$15,175	\$1,025
Trees	\$2,500	\$1,800
Amended Soil	\$2,900	\$0
Parking Lot Swales	\$92,325	\$4,575
Permeable Parking	\$1,070,652	\$2,467
Total (2022\$)	\$1,183,552	\$9,867
Total after adding soft costs	\$1,538,618	\$12,827
Total after adjusting to 2023\$	\$1,594,552	\$13,293
Total after adjusting for LA costs	\$2,101,620	\$17,521

Table 7: BMP costs of representative commercial site in Los Cerritos Channel Watershed estimated with CNT Green Values Stormwater Management Calculator

Los Cerritos Channel Parcel BMPs	Capital	Annual O&M
Rain Garden	\$15,175	\$1,025
Trees	\$2,500	\$1,800
Amended Soil	\$1,450	\$0
Parking Lot Swales	\$92,325	\$4,575
Permeable Parking	\$687,456	\$1,584
Total (2022\$)	\$798,906	\$8,984
Total after adding soft costs	\$1,038,578	\$11,679
Total after adjusting to 2023\$	\$1,076,334	\$12,104

[Site Information](#)[Green Improvements](#)

Rainfall data for: National Avg., US

[edit location](#)

Avg. Annual Rainfall: 32.64 inches ?

Volume Capacity Capture Goal

[edit goal](#)

Increase the capacity of the landscape to capture at least 0.5 inches of water over the impervious areas. For this scenario that is equal to 1,977 ft³ or a volume of 14,789 gallon.

Single Site

Life-cycle Cost

% of Goal

The Green Infrastructure BMPs included below can provide runoff reduction benefits through infiltration, evapotranspiration, and reuse of captured stormwater for irrigation and other non-potable uses. Green infrastructure BMPs provide additional environmental benefits including carbon sequestration, reduced energy use, and groundwater recharge in addition to reduced construction and maintenance costs and extended design life. Experiment with applying different combinations of BMPs then see how you can progress towards meeting the specified runoff reduction goal, reduce total runoff volume from the site (annually and for the average storm), reduce site imperviousness, and affect life-cycle costs and benefits.



Total Cost: \$133,161

Results: The green infrastructure applied in this scenario increases the area's potential volume capture capacity by 1,000.6 ft³ or 50.6% of the desired goal.

[Site Overview](#)[Volume](#)[Runoff](#)[Costs](#)[Benefits](#)

Total Land Use

Land Use	Original Area	Area including BMP(s)
Total Impervious Area	47,450 ft ²	42,400 ft ²
Flat Roof	10,000 ft ²	5,000 ft ²
Green Roof		5000 ft ²
Parking Surface	32,450 ft ²	32,400 ft ²
Rain Garden		50 ft ²
Driveway	5,000 ft ²	5,000 ft ²
Total Landscape Area	2,550 ft ²	2,550 ft ²
Shrub and Bushes	2,550 ft ²	2,550 ft ²
Total BMP Area		5,050 ft ²
Total Lot Area	50,000 ft ²	50,000 ft ²
Other Volume Control		0 gallons

Putting It All Together: The BMP Decision Framework



1. What are the regulatory requirements?



2. What are the site's physical constraints?



3. What pollutants/runoff characteristics need to be addressed?



4. What BMPs are feasible?



5. How will the BMP perform during each project phase?



6. How will it transition to the next phase?



7. Who will maintain it?



8. Can it be accessed and maintained?



9. What is the lifecycle cost?

Five Questions to Take Back to Your Next Project

1. What does the BMP need to accomplish?
2. How will it function as the site changes?
3. What happens when temporary becomes permanent?
4. Who will maintain it and can they access it?
5. Can we demonstrate compliance throughout the BMP's entire lifecycle?



Plan for the phase. Design for the transition. Maintain for the lifecycle.

Knowledge Check!



Thank you!

Robert Rodarte
**OC Public Works/
OC Environmental Resources**

Robert.Rodarte@pw.oc.gov
(714) 955-0600

Sue Stoffel
**OC Public Works/
OC Environmental Resources**

Sue.Stoffel@pw.oc.gov
(714) 955-0606