Mobile's
Low Impact Development
Volume

of the Stormwater Design Manual

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Why an LID Volume?

RESTORE Funding

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Stormwater Design Manual

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LID Volume of the Stormwater Design Manual

Discussion Today

- Goal of LID Volume
- Applicability (Projects)
- The “Lingo” or Terminology
- Non-Structural LID
- Structural LID & Underdrains
- Content Examples
- Conclusion

What is the Goal of the City's LID Volume?

- Encourage use of LID – align with City's ADEM Permit
- Change thinking/educate about what LID is
  - LID = LOW IMPACT DEVELOPMENT (*lessening* impacts)
  - Concepts are hand in hand with Alabama Handbook – such as selective/minimal clearing during construction – takes a step further
  - Improves water quality
  - Helps to slow down velocities in smaller flood events (not intended to mitigate larger flood events)
- Teach the proper way to design LID in Mobile's unique environment
- LID is optional in Mobile

Applicability and Requirements

REQUIREMENT	TRADITIONAL PROJECT	LID-WQP PROJECT
Tier 1 Land Disturbance ≥ 1 acre	↓	↓
Design requires professional engineer’s certification for design	✖	✖
Require maintenance agreement for stormwater practices	✖	✖
Requires as-built certification	✖	✖
Require annual post-construction inspections by owner submitted to City	✖	✖

Terminology

CONSTRUCTION vs. POST-CONSTRUCTION Practices:

BMP	**CONSTRUCTION** Erosion Prevention and Sediment Control (EPSC) practice
WQP	**POST-CONSTRUCTION** Water quality practice (e.g., extended detention pond, sand filter, hydrodynamic MTD, etc.)
LID-WQP	**POST-CONSTRUCTION** Water quality practice that is low impact development (e.g., bioretention, permeable pavement)
Non-structural LID-WQP	**POST-CONSTRUCTION** Not physical, constructed facilities
Structural LID-WQP	**POST-CONSTRUCTION** Physical Facilities designed and constructed to prevent stormwater pollution, or to remove pollutants from stormwater

Non-Structural WQPs

- **Non-structural WQPs are not physical, constructed facilities**

  - ***Approach*** to land development planning that focus on the overall goals of mimicking natural hydrology on a land development and reducing the volume of runoff generated by the site itself. These goals are achieved through planning methods that:
    - Conserve natural features and resources
    - Reduce impervious surfaces
    - Maximize vegetated spaces

Traditional vs. LID Subdivision Design

- Both designs have 110 lots
- In the LID design, parcels are clustered to preserve existing trees and natural drainageways and reduce site imperviousness

(Courtesy: Pierce County WA and AHBL, Inc.)

