Creating Climate Resilient Green Infrastructure

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Green Infrastructure

Factors Affecting Performance After Design

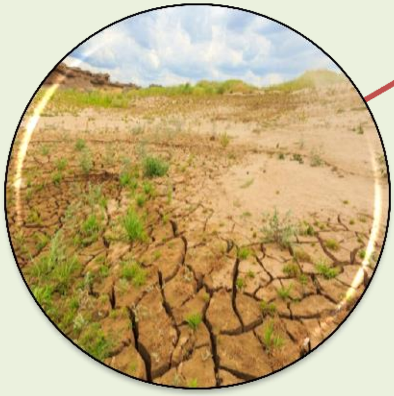
NE OHIO WINTER WEATHER

OWNER'S BUDGET

OWNER MAINTENANCE

STORMWATER CONTROL MEASURE

INVASIVE SPECIES



DRY WEATHER PERIODS

TRASH / ABUSE

INSTALLATION INTEGRITY


INSTALLATION INTEGRITY


INVASIVE SPECIES


REDUCED VOLUME CAPACITY


SNOW
LOADINGS
AND GRIT

Permeable Pavement Problems: Ground-in leaves and acorns

Clogged PICP

Bio&Ag ENGINEERING

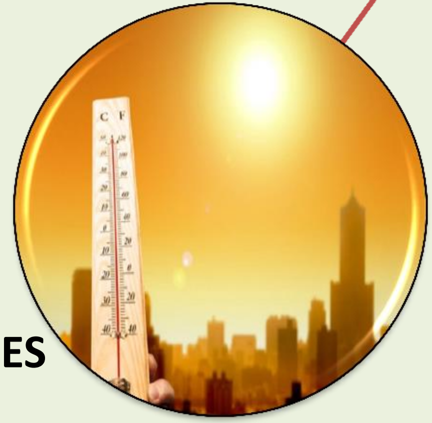
CLIMATE CHANGE AND FUTURE CITIES

INCREASING URBAN POPULATION

EXTENDED PERIODS OF DRY WEATHER

STORMWATER CONTROL MEASURES

GREATER URBAN IMPERVIOUS EFFECTS



INCREASED TEMPERATURES

GREATER INTENSITY STORM EVENTS

Can current designs handle the impacts of climate change?

How do we make Green Infrastructure Climate Resilient?

How do we ensure
DESIGN SERVICE LIFE?

