



Photo-based operations, inspection and maintenance tools for stormwater green infrastructure practices in coastal Georgia

MARCH 2020



Marine Extension and
Georgia Sea Grant
UNIVERSITY OF GEORGIA



GMC

Goodwyn Mills Cawood

ACKNOWLEDGEMENTS

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ABOUT

Marine Extension and Georgia Sea Grant¹

Marine Extension and Georgia Sea Grant is committed to improving the environmental and economic health of coastal Georgia through research, education and outreach. The program's mission is to improve public resource policy, encourage far-sighted economic and fisheries decisions, anticipate vulnerabilities to change and educate citizens to be wise stewards of the coastal environment. For more information about the program, go to gacoast.uga.edu.

Goodwyn, Mills and Cawood²

Goodwyn, Mills and Cawood (GMC) is an architecture and engineering firm, with offices throughout the Southeast. GMC is equipped to provide all of the services associated with architecture, electrical, engineering, environmental, geotechnical, landscape, planning, surveying, and transportation. More information about GMC is available at gmcnetwork.com.

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BACKGROUND

Without proper maintenance, stormwater green infrastructure/low impact development (GI/LID) practices will not perform as designed. While a fully functioning stormwater infrastructure system is essential to public health and safety, communities often lack the resources to determine maintenance needs and requirements for GI/LID practices. The tools and resources found herein were created to ensure proper maintenance is occurring in order to address the range of pollutants associated with coastal nonpoint sources.

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Bioretention is a shallow basin or landscaped depression designed to store, infiltrate and treat stormwater runoff. It is excavated and backfilled with well-draining, engineered soil media and planted with native vegetation, grasses or sod. Bioretention systems can also enhance habitat, mitigate for heat island effects and improve water quality.

They are designed to temporarily hold (24 hours post rain event) and slowly infiltrate stormwater runoff. Bioretention systems use many pollutant removal mechanisms (i.e., infiltration, absorption, adsorption, evapotranspiration, microbial and biological decomposition, plant uptake, sedimentation and filtration) to improve stormwater quality prior to it leaving the system. Filtered runoff can exfiltrate into surrounding native soils, or these systems can be designed to use an underdrain to collect and return filtered runoff to the conveyance system. Bioretention systems are most effective when used to treat small to moderate quantities of stormwater.

As with any type of infrastructure, bioretention and other green infrastructure practices require maintenance to ensure continued functionality. Key maintenance activities include stabilizing erosion and removal of sediment, trash and debris, particularly if inlet or outlet structure openings are impeded. General inspections and assessment of five critical features can keep the practice operational. Visual clues for inspection can be used at any time, but it is ideal to inspect the bioretention system shortly after a moderately-sized rainfall event (~ 1 inch) and, again, 24-hours later to ensure runoff is entering the bioretention cell and infiltrating.

Bioretention systems are often visual additions to the landscape and while the vegetation has a role in supporting pollutant removal, the plant health and plant density is related to the overall aesthetic value. Rating these conditions is highly subjective. When possible reference a landscaping plan and the overall site objectives.

BIORETENTION POLLUTANT REMOVAL¹

- 85% of suspended solids
- 80% of phosphorus
- 60% of nitrogen
- 90% of fecal coliform
- 95% of metals



Resources are required to inspect and properly maintain bioretention systems. The maintenance cost as a percentage of capital cost is estimated at 5–7%.²

A 2015 report by American Society of Civil Engineers found the median annual maintenance cost for bioretention was \$0.68/sq. ft. (range of \$0.13 to \$2.30/sq. ft.) and median cost of \$850/yr. per location.³

¹ Georgia Stormwater Management Manual. Atlanta, 2016. 2016 Edition. <https://atlantaregional.org/natural-resources/water/georgia-stormwater-management-manual/>

² USEPA (1999). "Preliminary data summary of urban stormwater best management practices." EPA-821-R-99-012, Washington, DC.

³ Clary, J. and Piza, H. (2017). "Cost of Maintaining Green Infrastructure." ASCE. Reston, VA.