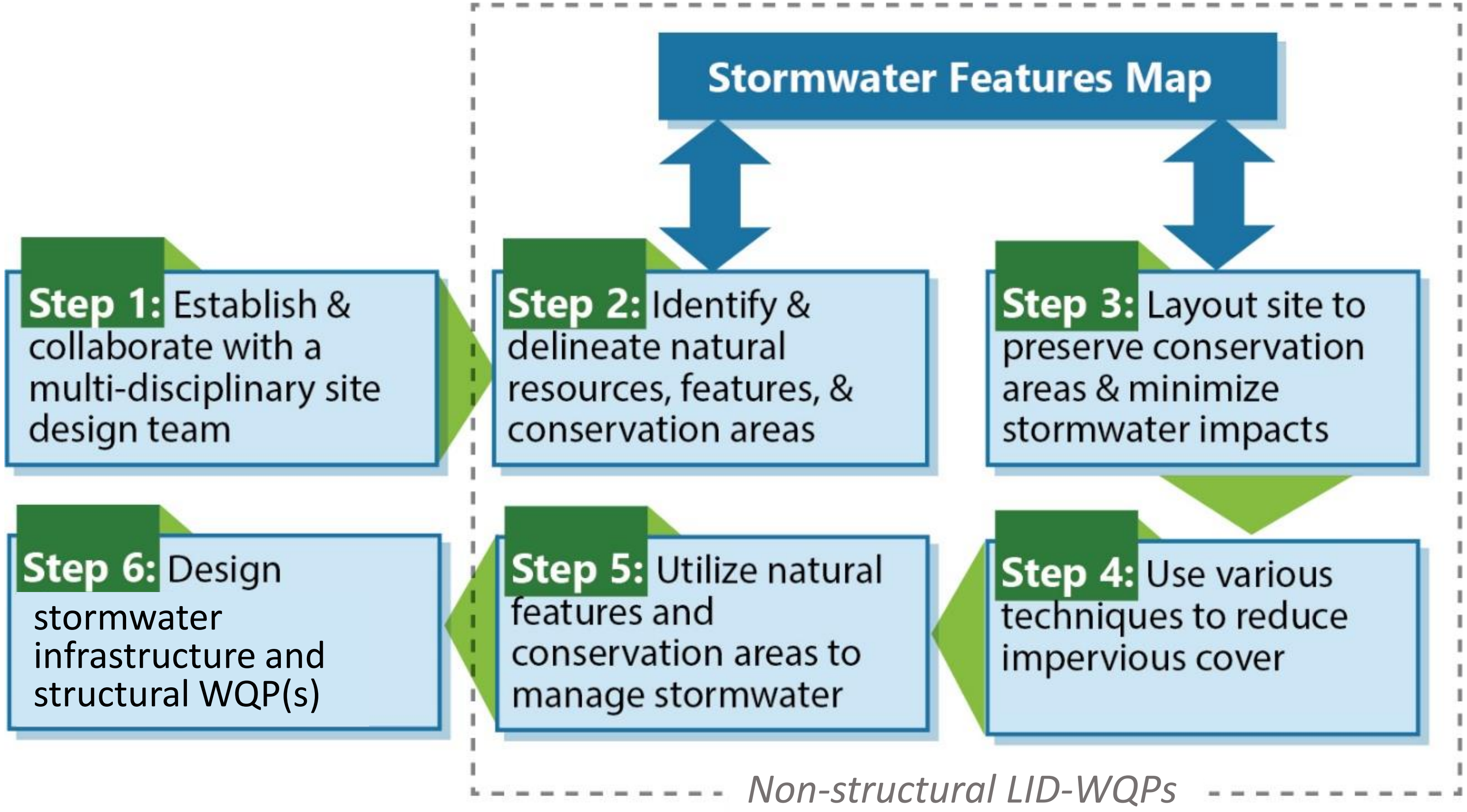
Traditional vs. Non-Structural "Fit to Terrain" Layout

Adapted from: Georgia Stormwater Management Manual (GSMM), 2001

A traditional residential layout means wide-scale clearing and grading, loss of stream buffers, and development in the floodplain.

The "Fit to Terrain" layout provides the same number of lots, but reduces clearing and grading, provides sufficient buffer for stream health, and avoids development in the floodplain.

LID Design Process



Structural LID-WQP Descriptions

LID-WQP Name	Description
Bioretention	Bioretention areas are vegetated, shallow depressions used to promote infiltration, biofiltration, and evapotranspiration of runoff. Runoff is captured in a landscaped depression and soaks into an engineered soil basin. It then either infiltrates into the soil below the base or drains into an underdrain and is discharged from the bioretention area.
Urban Bioretention	Urban bioretention areas refer to landscaped planter boxes designed to receive post-construction stormwater. Planters are concrete-walled landscape areas that capture, store, and filter stormwater runoff and are useful for highly developed spaces. They have underdrains and waterproof liners that are filled with an engineered soil mix, and planted with trees, shrubs, and other herbaceous vegetation. Urban bioretention areas are designed to capture and temporarily store stormwater in the engineered soil mix, where it is subject to the hydrologic processes of evaporation and transpiration before being conveyed back into the storm drain system through an underdrain.
Wet Bioswale	Wet bioswales are vegetated open channels that are explicitly designed and constructed to capture and treat stormwater runoff within wet cells formed by check dams or other means.
Dry Bioswale	Dry bioswales are vegetated open channels that are explicitly designed and constructed to capture and treat stormwater runoff within dry cells formed by check dams or other means.
Infiltration Basin	Infiltration basins are shallow excavations, typically filled with stone or an engineered soil mix to readily accept and temporarily hold stormwater runoff until it infiltrates into the surrounding soil.
Permeable Pavement	Pervious concrete pavement and permeable concrete pavers are hard surfaces with void areas that allow rainfall (and sometimes stormwater runoff) to pass through the pavement or in between pavers into an underlying stone reservoir. The reservoir temporarily stores runoff before it infiltrates into the subsoil and/or drains out through an underdrain collection system. These WQPs are used for driveways and parking areas.
Engineered Wetlands	Engineered wetlands are compact, simulated wetland systems designed to capture stormwater and remove pollutants through settling and biofiltration of pollutants as the water slowly drains through the wQP. Runoff reduction is provided via evapotranspiration and root uptake by wetland plants.
Manufactured Treatment Devices	LID Manufactured Treatment Devices (MTDs) are pre-constructed WQPs available from commercial vendors that are designed to treat stormwater runoff using infiltration, biofiltration, and/or evapotranspiration. LID-MTDs can often be advantageous on small sites and in space-limited areas.

