Green Infrastructure: Best Practices and Construction Management

Kelsey Hoffman

The Rise of Green Infrastructure

Lessons Learned

- Understand green infrastructure components and implementation
- Ensure success with sound construction management practices
- It has to be built right to work right

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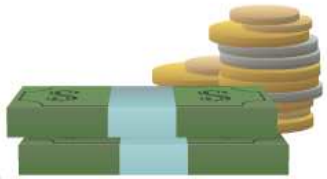
Best Practices

Legislation and Growth

The Rise of Green Infrastructure



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Legislation and Growth

Innovative Stormw
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S.1677 and H.R. 349

Guides stormwater strategies t
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Relieves pressure on aging inf

- **S. 1677** introduced on Nov. 12, 2013
- Referred to the Senate Committee on Environment and Public Works
- **H.R. 3449** introduced on Nov. 11, 2013
- Referred to the House Subcommittee on the Environment

Legislation is Supported By:

- Water Environment Federation (WEF)
- American Society of Landscape Architects

Innovative Stormwater Infrastructure Act

S.1677 and H.R. 3499

Guides stormwater strategies to effectively manage runoff and overflows

Relieves pressure on aging infrastructure

"The reason behind using a more sustainable type of infrastructure is to reduce the demand, stress and strain on the pipes. By controlling stormwater at the source, it reduces stress on the pipes, which then leverages the infrastructure. The idea is trying to work with what nature wants to do."

Chris Crockett, deputy commissioner, Philadelphia Water Dept

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- Water Environment Federation (WEF)
- American Society of Landscape Architects
- Environmental Protection Agency's (EPA) Office of Water
- American Rivers
- Natural Resource Defense Council (NRDC)
- National Association of Clean Water Agencies (NACWA)
- American Planning Association
- National Parks and Recreation Association

Estimated value of green nonresidential building construction

By 2015: estimated between $120 billion to $145 billion

2010: Between $43 billion and $54 billion

2005: About $3 Billion

for Growth

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By 2015: estimated between $120 billion to $145 billion

2010: Between $43 billion and $54 billion

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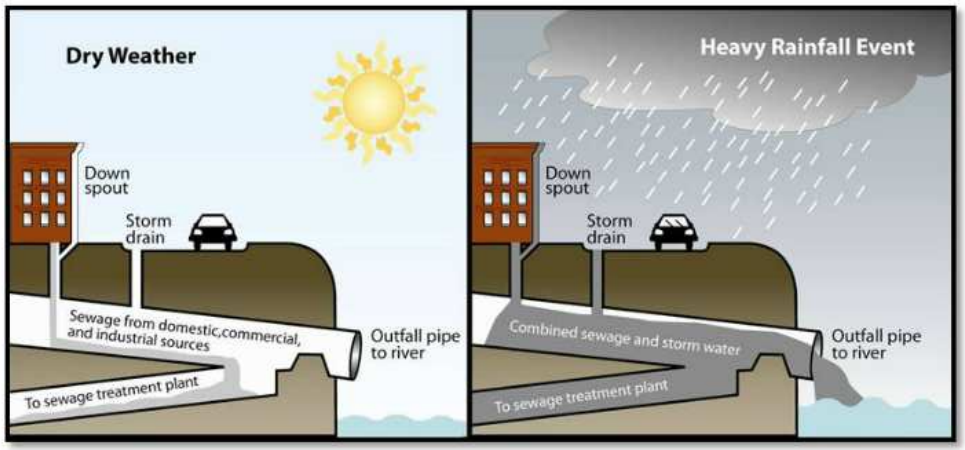
statistics from McGraw-Hill Construction

Reasons for Growth

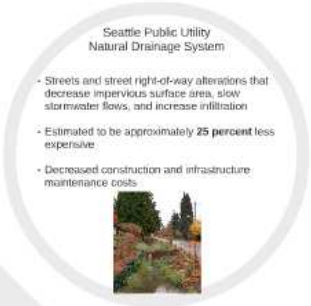
- Tighter environmental regulations
- Potential to reduce the number of CSO events



akroncso.com

Benefits

- Public engagement
- Creation of green community spaces
- A lighter environmental footprint
- Potential for cost savings