For more a more detailed inspection checklist reference:

gacoast.uga.edu/stormwater-management

Five Critical Features to Inspect

- 1 Drainage Area**

The drainage area and surrounding landscape that will contribute runoff to the practice is essential to its overall function. Unstable areas that are sources of sediment or drainage ways, including overland flow and pipes, that have pollutants such as trash, debris, sediment, and grass clippings can hinder the performance of the bioretention cell by clogging the main treatment area or contributing additional nutrient and pollutant loads.
- 2 Inlet Structures or Pretreatment Device**

There are various types of inlet structures and pretreatment devices such as forebays, weirs, filter strips, grass channels and rock-lined plunge pools. If these structures are impeded or there is evidence of erosion or that runoff is not entering the cell (i.e., short-circuiting) maintenance is required to restore function. It is important to confirm that these structures are configured properly to maintain longevity of the bioretention media.
- 3 Main Treatment**

The surface of the bioretention system is the primary location for infiltration of stormwater. Physical clues such as accumulation of fine sediment, stains, mosquito larvae or plant stress are evidence of surface clogging and subsequent maintenance needs. The vegetation is an important part of the practice because it aids in infiltration, evapotranspiration and pollutant uptake, and it provides aesthetic appeal.
- 4 Underdrain**

Not all bioretention systems are designed with an underdrain; however, cleanouts are good indicators. If cleanout caps are broken or missing, runoff could short-circuit through the system. If there are signs of an underdrain blockage, a professional may be required to complete the necessary maintenance.
- 5 Emergency Overflow or Outlet Structure**

Emergency overflows and outlet structures are necessary for rain events that are larger than the bioretention system was designed to treat. There is often a safety risk associated with the failure of these features and any signs of blockages or structural damage should be addressed immediately following inspection. It is important to confirm that these are configured for the bioretention cell to allow for the appropriate maximum and average surface ponding depth.



BIOSWALES

FACT SHEET

Bioswales, or dry enhanced swales, are vegetated open channels designed to capture and treat stormwater. Unlike other stormwater green infrastructure, bioswales are configured in a linear fashion for conveyance.

Bioswales are often vegetated, improving aesthetics, reducing the velocity of stormwater and assisting with pollutant removal; but do not confuse them with a grassed channel or ditch. Much like other bioinfiltration practices (i.e. bioretention), bioswales utilize an engineered soil media and underdrain to enhance pollutant removal. Bioswales should be designed with less than a 4% longitudinal slope. Berms or check dams can be used in bioswales to promote surface ponding, infiltration, and settlement of sediment and pollutants.

Like all infrastructure, green infrastructure practices such as bioswales require proper maintenance to perform long-term. Accumulation of sediment, litter, debris and improper vegetation growth are a result of poor maintenance. During vegetation establishment, more frequent inspections are required to inspect for erosion. If the bioswale isn't draining within 48 hours after a moderately-sized rain event (~1 inch), check the inlet and outlet structures and media surface for clogging. Bioswales are frequently used parallel to roadways; therefore, specific care should be given to ensure vegetation does not block lines of sight and overflow does not create driving hazards. Maintenance costs for bioswales are not extensively documented; however, due to the similarities in design and function, average maintenance costs are expected to be comparable to bioretention (median cost ~\$0.70/sq. ft.).

BIOSWALES POLLUTANT REMOVAL¹

80% of suspended solids
50% of phosphorus
50% of nitrogen
95% of metals



¹ Georgia Stormwater Management Manual. Atlanta, 2016. 2016 Edition. <https://atlantaregional.org/natural-resources/water/georgia-stormwater-management-manual/>

Site ID/Name: _____

Location: _____

Inspector: _____

Date: _____

BIORETENTION

Applies to Bioinfiltration, Bioswales (Dry Enhanced Swales) and Rain Gardens.



GOOD EXAMPLES

GENERAL INSPECTION QUESTIONS

Note: 'Yes' indicates a maintenance need and action

General:

- 1. Is access to the site inadequately maintained for inspection and maintenance? **YES / NO**
- 2. Are grass clippings present in the drainage area or within the system [inlet structure, pretreatment (filter strip and grass channel), main treatment, or outlet/overflow structure]? (Note: grass clippings should be removed) **YES / NO**

Drainage Area: (pertains to the surrounding landscape that will contribute runoff to the practice)

- 3. Is there any exposed or unstable soil that could cause sediment accumulation within the practice? **YES / NO**
- 4. Do the drainage ways (overland flow or pipes) to the practice have trash, debris, grass clippings, large branches, etc. present? **YES / NO**