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Structural LID-WQP Application by Land Use/Location

LID-WQP Name	Land Use										Characteristic of Drainage Area or WQP Location					
	Comm., Industrial, & Institutional			Residential			Private Roads[1]		Other							
	Landscaped Areas	Parking Spaces	Driveways and Parking Lots	Single Family Home Lots	Multi-Family Residential Lots	Areas Owned in Common	Roadway Shoulders/Medians	Travel Ways	Private Parks & Open Spaces	SFHAs & 100-year Floodplains	Areas with a History of Flooding	Areas with Contaminated[2] Soil	Chemical/Waste Storage, Loading & Transfer Areas	Near Site Utilities	Wellhead Protection Areas	Groundwater Recharge Areas
Bioretention	●	●	●	○	◉	●	●	●	●	✖	◉	✖	✖	✖	✖	✖
Urban Bioretention	●	●	●	○	◉	●	●	●	●	✖	◉	✖	✖	✖	✖	✖
Wet Bioswale	●	●	●	○	◉	●	●	●	●	✖	◉	✖	✖	✖	✖	✖
Dry Bioswale	●	●	●	○	◉	●	●	●	●	✖	◉	✖	✖	✖	✖	✖
Infiltration Basin	●	●	●	○	◉	●	●	●	●	✖	◉	✖	✖	✖	✖	✖
Permeable Pavement	●	●	◉	○	◉	●	◉	✖	●	✖	◉	✖	✖	◉	◉	◉
Engineered Wetlands	●	●	●	○	◉	●	●	●	●	✖	●	✖	✖	✖	✖	✖
LID-MTDs	●	●	●	○	◉	◉	◉	●	●	✖	✖	✖	✖	◉	✖	✖

● - WQP is usually suitable for this land use or WQP location. Check WQP design specifications to confirm suitability.
◉ - WQP is sometimes unsuitable for this land use or WQP location. Check WQP design specifications to determine suitability.
○ - WQP is usually suitable for this land use or WQP location but may not be approved due to concerns about future owner maintenance.
✖ - WQP is not suitable for this land use or WQP location and will not be approved.

Underdrains – Required or Not

6.13 UNDERDRAINS design specifications

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General Description

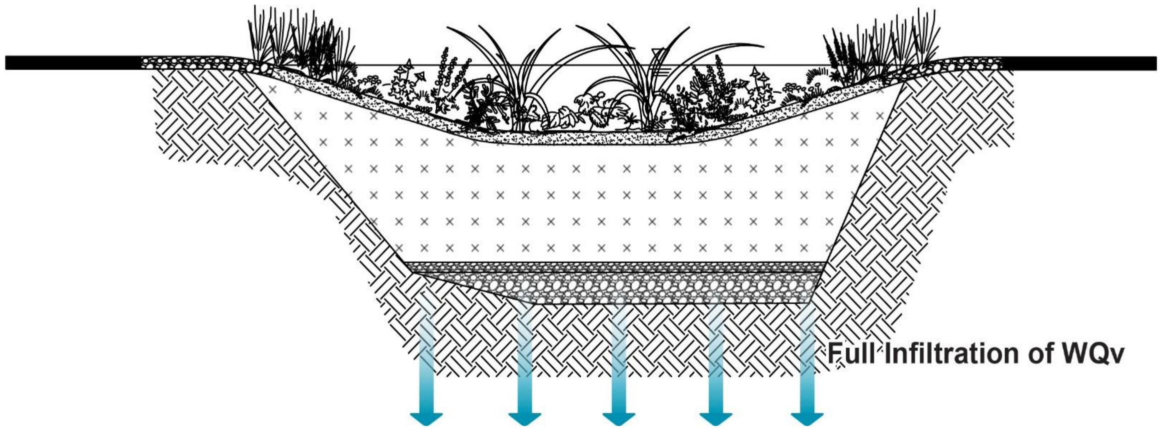
High and intense rainfall, lack of areas with suitable native soil, and generally low native soil permeability in the Mobile area are all factors that influence the design of LID-WQPs. In Mobile, most LID-WQPs must be designed with an underdrain collection system to prevent the WQP from flooding and/or remaining wet for long periods of time. The in-situ soil and infiltration rate criteria that determine the need for an underdrain is provided in Section 6.3 and shall be followed.