Metropolitan Sewer District of Greater Cincinnati

- Must eliminate 1.78 billion gallons of CSOs from the Mill Creek by 2018

projectgroundwork.org

- Lower Mill Creek Partial Remedy uses both green and gray projects
  - stream restoration
  - bioswales
  - stormwater detention basins
  - new storm sewers

- Total cost estimated: $244 million (in 2006 dollars). $200 million less expensive than deep tunnel solution

Seattle Public Utility
Natural Drainage System

- Streets and street right-of-way alterations that decrease impervious surface area, slow stormwater flows, and increase infiltration
- Estimated to be approximately **25 percent** less expensive
- Decreased construction and infrastructure maintenance costs

hiladelphia

Average of 45 inches of rain per year

Managed through green and gray infrastructure

oofs ⟹ act like grass

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Not just the latest trend...

"We need to be careful of thinking that green is always the solution. There should be a hybrid approach. Soils and other constraints in ultra-urban areas can limit the applicability. You just don't want to 'oversell' green construction or 'green wash' things."

- Seth P. Brown, P.E., stormwater program and policy director for the Water Environment Federation

"Green and traditional infrastructure work together. It only makes sense to work together – that's where there is the most benefit. People often try to make it gray versus green, but it's not – especially with stormwater management."

- Chris Crockett, deputy commissioner with the Philadelphia Water Department

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A case in Philadelphia

- Average of 45 inches of rain per year
- Managed through green and gray infrastructure

Pervious pavement and green roofs ⟶ act like grass

"In the end, we put 32 inches of the 45 inches each year into the ground. That means the system is only dealing with 13 inches of rain per year."

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Ensuring project success

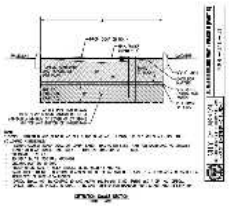
- Experienced team for onsite management and quality assurance
- Knowledge of project specifications, plans and standards
- Project team communication

Green infrastructure components are tools in the tool box and must be constructed properly to be effective

Best Practices

What are permeable pavements?

What is a bioswale?



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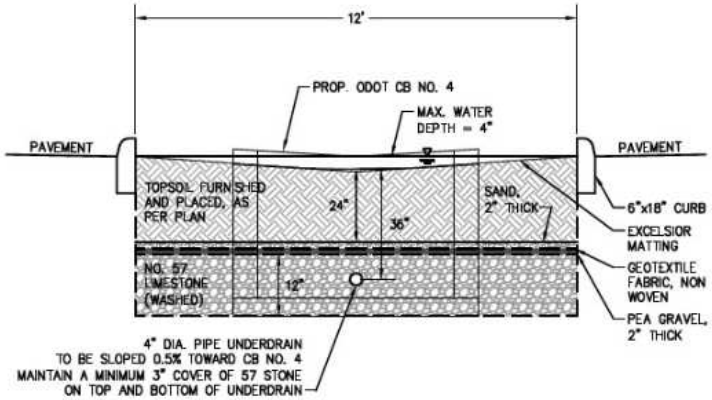

NOTE:
"TOPSOIL FURNISHED AND PLACED, AS PER PLAN" IN AREAS UTILIZING THIS SECTION SHALL HAVE THE FOLLOWING ATTRIBUTES:

- TEXTURE CLASS: SANDY LOAM OR LOAMY SAND. HAVING NO LESS THAN 72% SAND AND NO GREATER THAN 10% CLAY CONSIDERING ONLY THE MINERAL FRACTION OF THE SOIL.
- PH RANGE: 5.2–7.0.
- SOLUBLE SALTS: 500 PPM MAXIMUM.
- ORGANIC MATTER: 5–20%
- PHOSPHORUS: SOIL P–INDEX SHOULD BE BETWEEN 15 AND 40.
- SAND ADDED TO MEET TEXTURAL CLASS SHALL BE CLEAN AND MEET AASHTO M–6 OR ASTM C–33 WITH A GRAIN SIZE OF 0.02–0.04 INCHES.
- TOPSOIL SHALL NOT BE COMPACTED AND HEAVY EQUIPMENT IS NOT PERMITTED ATOP THE TOPSOIL.
- TOPSOIL SHALL BE PLACED IN SMALL LIFTS AND FLUFFED FOR MAXIMUM PORE SPACE AND INFILTRATION.