Inlet Structure / Pretreatment: (Choose One)

- A.** Forebay **B.** Weir **C.** Filter Strip / Grass Channels **D.** Rock-Lined Plunge Pools

- 5. Does this area have trash, debris, or sediment present? **YES / NO**
- 6. Condition of **A-D** listed above:
 - A/C:** Is there any undesirable vegetation or unhealthy grass (bare or dying)? **YES / NO**
 - B:** Is the sediment more than 25% of the total depth of the weir? **YES / NO**
 - D:** Is the rock thickness in the pool inadequate? **YES / NO**
- 7. Is there evidence of runoff short-circuiting (going around) the inlet structure? **YES / NO**
- 8. Is there evidence of gullies, rills, or erosion around the inlet or pre-treatment structure? **YES / NO**

COMMENTS: _____

- 9. Does the area around the inlet structure (including filter strip and grass channels) need to be mowed? **YES / NO**
- 10. If a diversion structure (high flow bypass structure or underdrain) is present, is there presence of trash, debris, on sediment? **YES / NO**

Main Treatment:

- 11. Is there evidence of long-term ponding or standing water in the practice (more than 48 hours after a rain event)? (e.g., stains, odors, mosquito larvae, etc.) **YES / NO**
- 12. Is there any evidence of fertilizer use on plants? (e.g., fertilizer crusting on surface of soil, tips of leaves turning brown or yellow, blackened roots, etc.) **YES / NO**
- 13. For practices with internal check dams to allow for surface ponding on a slope, is there erosion present around the side of the check dams? **YES / NO**
- 14. Is the mulch depth inadequate or too deep? Note: target depth is 2 to 4 inches **YES / NO**

Underdrain: (if installed)

- 15. If cleanouts are included, are caps missing? **YES / NO**
- 16. Are cleanout caps in poor condition? (e.g., inadequately sealed or set below maximum ponding depth) **YES / NO**
- 17. Are there any signs of the underdrain being clogged or a blockage? **YES / NO**

Emergency Overflow / Outlet Structure:

- 18. Do these structures have trash, debris, sediment or structural damage present? **YES / NO**
- 19. Is there evidence of erosion, scour, or flooding around the structure? **YES / NO**

QUALITATIVE INSPECTION QUESTIONS (GOOD/MARGINAL/POOR)

Note: 'Poor' indicates a maintenance need and action

- 20. Rate the presence of sediment accumulation in the bioretention surface area.
- 21. Rate the presence of debris (e.g., leaves, trash, grass clippings) in the bioretention surface area.
- 22. Rate the presence of undesirable vegetation.
- 23. Rate the condition of plant health per landscaping plan and site objectives.*
- 24. Rate the condition of plant density per landscaping plan and site objectives.*

GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
GOOD (<25% dying/stressed)	MARGINAL (25%-50% dying/stressed)	POOR (>50% dying/stressed)
GOOD (>50% vegetation coverage)	MARGINAL (25%-50% vegetation)	POOR (overgrown or <25% vegetation)

* General percentages provided if landscaping plan and site objectives are not available

EXAMPLES OF POTENTIAL ISSUES:



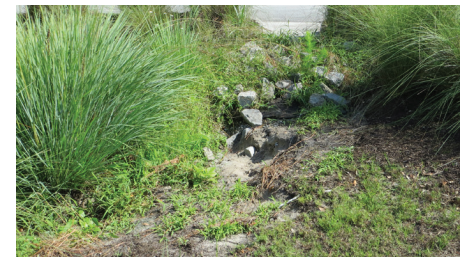
5 INLET SEDIMENT



5 INLET STRUCTURE DEBRIS & SEDIMENT



8 INLET EROSION (GRASS CHANNEL)



8 INLET EROSION (ROCK PLUNGE POOL)



8 PRETREATMENT EROSION (FILTER STRIPS), 14 MULCH (NONE), & 24 PLANT DENSITY (POOR)



8 PRETREATMENT EROSION (SLIDE SLOPES) & 22 UNDESIRABLE VEGETATION (POOR)



11 EXCESSIVE PONDING (CATTAILS & STAINING)



14 MULCH (NONE), 18 OUTLET DEBRIS, & 22 UNDESIRABLE VEGETATION (MARGINAL)



14 MULCH (NONE) & 22 UNDESIRABLE VEGETATION (POOR)



14 MULCH (NONE) & 24 PLANT DENSITY (POOR)



14 MULCH (<2"), 22 UNDESIRABLE VEGETATION (MARGINAL)



18 OUTLET DEBRIS



19 OUTLET STRUCTURE EROSION



23 PLANT HEALTH (POOR - EXPOSED ROOTS AND UNSTABLE)



23 PLANT HEALTH (GOOD) & 24 PLANT DENSITY

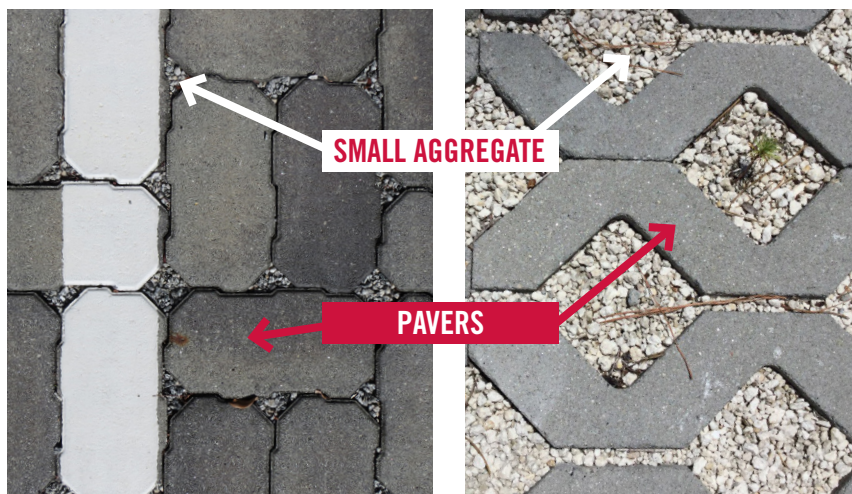
PERMEABLE INTERLOCKING PAVERS FACT SHEET

Permeable pavement systems have structural units that include void, or open, spaces, allowing stormwater to infiltrate and get treated and stored in an underlying gravel base. The stormwater is then filtered through native soils or is discharged through an underdrain. Permeable pavement systems include, permeable pavers (bricks or blocks), along with pervious concrete and porous asphalt. Permeable pavers use pervious void space located between the pavers that is often filled with small aggregate.

Permeable pavement systems are designed to reduce peak flows and volumes of stormwater runoff. They are advantageous for groundwater recharge, particularly in areas where land values are high, as vehicles can drive and park on this stormwater practice. Placement of these systems where in-situ subsoils have an infiltration rate greater than 0.5 in./hr. is recommended. When underlying soils have low permeability, permeable pavement systems can utilize an underdrain to return filtered runoff to the conveyance system. There are many different shapes, styles, and materials used to create the pavers used in these systems. Permeable Pavement is designed to reduce runoff and treat the water quality rain event (1.2 inches); however they can also be designed to handle larger storm events and store larger volumes of runoff. The ratio of impervious area to permeable paver surface area should be no greater than 3:1.

PERMEABLE PAVEMENT POLLUTANT REMOVAL¹

- 80% of suspended solids
- 50% of phosphorus
- 50% of nitrogen
- 60% of metals



As with any type of green infrastructure, permeable pavers require maintenance to ensure continued functionality. It is important to avoid compaction and clogging of these pavement systems, beginning with construction. Undesirable vegetation, sediment accumulation and debris are common culprits of clogged permeable pavement systems. General inspection and assessment of three critical features can keep the practice operational. Street sweeping and hydro-excavation can be effective for source control and routine maintenance of the top layer. Surface cleaning is required to remove debris and undesired vegetation that clog the top layer of the permeable pavement system. Locations that are highly trafficked or near overhanging vegetation may need more frequent surface cleaning to maintain higher infiltration rates.

Three Critical Features to Inspect

1 Drainage Area

The condition of the drainage area and surrounding landscape that will contribute runoff to the practice is essential to its overall function. Unstable areas that are sources of sediment or drainage ways that have pollutants such as trash, debris, sediment, and grass clippings can hinder the performance of the permeable pavement by clogging the pavement surface or contributing additional nutrient and pollutant loads.