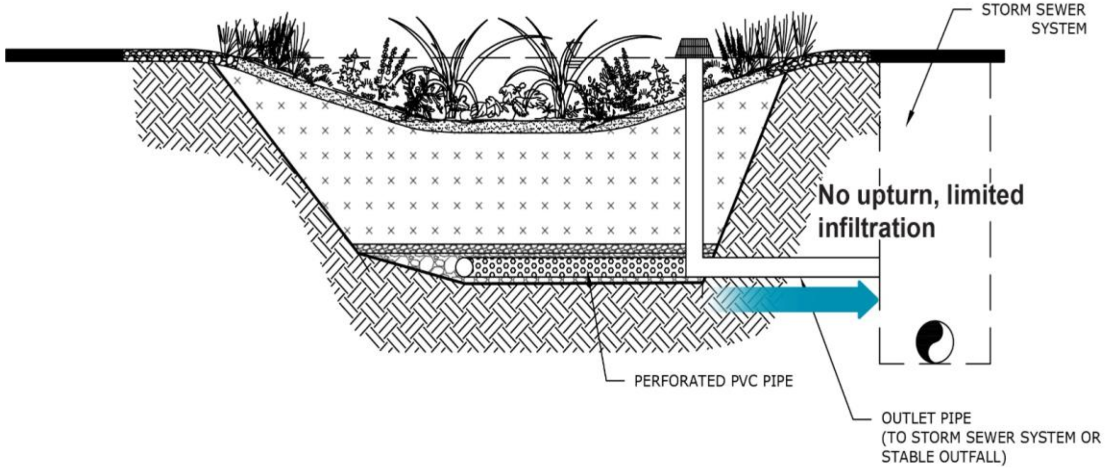
This Chapter provides additional guidance on underdrain collection system applicability (**Table 6.13.1**), configurations (**Table 6.13.2**), and design specifications (**Table 6.13.3)** of each of these types of designs. Table 6.13.2 also provides information on the types of underdrain systems and WQ_v filtration vs. infiltration. In addition, all LID-WQPs can be designed with an impermeable liner, making the LID-WQPs pure detention systems.

Table 6.13.1 Underdrain Collection System Applicability

LID-WQP Type	Always Designed Without Underdrains[1]	Designed Without Underdrain*	Underdrain on Bottom	Elevated Underdrain (Internal Water Storage Design)	Designed w/ Impermeable Liner[2]
6.5 Bioretention		X	X	X	X
6.6 Urban Bioretention			X		X
6.7 Wet Bioswale	X				X
6.8 Dry Bioswale		X	X	X	X
6.9 Infiltration Basin		X	X	X	X
6.10 Permeable Pavements		X	X	X	X
6.11 Engineered Wetland	X				X
6.12 MTDs					

** If requirement in **Section 6.3 Underdrain and Infiltration Test Requirements** are met*





Manufactured Treatment Devices (MTD)