DETENTION SWALE SECTION
SCALE: NONE

SUM–SEIBERLING WAY – PHASE II [PART B]
2008–048–01
CITY OF AKRON
DEPARTMENT OF PUBLIC SERVICE
AKRON ENGINEERING BUREAU

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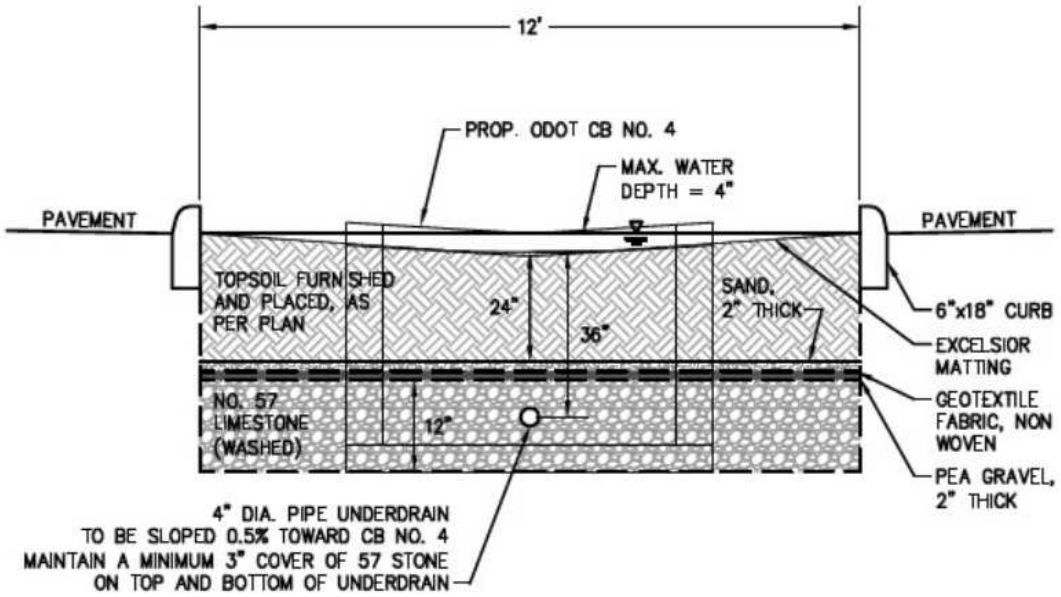
What is a bioswale?



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Contractor must understand the importance of using specified soils and correct timing of plantings

- The type of soil is important for filtration and proper drainage

the bioswale must be

Cross-section of the bioswale must be constructed properly

- Maximize removal of pollutants
- Maximize residence time of stormwater runoff
- Knowledge of plans and intent of design is important

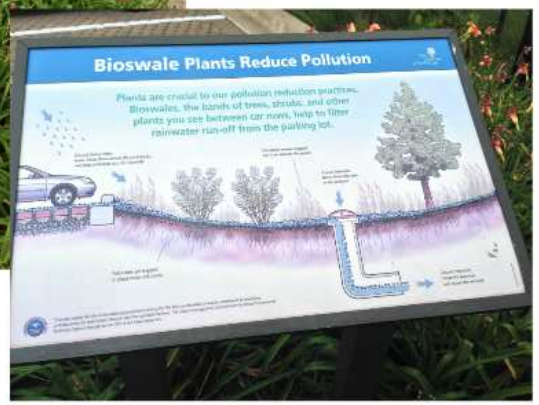
Construction sediment must be removed from the bioswale

- If bioswale is used as temporary sediment basin, it is crucial that sediment is removed
- Sediment can clog the bioswale and inhibit proper drainage

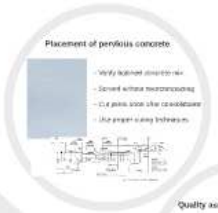
The soils must be non-compacted

- Promotes good root growth and biological organism development
- Important for water retention during dry periods
- Aids in filtering and infiltration
- Reiterate importance in project meetings

Select the proper native plants to provide year-round cover without need for supplemental irrigation

