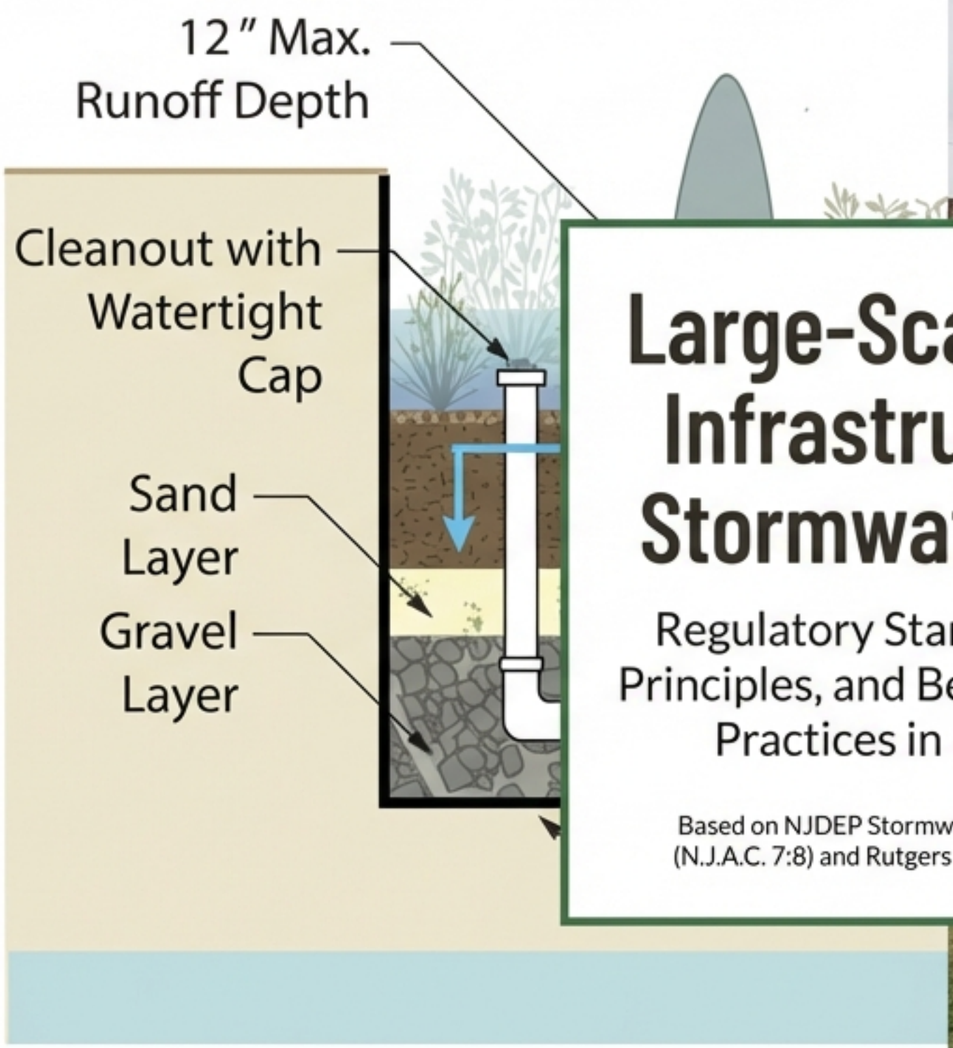


Large-Scale Green Infrastructure & Stormwater BMPs

Regulatory Standards, Design Principles, and Best Management Practices in New Jersey

Based on NJDEP Stormwater Management Rules (N.J.A.C. 7:8) and Rutgers University Case Studies.

NOTE:
→ = Direction of Runoff

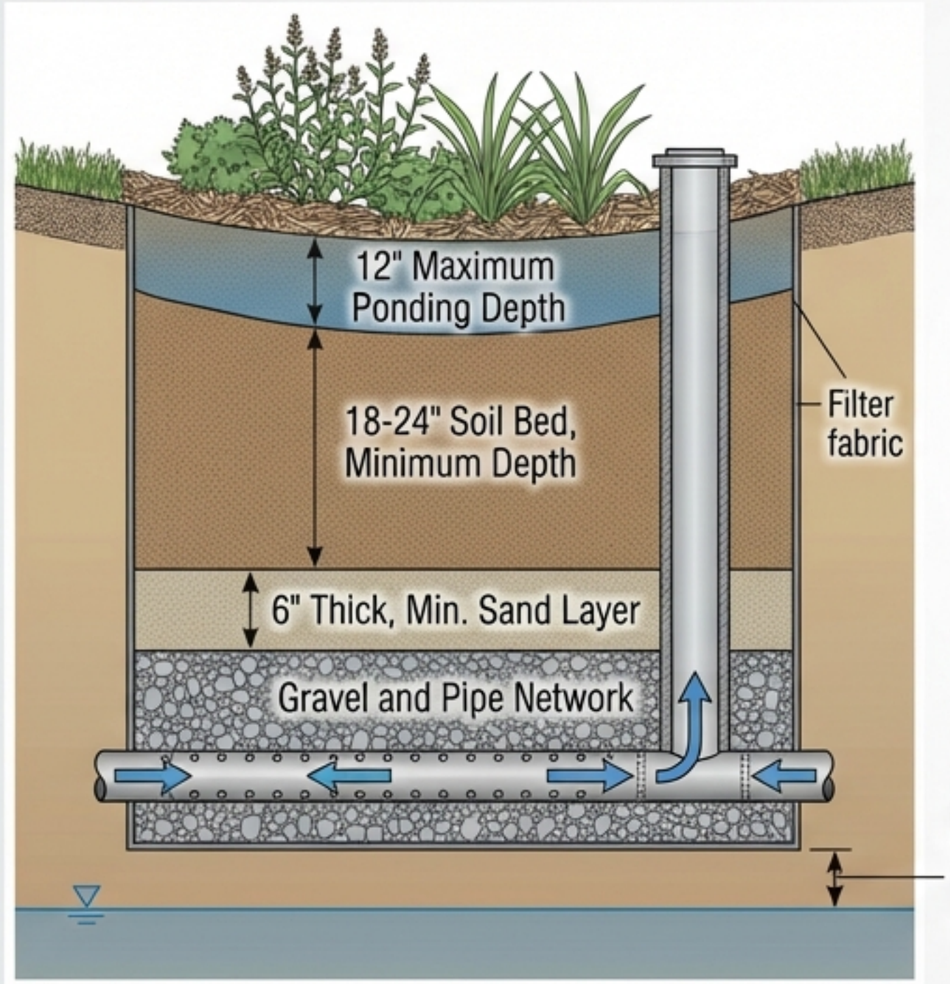
The NJDEP Regulatory Hierarchy: Selecting the Right BMP