Pre-manufactured structural WQPs

Step	Design Activity
Step 1	**Evaluate LID-MTD feasibility.** Use the feasibility criteria provided in Tables 6.12.1, 6.12.2, and 6.12.3 to determine if an LID-MTD is feasible for the selected location on the land development site. Consider also whether the MTD being considered is appropriate for the future landowner(s), based on the intended land use of the property, the MTD's maintenance burden, and assumptions or knowledge of how the future landowner(s) will care for the MTD (e.g., maintain it themselves, through a property manager, or hiring a landscape contractor).
Step 2	**Determine the goals and primary function of the WQP.** Consider whether the MTD is intended to: • Comply with the City's stormwater quality requirements (i.e., treat all, or a portion of, the WQ_v) • Include additional storage capacity for a higher level of stormwater quality treatment, if desired or required by the City. While not typical, some LID-MTDs have the ability to provide additional, but limited, underground storage • Enhance landscape and provide aesthetic qualities
Step 3	**Determine the minimum size of the MTD needed.** Use the MTD sizing calculation procedure provided in Section 6.12.6.
Step 4	**Select the LID-MTD and contact a local vendor or the MTD manufacturer for design support.** Consult the vendor or manufacturer regarding location, size, and surface footprint, taking into consideration existing trees, utility lines, and other obstructions to ascertain if the MTD will fit into the desired space, given its design requirements and sizing calculations. The vendor or manufacturer will assist with (or perform) the MTD design, including offline/online configuration, overflow/bypass structure, underdrain collection system (required), and vegetation (required), as well as its configuration at the desired location and connection with the onsite stormwater drainage system.
Step 5	**Design the protection measures for the MTD, if needed** Use guidance in Section 6.12.9 to design protection measures.

BioPod™ Planter with StormMix™ Media by Oldcastle Infrastructure

LID-MTD with Pretreatment Cell *(EcoPure™ BioFilter by Advance Drainage Systems)*

Manual Content

6.6 URBAN BIORETENTION

LID-WQP ATTRIBUTES	
Stormwater Quality Control	HIGH
Stormwater Flood Protection	LOW
WQP Footprint Size *(use of otherwise buildable area)*	LOW
Construction Cost	HIGH
Operation & Maintenance Cost *(when properly maintained)*	MODERATE
Owner Benefits *(property aesthetics, multi-functionality, amenity areas, etc.)*	HIGH

PRIVATE PROJECT SUITABILITY

Industrial	Commercial	Residential *(common areas only)*	Pollutant Hotspots	Private Roadways *(requires HOA)*
✓	✓	▼	✓	✓