2 Inlet and Outlet Structures

If inlet or outlet structures are impeded, this could mean a number of things. Structural damage might be present, there might be evidence of erosion, or runoff may not be flowing over the pavement surface and maintenance is required to restore function.

3 Pavement Surface

The void space between the surface of the permeable pavers is the primary location for infiltration of stormwater. Physical clues such as accumulation of fine sediment, stains, standing water, and paver settling are evidence of surface clogging and subsequent maintenance needs. Any missing aggregate needs to be replaced to maintain optimal performance of the system. Pavers that have been damaged (signs of cracks, splitting, or structural damage) need to be replaced to maintain public safety.

Maintenance costs vary based on many factors. The maintenance cost as a percentage of capital cost is estimated at 3-5%; however, more robust local datasets are needed.²

¹ Georgia Stormwater Management Manual. Atlanta, 2016. 2016 Edition. <https://atlantaregional.org/natural-resources/water/georgia-stormwater-management-manual/>

² Clary, J. and Piza, H. (2017). "Cost of Maintaining Green Infrastructure." ASCE. Reston, VA.

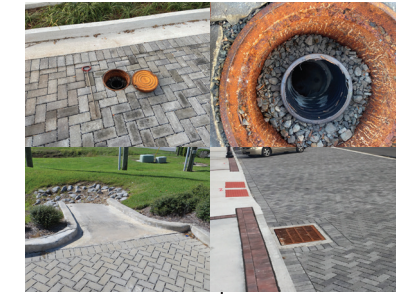
For more a more detailed
inspection checklist reference:

gacoast.uga.edu/stormwater-management



PERMEABLE PAVEMENT

Permeable Interlocking Concrete Pavement (PICP)



GOOD EXAMPLES

GENERAL INSPECTION QUESTIONS

Note: 'Yes' indicates a maintenance need and action

General:

- 1. Is access to the site inadequately maintained for inspection and maintenance? **YES / NO**
- 2. Is there evidence of runoff short-circuiting (going around) the practice? **YES / NO**
- 3. Is there evidence of gullies, rills, or erosion around the practice? **YES / NO**

Drainage Area: (pertains to the surrounding landscape that will contribute runoff to the practice)

- 4. Does the vegetation around the practice need to be pruned/mowed?
Is vegetation unhealthy? (e.g., signs of bare/dead grass) **YES / NO**
Note: grass clippings should be removed.
- 5. Is there any exposed or unstable soil around the practice that could cause sediment accumulation within the practice? **YES / NO**

Permeable Pavement Surface:

- 6. Is there evidence of long-term ponding or standing water in the practice? **YES / NO**

QUALITATIVE INSPECTION QUESTIONS (GOOD/MARGINAL/POOR)

Note: 'Poor' indicates a maintenance need and action

- 14. Rate the presence of undesirable vegetation.
- 15. Rate the presence of sediment accumulation in pore spaces/aggregate between pavers.
- 16. Rate the presence of debris (e.g., leaves, trash, grass clippings) on the permeable pavement surface.

- 7. Are there signs of the bricks/pavers settling? **YES / NO**
- 8. Do the bricks/pavers show signs of cracks, splitting or structural damage? **YES / NO**
- 9. Is there aggregate missing between the bricks/pavers? **YES / NO**

Inlets/Outlets:

- 10. Do drainage ways (overland flow or pipes) to the practice have trash, debris, large branches, etc. present? **YES / NO**
- 11. If cleanouts are included, are caps missing? **YES / NO**
- 12. If an underdrain system is included, are there signs of it clogging or a blockage? **YES / NO**
- 13. Does the emergency overflow have trash, debris, sediment or structural damage present? **YES / NO**

Special Scenario (Concrete Grid Pavers with Vegetation):

- A. Is the grass in the concrete grid unhealthy? (e.g., dead grass or bare spots) **YES / NO**
- B. Is the grass in the concrete grid unmowed or are grass clippings present? **YES / NO**

GOOD (<25% OF AREA)	MARGINAL (25-50%)	POOR (>50%)
GOOD (<25% OF AREA)	MARGINAL (25-50%)	POOR (>50%)
GOOD (<25% OF AREA)	MARGINAL (25-50%)	POOR (>50%)

COMMENTS: _____

EXAMPLES OF POTENTIAL ISSUES:



5 UNSTABLE DRAINAGE AREA



5 UNSTABLE DRAINAGE AREA



7 SETTLING & 15 SEDIMENT



7 SETTLING



8 STRUCTURAL



**8 STRUCTURAL &
15 SEDIMENT (POOR)**



9 AGGREGATE



9 AGGREGATE



14 VEGETATION (POOR)



14 VEGETATION (POOR)



14 VEGETATION (MARGINAL)



15 SEDIMENT (POOR)



15 SEDIMENT (POOR)



16 DEBRIS (POOR)



16 DEBRIS (POOR)

PERMEABLE PAVEMENT

(PERVIOUS CONCRETE
OR POROUS ASPHALT) FACT SHEET

Permeable pavement systems have structural units that include void, or open, spaces, allowing stormwater to infiltrate and get treated and stored in an underlying gravel base. The stormwater is then filtered through native soils or is discharged through an underdrain. Permeable pavement systems include, permeable pavers (bricks or blocks), along with pervious concrete and porous asphalt. Pervious concrete and porous asphalt are similar in that their mixtures consist primarily of larger aggregate, which creates void spaces within the material. The pervious concrete or porous asphalt is applied over an open-graded gravel base course that is used for structural strength, stability and storage of stormwater. It is important that the subgrade not be overly compacted during placement.

These systems are designed to reduce peak flows and volumes of stormwater runoff. They are advantageous for groundwater recharge, particularly in areas where land values are high, as vehicles can drive and park on this stormwater practice. Placement of these systems where in-situ subsoils have an infiltration rate greater than 0.5 in./hr. is recommended. When underlying soils have low permeability, permeable pavement systems can utilize an underdrain to return filtered runoff to the conveyance system. Permeable pavement is designed to reduce runoff and improve water quality for average rain events (1.2 inches), but they can be designed to handle larger storm events with heavier rain. The ratio of impervious area to porous asphalt surface area should be no greater than 3:1. The ratio of impervious area to pervious concrete surface area should be no greater than 1:1.



POROUS ASPHALT POLLUTANT REMOVAL¹

- 80% of suspended solids
- 50% of phosphorus
- 50% of nitrogen
- 60% of metals



PERVIOUS CONCRETE POLLUTANT REMOVAL¹

- 80% of suspended solids
- 50% of phosphorus
- 65% of nitrogen
- 60% of metals

As with any type of infrastructure, pervious concrete, porous asphalt and other green infrastructure practices require maintenance to ensure continued functionality. It is important to avoid compaction and clogging of these pavement systems, beginning with construction. Undesirable vegetation, sediment accumulation and debris are common culprits of clogged permeable pavement systems. General inspection and assessment of three critical features can keep the practice operational. Street sweeping can be effective for source control and routine maintenance of the top layer. Surface cleaning is required to remove debris and undesired vegetation that clog the top layer of the permeable pavement system. Locations that are highly trafficked or near overhanging vegetation may need more frequent surface cleaning to maintain higher infiltration rates.

Three Critical Features to Inspect

1 Drainage Area
The condition of the drainage area or surrounding landscape that will contribute runoff to the practice is essential to its overall function. Unstable areas that are sources of sediment or drainage ways that have pollutants such as trash, debris, sediment, and grass clippings can hinder the performance of the permeable pavement by clogging the pavement surface or contributing additional nutrient and pollutant loads.

2 Inlet and Outlet Structures
If inlet or outlet structures are impeded, this could mean a number of things. Structural damage might be present, there might be evidence of erosion, or runoff may not be flowing over the pavement surface and maintenance is required to restore function.

3 Pavement Surface
Physical clues such as accumulation of fine sediment, stains, standing water, as well as cracking or settling of pervious concrete or porous asphalt are evidence of surface clogging, structural damage and subsequent maintenance needs. Pervious concrete raveling (i.e. aggregate becoming loose) and no visible pore space can reduce functionality or become a hazard to the public. This should be inspected regularly and replaced if needed.

Maintenance costs vary based on many factors. The maintenance cost as a percentage of capital cost is estimated at 3-5%; however, more robust local datasets are needed.²

¹ Georgia Stormwater Management Manual. Atlanta, 2016. 2016 Edition. <https://atlantaregional.org/natural-resources/water/georgia-stormwater-management-manual/>

² Clary, J. and Piza, H. (2017). "Cost of Maintaining Green Infrastructure." ASCE. Reston, VA.