GREEN INFRASTRUCTURE (Table 5-1)	GI WITH WAIVER (Table 5-2)	NON-GI / WAIVER REQUIRED (Table 5-3)
Cisterns	Bioretention Systems (> 2.5 acres)	Blue Roofs
Small-Scale Bioretention Basin	Infiltration Basins	Extended Detention Basins
Small-Scale Infiltration Basin	Standard Constructed Wetlands	Manufactured Treatment Devices (Non-GI)
Small-Scale Sand Filter	Wet Ponds	
Pervious Paving System		

Design Constraints

- Dry Well: Max 1 acre drainage
- MTDs: Max 2.5 acres drainage
- Small-Scale GI: Max 2.5 acres drainage

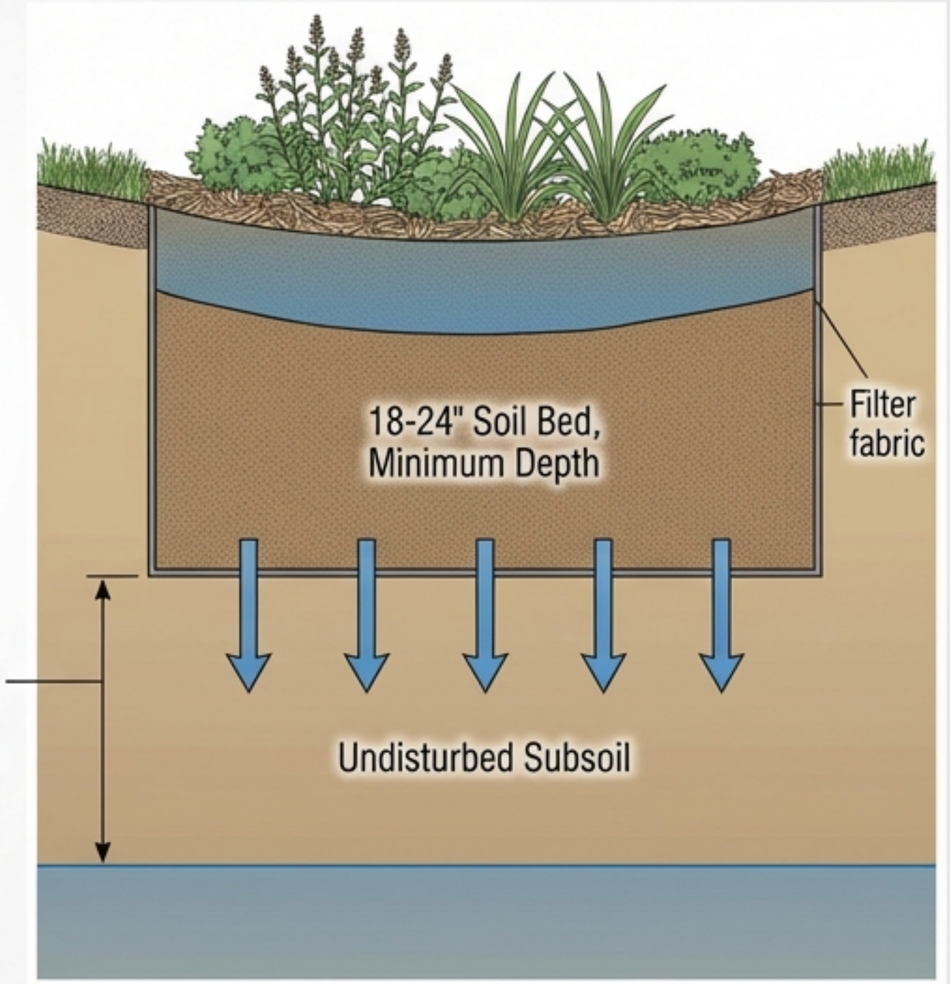
Small-Scale GI: Bioretention System Configurations



Bioretention System with Underdrain

Common Specs:

- Planting Soil Bed: 18-24 inches deep
- Max Ponding Depth: 12 inches
- TSS Removal Rate: 80-90%



Bioretention System with Infiltration

Engineering Design: Sizing a Bioretention Basin

1. Input

Drainage Area (1.2 ac) × Runoff Coeff (1.0) × Rainfall (1.25 in)

2. Runoff Volume (V)

5,450 cubic ft

3. Basin Area (A)

Volume ÷ Max Depth (0.5 ft) = 10,900 sq ft (0.25 acres)

Safety Check: Ponding Time calculation (Darcy's Law)

Formula: T = Max Depth / (Permeability / Safety Factor)

Calculation: 6 inches / (4 inches/hr / 2) = 3 Hours

Result: 3 Hours < 72 Hours Max Limit (ACCEPTABLE)

From Plan to Ground: Bioretention Reality

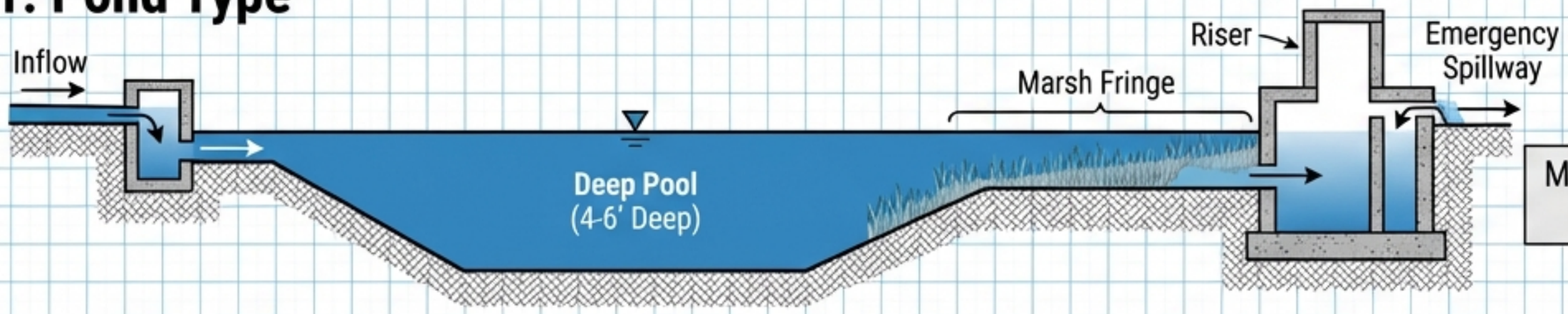
Concrete Outlet Structure with Trash Rack

Underdrain Cleanout Port

Established Vegetation (Chemistry Building)