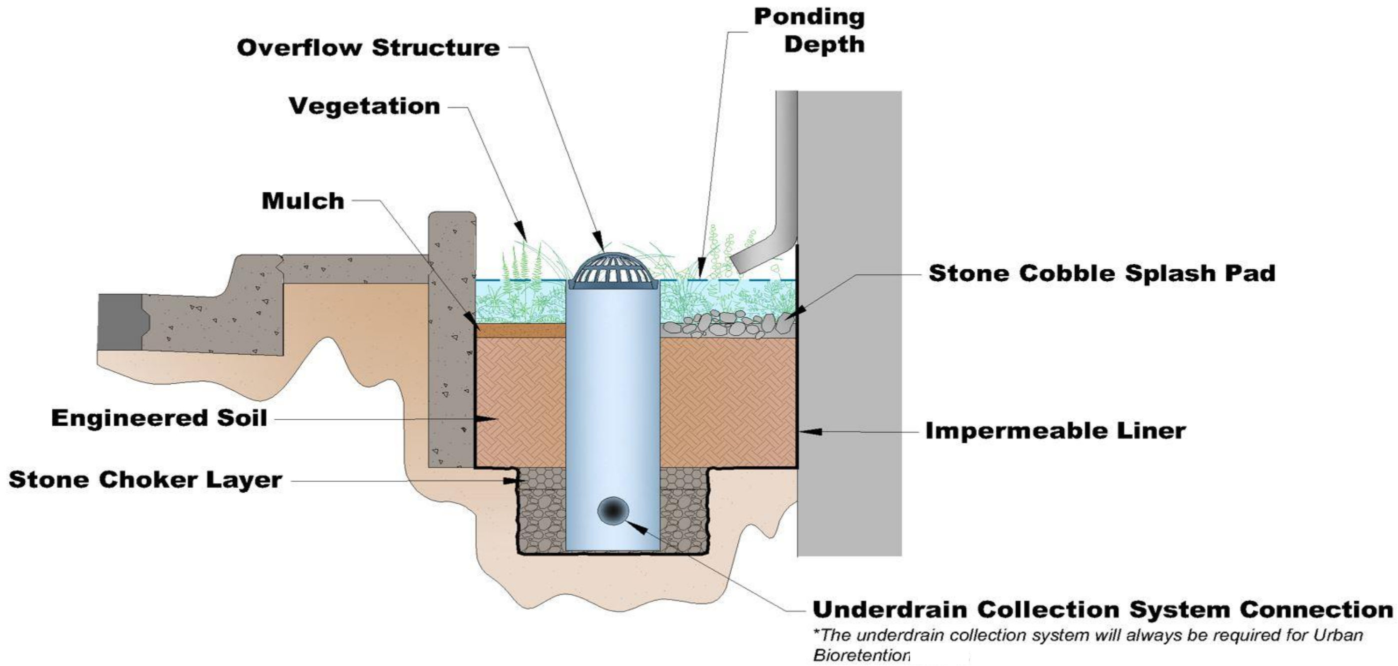
PUBLIC PROJECT SUITABILITY

Buildings & Parks	Rights-of-Way
✓	✖

Legend: ✓ High ▼ Limited ✖ None

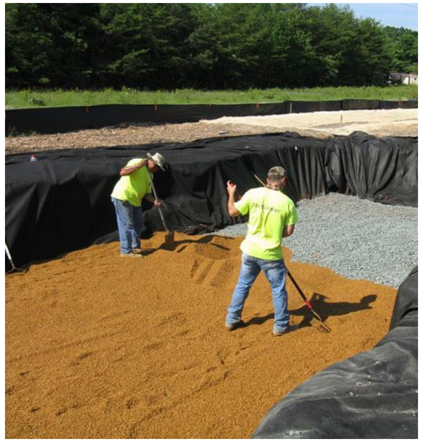
Attribute and Suitability Tables

Cross Sectional View of Components



Manual Content

Importance of Good Construction Practices!!

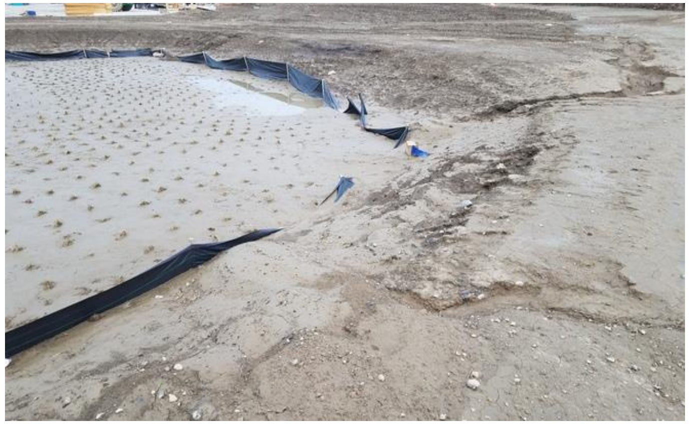


Left source: Chesapeake Stormwater Network;
Right source: Courtesy of Stormwater Facilities, www.stormwaterfacilities.com