For more a more detailed
inspection checklist reference:

gacoast.uga.edu/stormwater-management



PERMEABLE PAVEMENT

Pervious Concrete (PC)
(applicable to Porous Asphalt)



GOOD EXAMPLES

GENERAL INSPECTION QUESTIONS

Note: 'Yes' indicates a maintenance need and action

General:

- 1. Is access to the site inadequately maintained for inspection and maintenance? **YES / NO**
- 2. Is there evidence of runoff short-circuiting (going around) the practice? **YES / NO**
- 3. Is there evidence of gullies, rills, or erosion around the practice? **YES / NO**

Drainage Area: *(pertains to the surrounding landscape that will contribute runoff to the practice)*

- 4. Does the vegetation around the practice need to be pruned/mowed?
Is vegetation unhealthy? (e.g., signs of bare/dead grass) **YES / NO**
Note: grass clippings should be removed.
- 5. Is there any exposed or unstable soil around the practice that could cause sediment accumulation within the practice? **YES / NO**

Permeable Pavement Surface:

- 6. Is there evidence of long-term ponding or standing water in the practice? **YES / NO**
- 7. Are there signs of the pervious concrete settling or cracking? **YES / NO**

Inlets/Outlets:

- 8. Do drainage ways (overland flow or pipes) to the practice have trash, debris, large branches, etc. present? **YES / NO**
- 9. If cleanouts are included, are caps missing? **YES / NO**
- 10. If an underdrain system is included, are there signs of it clogging or a blockage? **YES / NO**
- 11. Does the emergency overflow have trash, debris, sediment or structural damage present? **YES / NO**

QUALITATIVE INSPECTION QUESTIONS (GOOD/MARGINAL/POOR)

Note: 'Poor' indicates a maintenance need and action

- 12. Rate the presence of undesirable vegetation.
- 13. Rate the presence of sediment accumulation in pore spaces.
- 14. Rate the presence of debris (e.g., leaves, trash, grass clippings) on the permeable pavement surface.
- 15. Rate the presence of concrete raveling. (e.g., aggregate becoming loose)
- 16. Is there visible smearing of pervious concrete? (e.g., no visible pore space)

	GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
12. Rate the presence of undesirable vegetation.	GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
13. Rate the presence of sediment accumulation in pore spaces.	GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
14. Rate the presence of debris (e.g., leaves, trash, grass clippings) on the permeable pavement surface.	GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
15. Rate the presence of concrete raveling. (e.g., aggregate becoming loose)	GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)
16. Is there visible smearing of pervious concrete? (e.g., no visible pore space)	GOOD (<25% of area)	MARGINAL (25-50%)	POOR (>50%)

COMMENTS: _____

EXAMPLES OF POTENTIAL ISSUES:



5 UNSTABLE DRAINAGE AREA & 13 SEDIMENT (POOR)



5 UNSTABLE DRAINAGE AREA & 14 DEBRIS (MARGINAL)



6 STANDING WATER, 12 VEGETATION (POOR) & 13 SEDIMENT (POOR)



6 PONDING / STANDING WATER



7 CRACKING-STRUCTURAL



7 CRACKING & 15 RAVELING (POOR)



7 CRACKING-STRUCTURAL



13 SEDIMENT (POOR)



13 SEDIMENT (POOR)



14 DEBRIS (MARGINAL)



15 RAVELING (POOR)



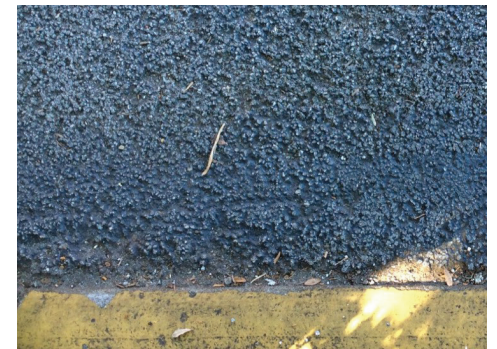
15 RAVELING (MARGINAL)



16 SMEARING (POOR)



16 SMEARING (POOR)



**16 SMEARING (POOR)
(COVERED WITH ASPHALT SEALER)**

MAINTENANCE OF STORMWATER PRACTICES IN COASTAL GEORGIA



<https://bit.ly/3eZi74T>