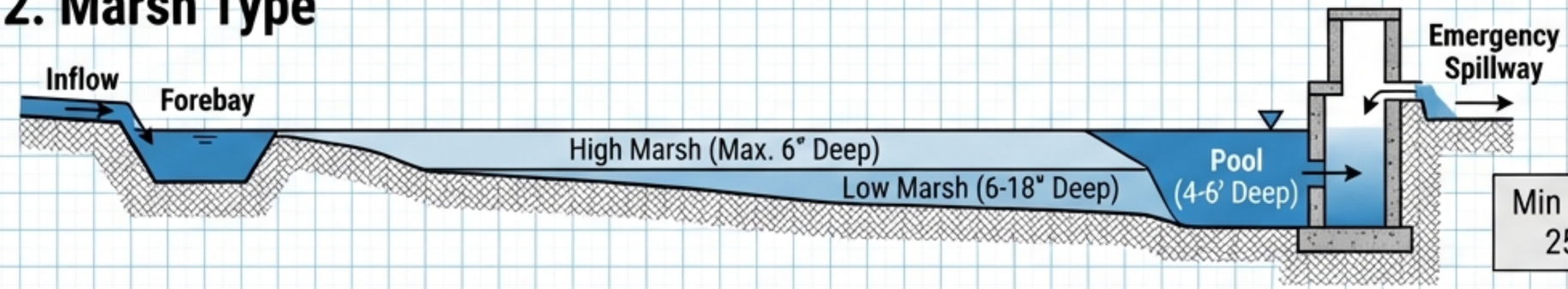
Large-Scale GI: Constructed Wetlands

1. Pond Type



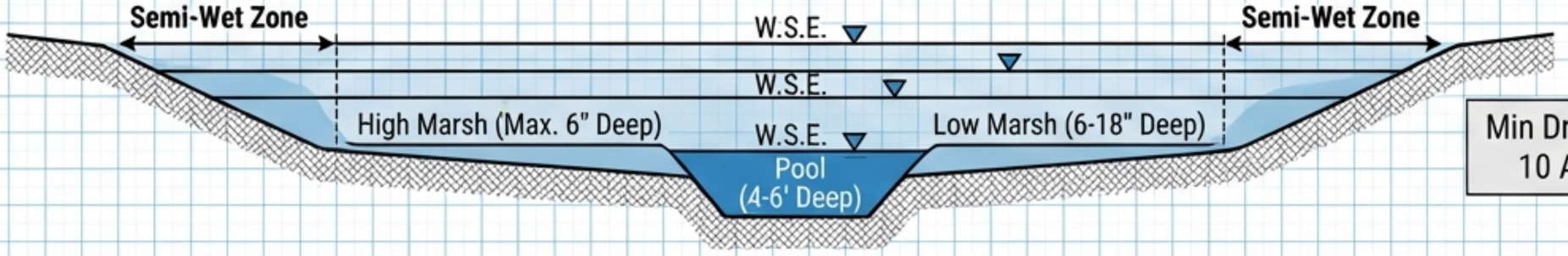
Min Drainage: 25 Acres

2. Marsh Type



Min Drainage: 25 Acres

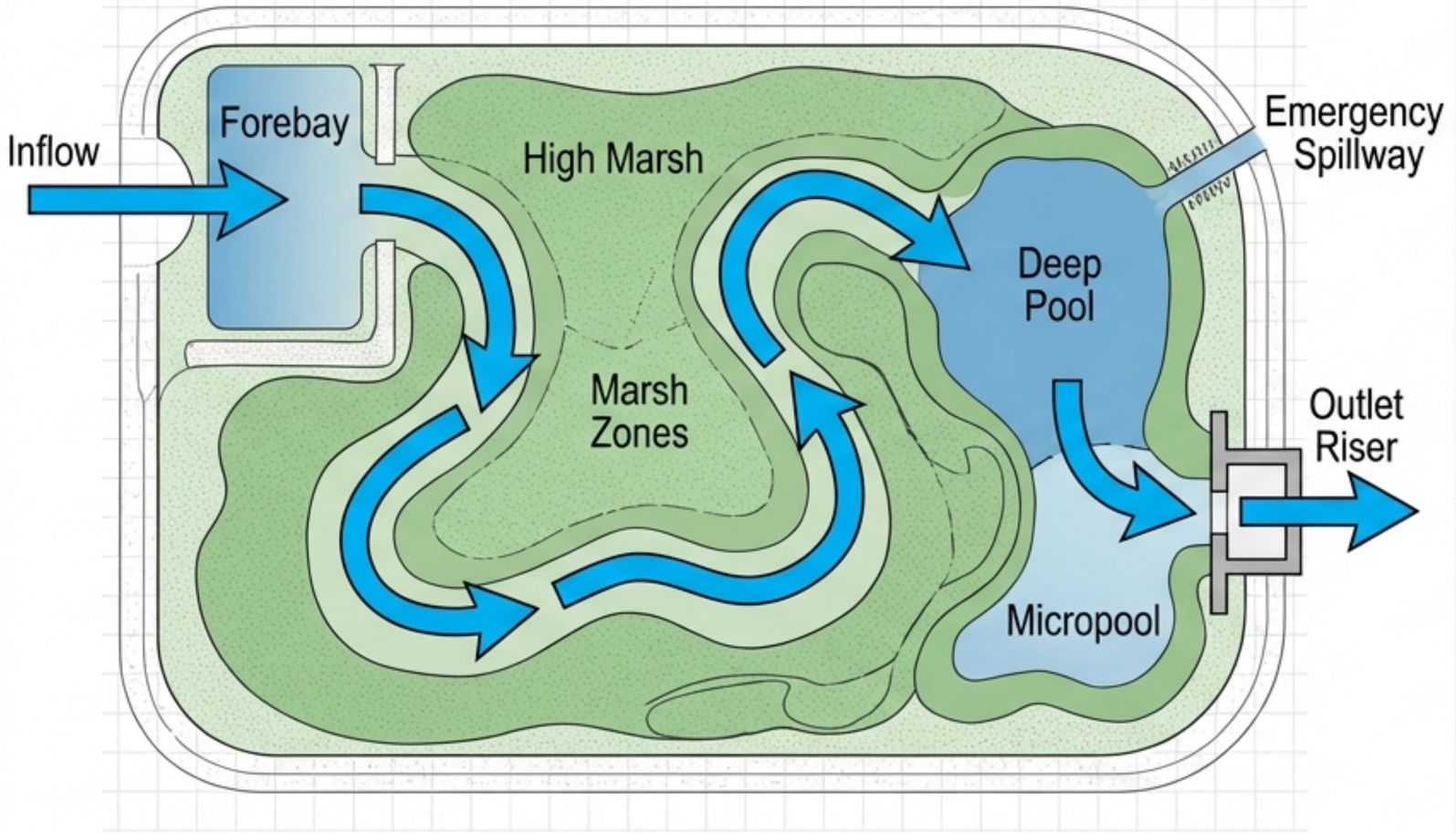
3. Extended Detention Type



Min Drainage: 10 Acres

Key
Deep Pool: 4-6 ft
Low Marsh: 6-18 in
High Marsh: Max 6 in