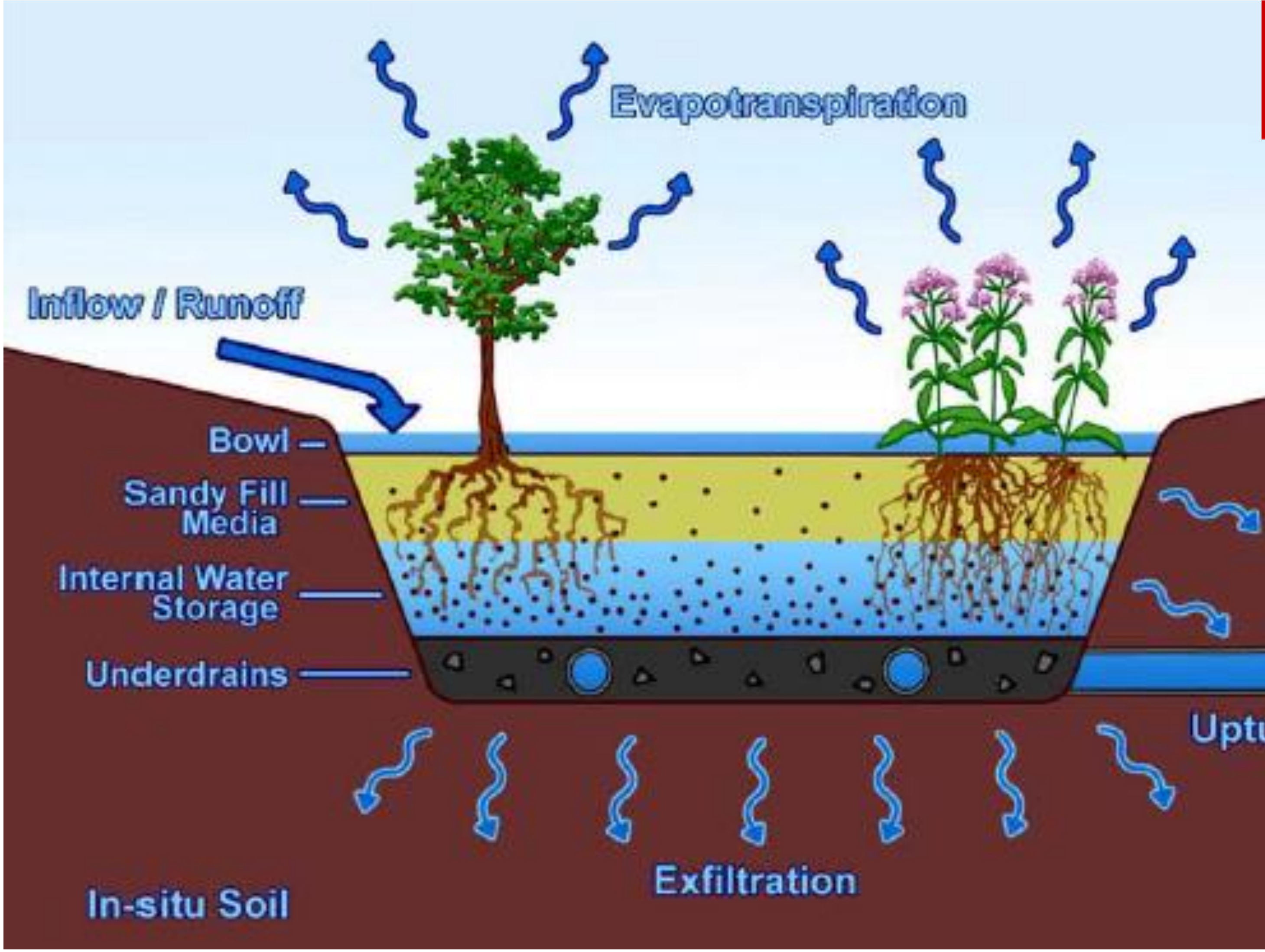
Bioretention: Design Components Affecting Performance

- Ksat (hydraulic conductivity)
- Soil media depth
- Internal Water Storage Zone
- Root depth
- Bowl storage depth
- Hydraulic Loading Ratio

Permeable Pavement: Design Components Affecting Performance

- Ksat (hydraulic conductivity)
- Aggregate depth
- Internal Water Storage Zone
- Hydraulic Loading Ratio