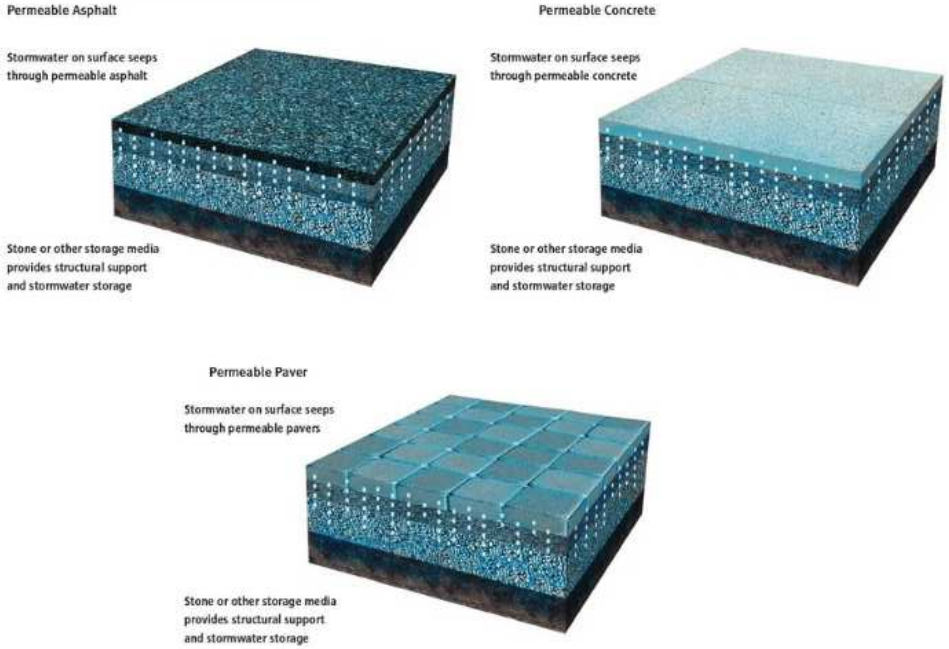


- Have an arborist or landscape architect onboard during the process to pick the variety of plants
- Quality assurance that plants are per plan
- Recognize in schedule when planting is to occur



What are permeable pavements?

Figure 2.5: Three-Dimensional View of Permeable Pavement



Philadelphia Green Streets Design Manual

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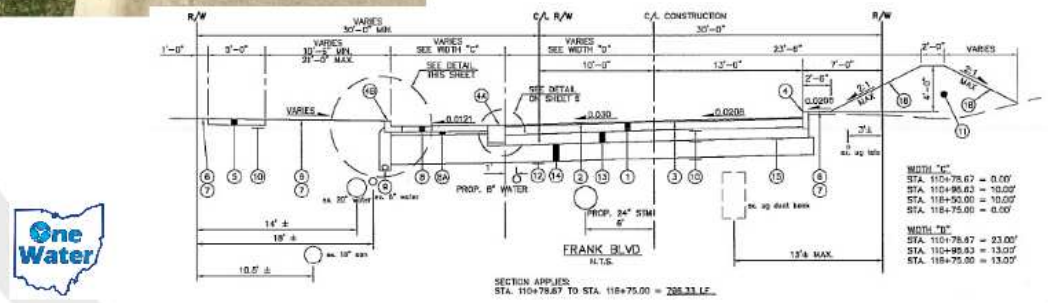
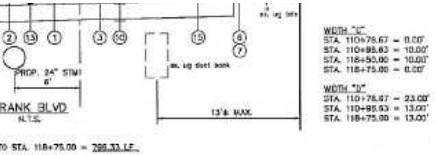
Placement of pervious concrete

- Verify batched concrete mix
- Screed without overcompacting
- Cut joints soon after consolidation
- Use proper curing techniques



from City of Akron, OH Frank Blvd project

Quality assurance



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Quality assurance during construction

- Ensure uniform subgrade for proper draining
- Prevent construction debris from clogging permeable pavement

Lessons learned from Akron, Ohio

- Technical representative from manufacturer on site
- Implement design features that aid in better results
- Use selectively in projects

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- Ensure success with sound construction management practices
- It has to be built right to work right

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