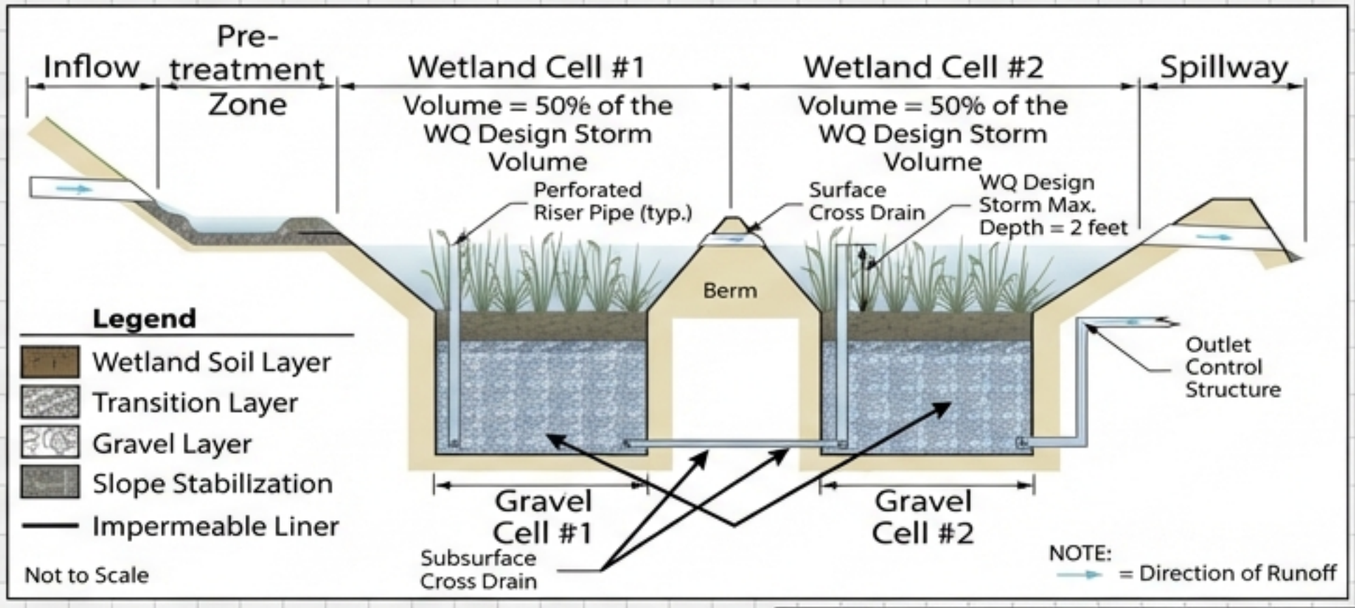
Wetland Design Criteria & Configuration

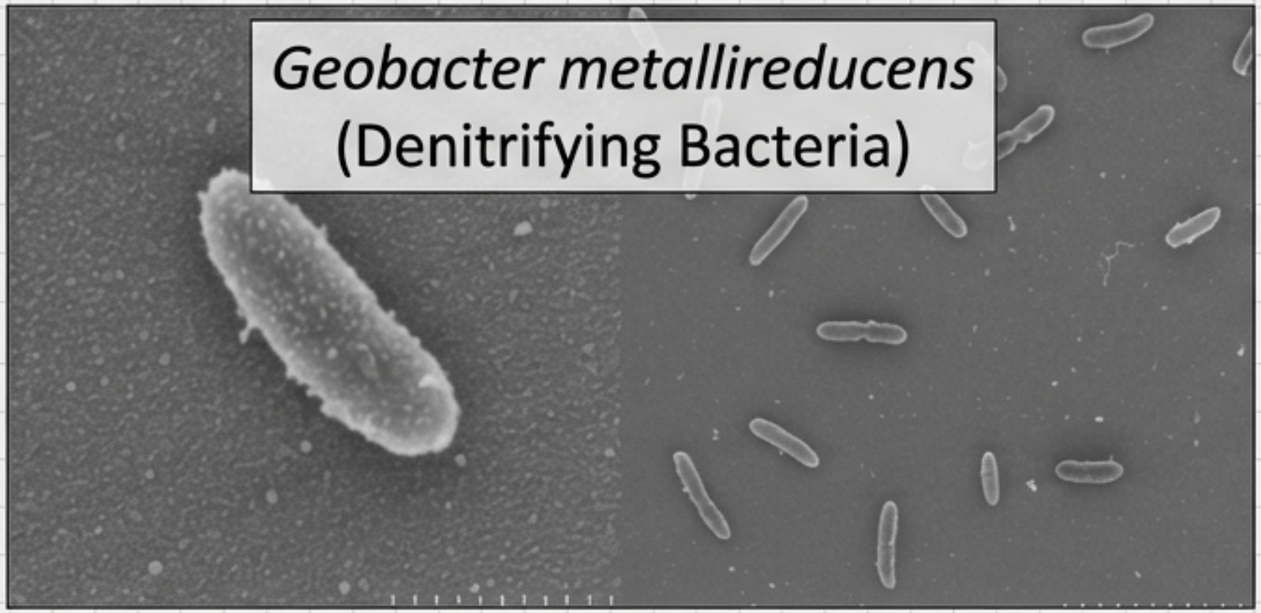


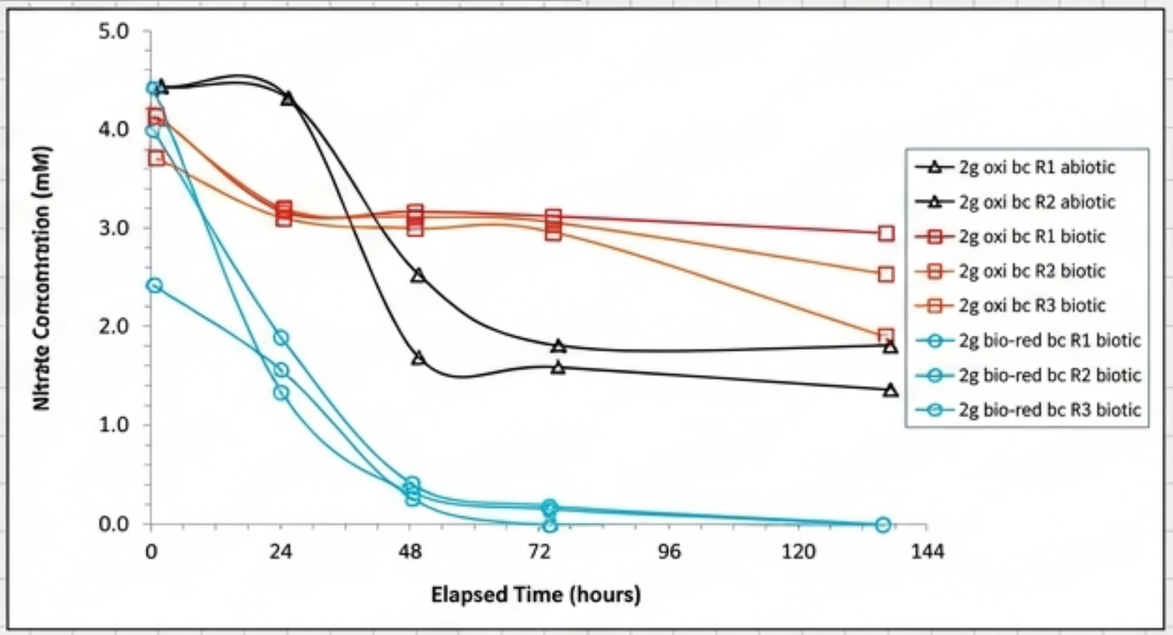
Plan view: Marsh Constructed Wetland

Configuration Rules
• Length-to-Width Ratio: 1:1 Minimum
• Pretreatment: Forebay Required
• High Marsh Depth: Max 6 inches
• Low Marsh Depth: 6 - 18 inches
• Deep Pool Depth: 4 - 6 feet