Use hand tools instead of heavy equipment for small WQPs

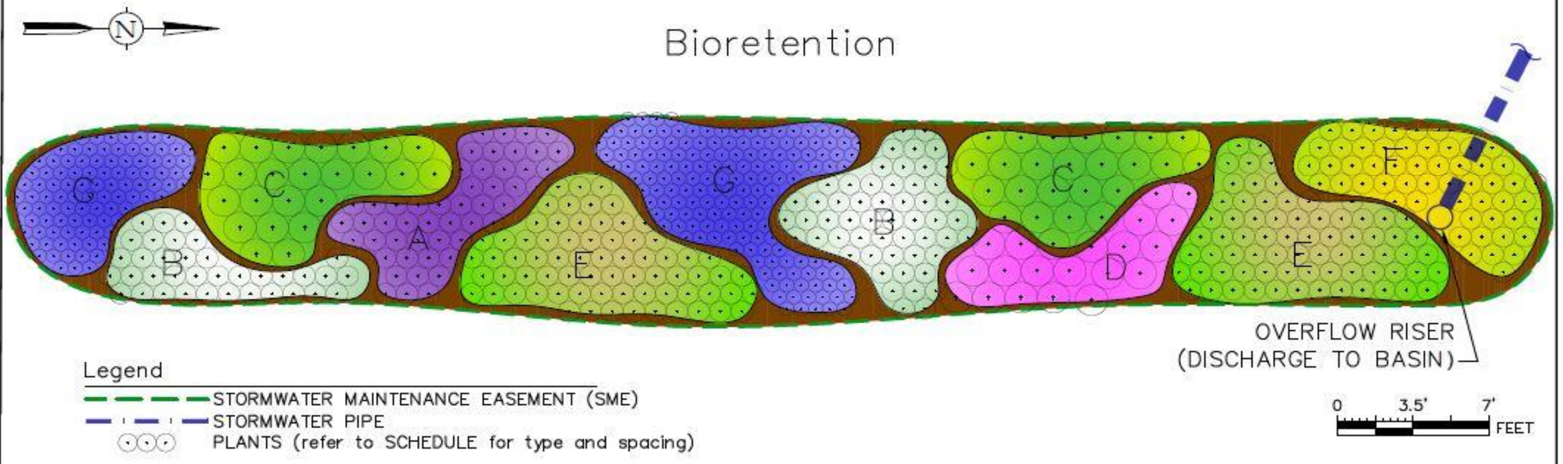
Bad Construction Practices

Failed bioretention WQP due to poor construction BMPs before they were ever completed



Left Source: Cuyahoga Soil & Water Conservation District; Right Source: City of Ballard WA

Manual Content



Example Planting Plans

PLANT SCHEDULE

IDEN.	SCIENTIFIC NAME	COMMON NAME	NATIVE	QUANTITY	COLOR	SPACING	HEIGHT
A	BAPTISIA AUSTRALIS	BLUE FALSE INDIGO	YES	50	PURPLE	12" OC	2–4 FT
B	PENSTEMON DIGITALIS	FOXGLOVE BEARDTONGUE	YES	90	WHITE	12" OC	2–3 FT
C	SPOROBOLUS HETEROLEPSIS	PRAIRIE DROPSEED	YES	49	GREEN	18" OC	1–3 FT
D	ASCLEPIAS INCARNATA	SWAMP MILKWEED	YES	20	PINK/PURPLE	18" OC	3–5 FT
E	CAREX VULPINOIDEA	FOX SEDGE	YES	142	TAN	12" OC	2–3 FT
F	RUDBECKIA FULGIDA SPECIOSA	SHOWY BLACK-EYED SUSAN	YES	54	YELLOW	12" OC	2–3 FT
G	GENTIANA ANDREWSII	BOTTLE GENTIAN	YES	262	BLUE	8" OC	1–2 FT

NOTES:

1. Planting shall take place in the spring (April 1 to June 1) or in the fall (Sept 1 to Oct 1). Remove unwanted vegetation prior to planting.
2. Applicants are encouraged to obtain plant warranties (typically through 2 growing seasons). THE WARRANTY PERIOD, TERMS, AND CONDITIONS SHOULD BE STATED IN WRITING (E.G. "The warranty period for all plants in BMP #2 is provided by <insert name of warrantor> and covers two years from purchase date of <MONTH, DAY, YEAR>"). BE SURE TO PRESERVE any warranty information needed to actuate the warranty (e.g., purchase receipts, plant installation contractor warranty statement, etc.).

MOBILE ALABAMA | Planting Plan Bioretention | REVISION: 0 | FIGURE: 1

Conclusion

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- Encourage use of LID
- Change thinking/educate about what LID is
- Design/construct LID the appropriate way
- The LID Volume of the Stormwater Design Manual is the guide
- Choose LID in developments

(City of Nashville TN);

(University of Cincinnati's Clermont College, the Water Environment Foundation)

FocalPoint Modular Biofiltration System by ACF Environmental

Filterra® Bioretention System by Contech® Engineered Solutions

Third Creek Greenway Map from Map for Mobile website

Project Contacts:

Questions?

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