Innovation: Subsurface Gravel Wetlands & Nitrogen Removal

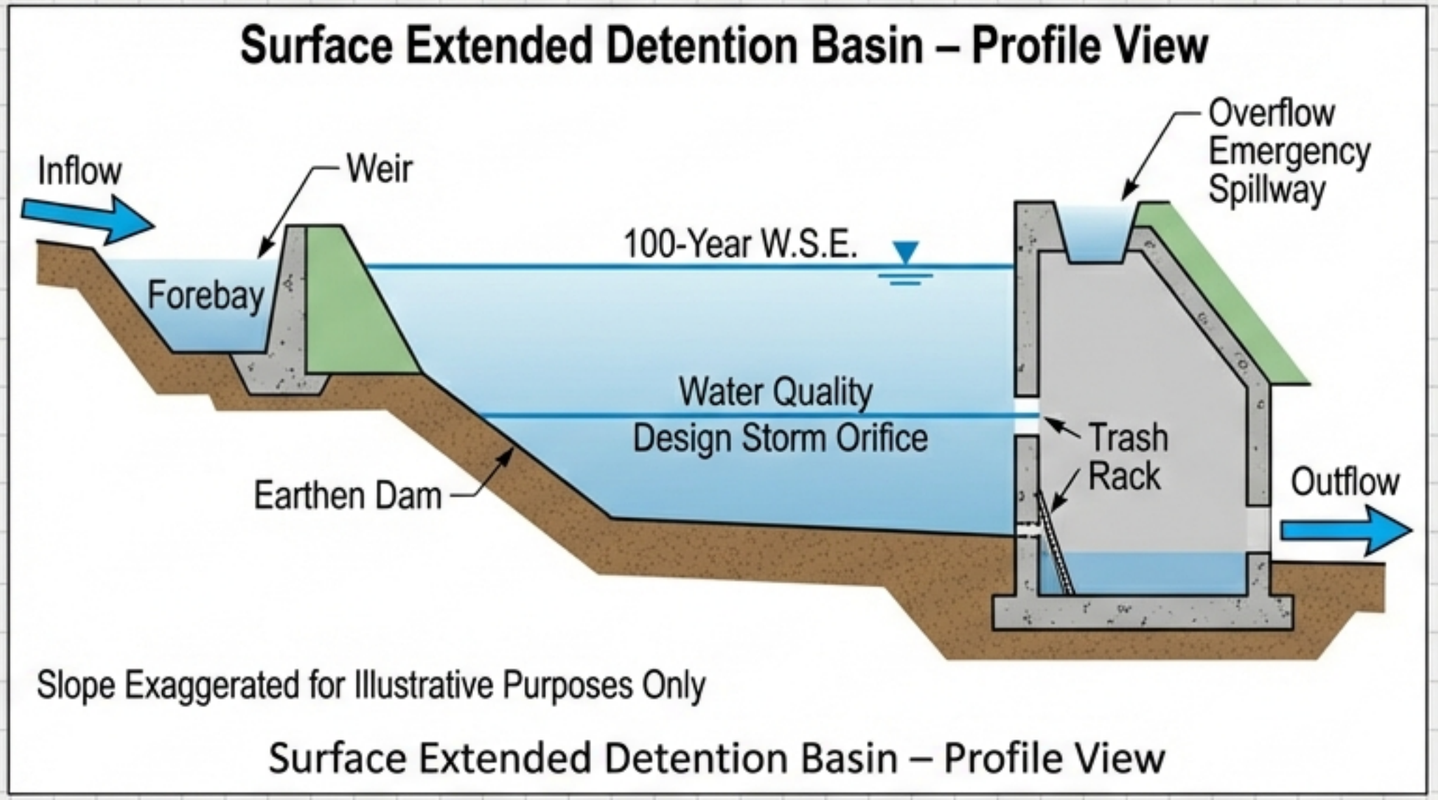




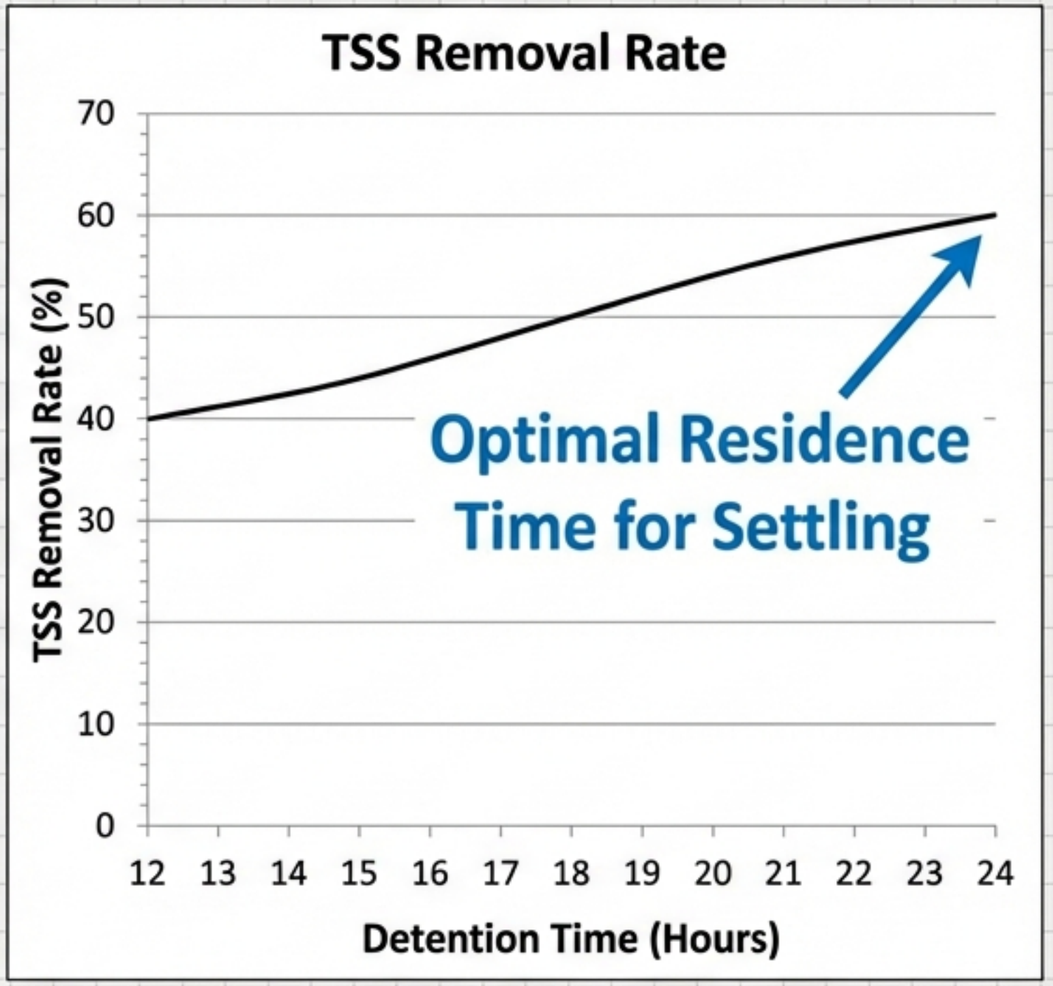


Nitrate reduction over 48 hours with Biochar

Traditional Quantity Control: Extended Detention Basins

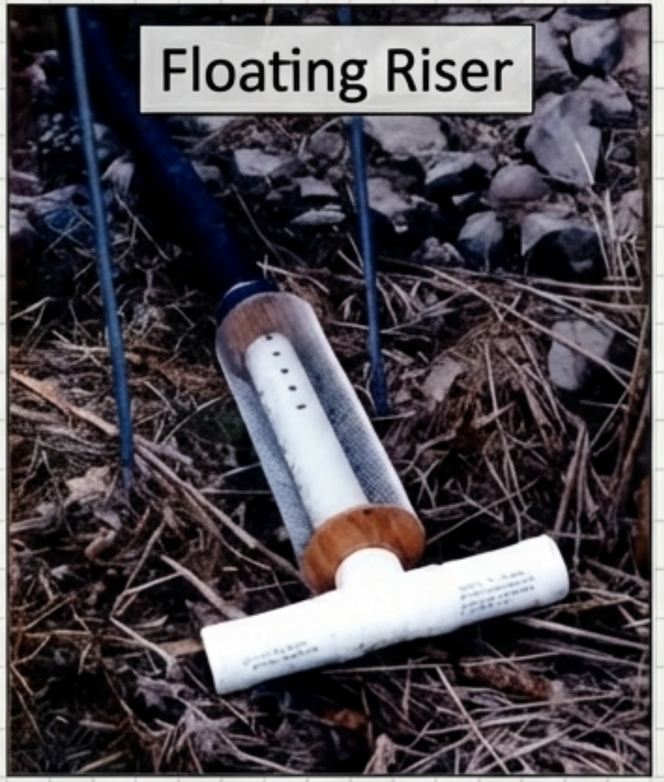


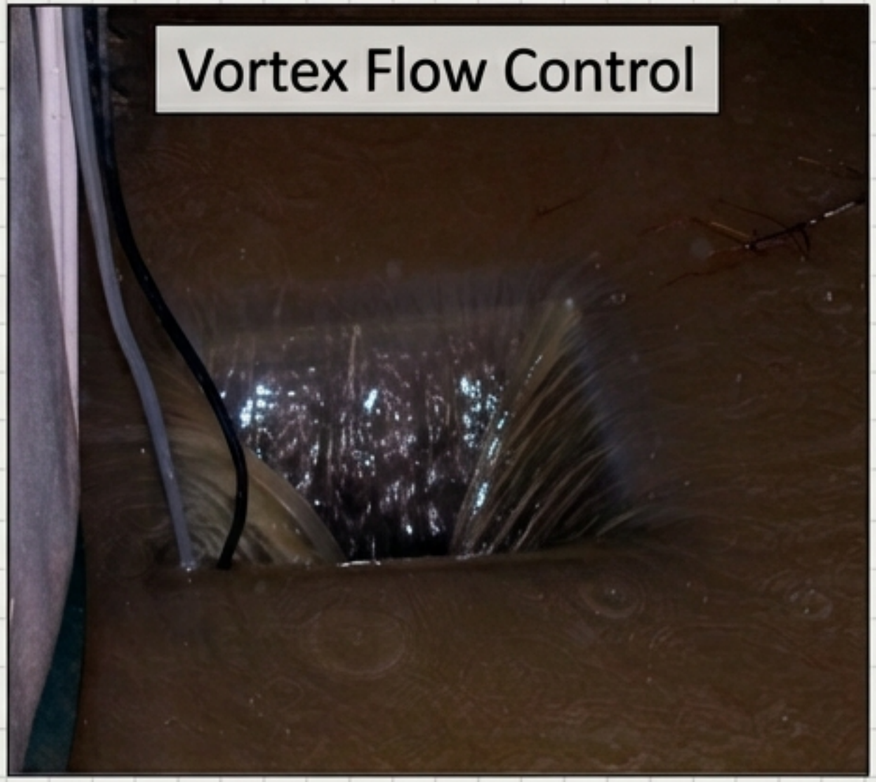
Surface Extended Detention Basin – Profile View



Retrofitting Legacy Infrastructure

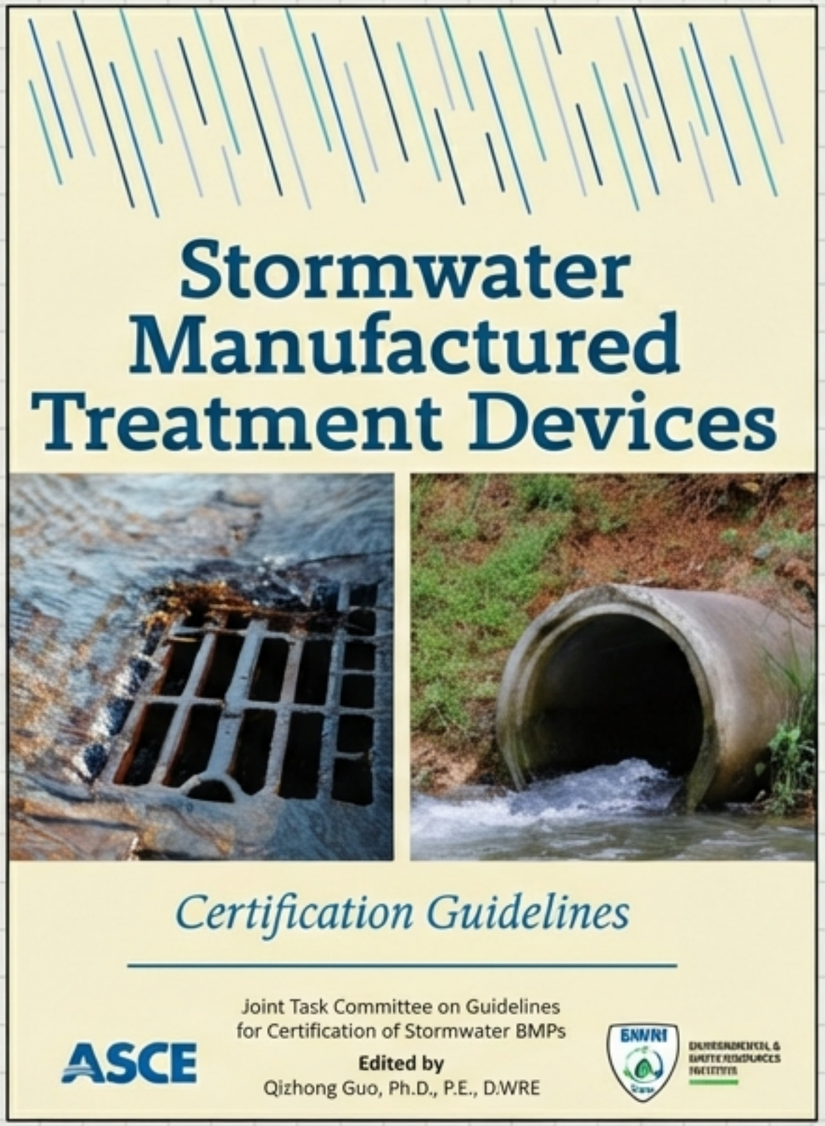
Upgrading Dry Detention Basins for Water Quality





Technique: Constricting the outlet to increase **residence time** and **settling** without full reconstruction.

Manufactured Treatment Devices (MTDs): Solutions for Constraints



Use Case:

High-density urban redevelopment and highway expansion where space is limited.

Certification Process:

1. NJCAT Verification (Laboratory Testing)
2. NJDEP Certification (Regulatory Approval)

Critical Constraint:

- Maximum Drainage Area: **2.5 Acres per device.**

Classifying MTDs: Green vs. Non-Green

GREEN INFRASTRUCTURE (GI) MTDs

Must infiltrate into subsoil OR treat runoff via bio-filtration with vegetation.

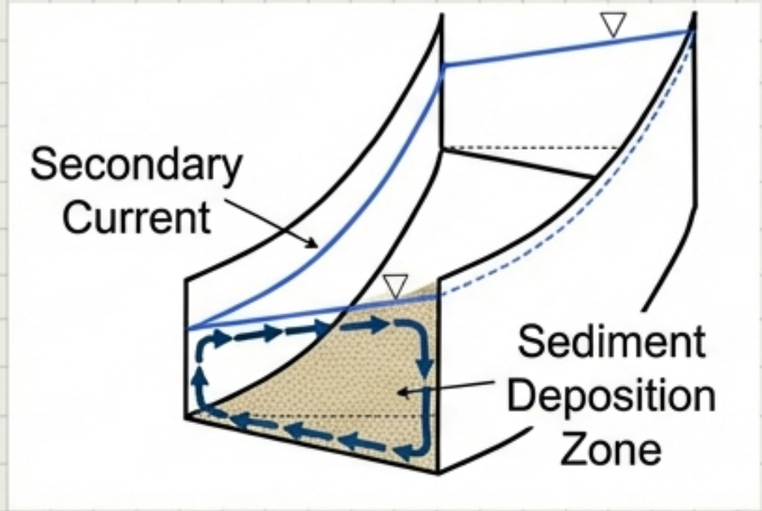
- Filterra Bioretention System
- BioPod with StormMix
- StormGarden Bio-Filter
- Modular Wetlands 360

NON-GI MTDs

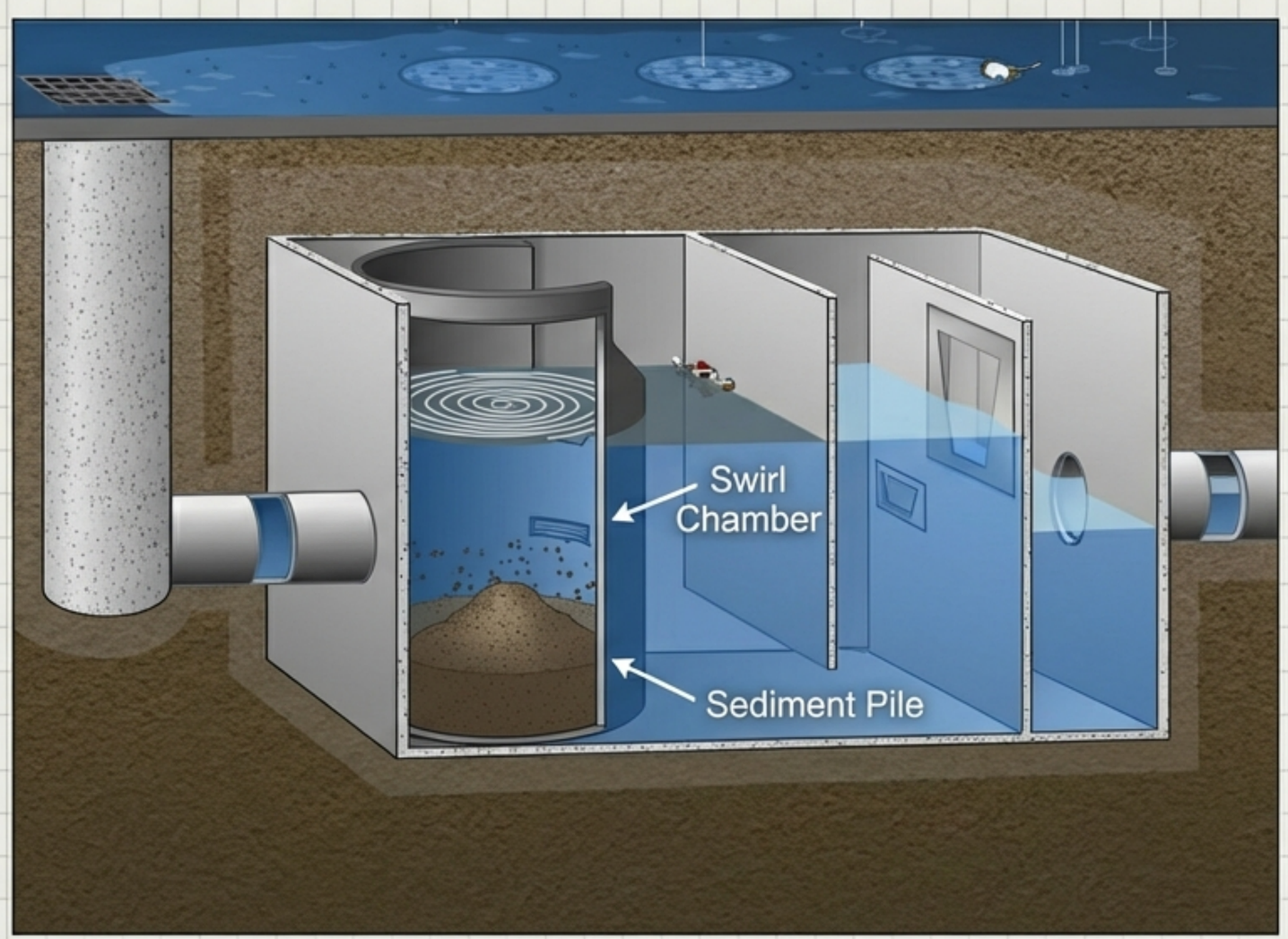
Hydrodynamic separators or media filters without biological processes.

- Vortechs
- StormFilter
- Aqua-Filter
- Kraken Filter
- StormTrap

Mechanisms of Action: Hydrodynamic Separation

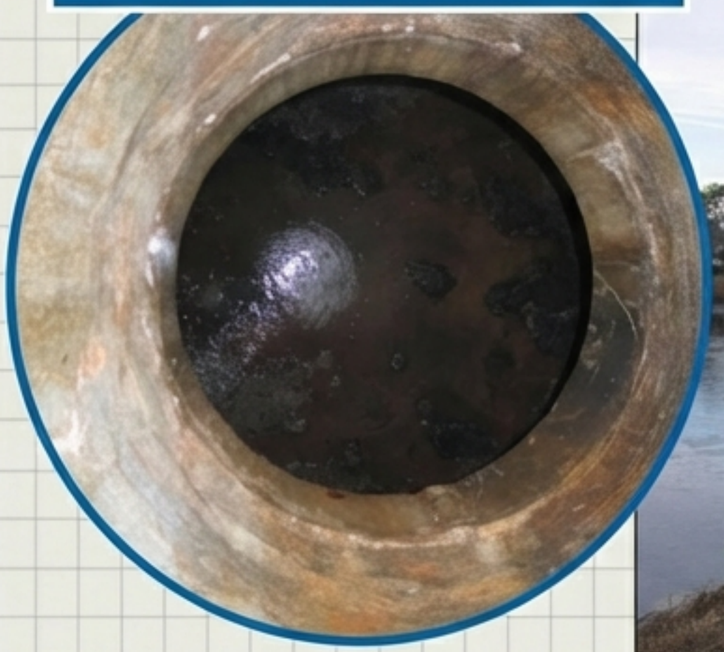


Historical Precedent: River separation physics used for >2000 years.



Operations & Maintenance: The MTD Reality

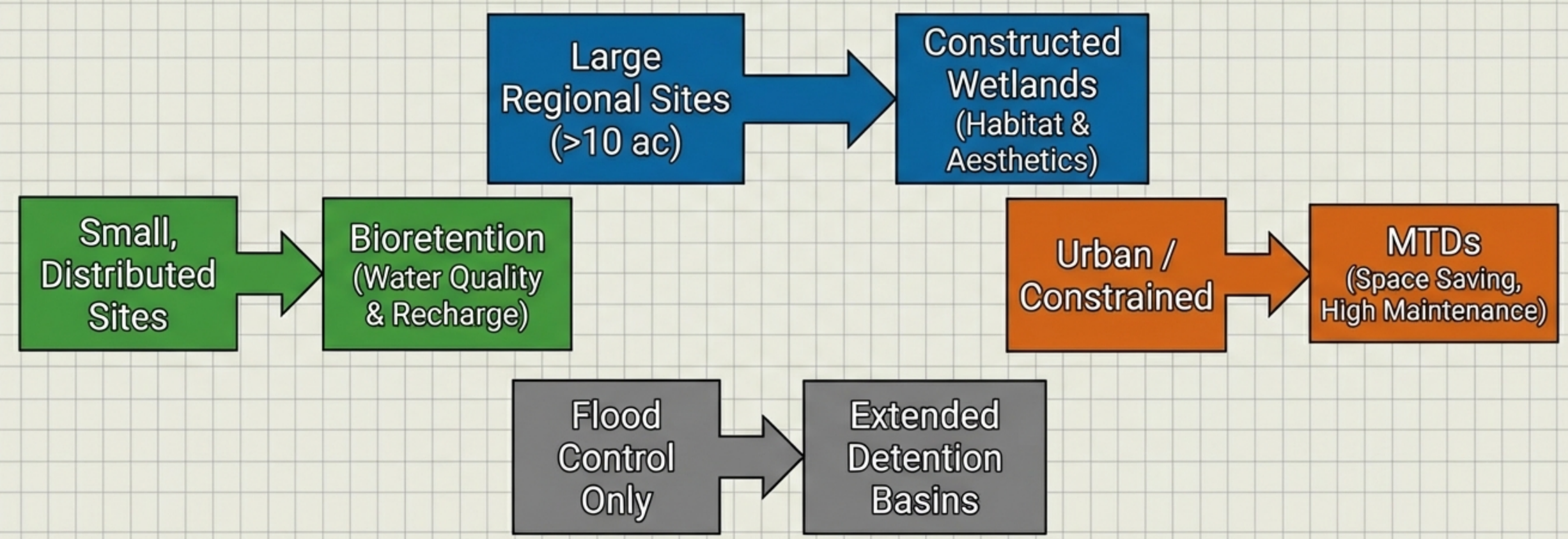
Before Maintenance



After Maintenance

Requirement: Specialized vacuum trucks are mandatory for removing accumulated solids. Neglected MTDs bypass treatment.

Summary: The Spectrum of Intervention



Successful stormwater management balances the Regulatory Hierarchy (Green first) with Site Constraints (Space/Water Table) and Long-Term Maintenance capabilities.