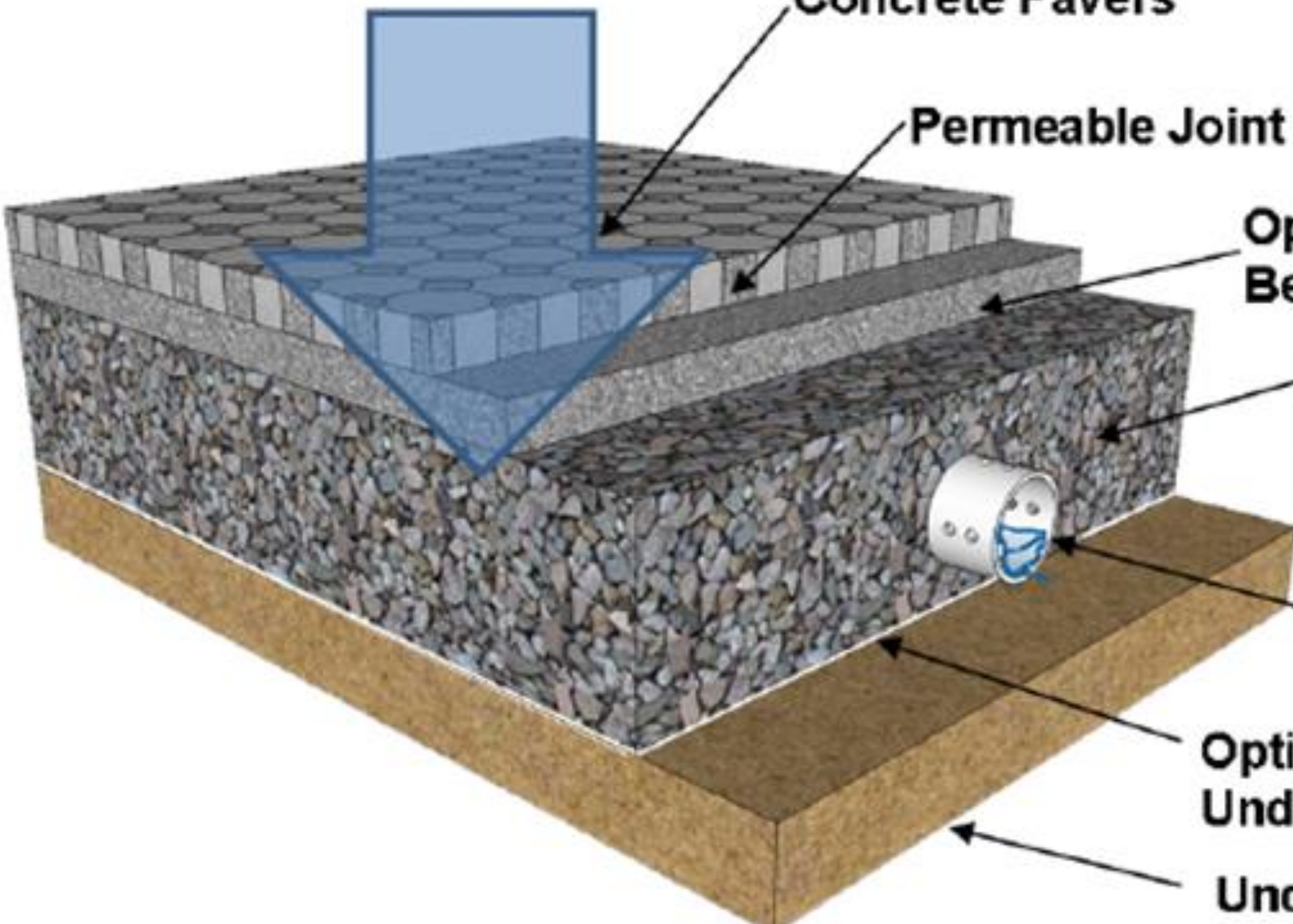
Reduce the Hydraulic Loading To the BMP



NC STATE UNIVERSITY

Retrofitting Existing Bioretention
Reducing the Internal Water Storage (IWS) Zone

Retrofitting Permeable Pavement
Increasing the Aggregate Depth



- Owner Education and Design Input
- Operation and Maintenance Education
- Understanding Real O&M Costs and Maintenance Requirements
- Winter / Snow Considerations
- Using Climate Modeling For Designs
- Performance Specifications

HOW DO WE ENSURE THE BMP ALWAYS MEETS ITS DESIGN INTENT?

VOLUME CAPTURE
HYDRAULIC DESIGN
WATER QUALITY

6.3—PREFABRICATED BURIED INFILTRATION STRUCTURES

DESCRIPTION: Prefabricated buried infiltration structures can be used to provide void space for water storage. These structures may be installed as stand-alone storage or in combination with bioretention basins, permeable pavements and other green infrastructure practices. Systems vary greatly by manufacturer, but generally can be open bottom arch shapes or rectangular shapes and made of plastic or concrete material. Systems should be designed to promote infiltration where underlying soils allow. This specification does not include solid wall storage structures such as pipes and box culverts. Buried infiltration structures are generally not considered injection wells if the length of the system exceeds the depth.

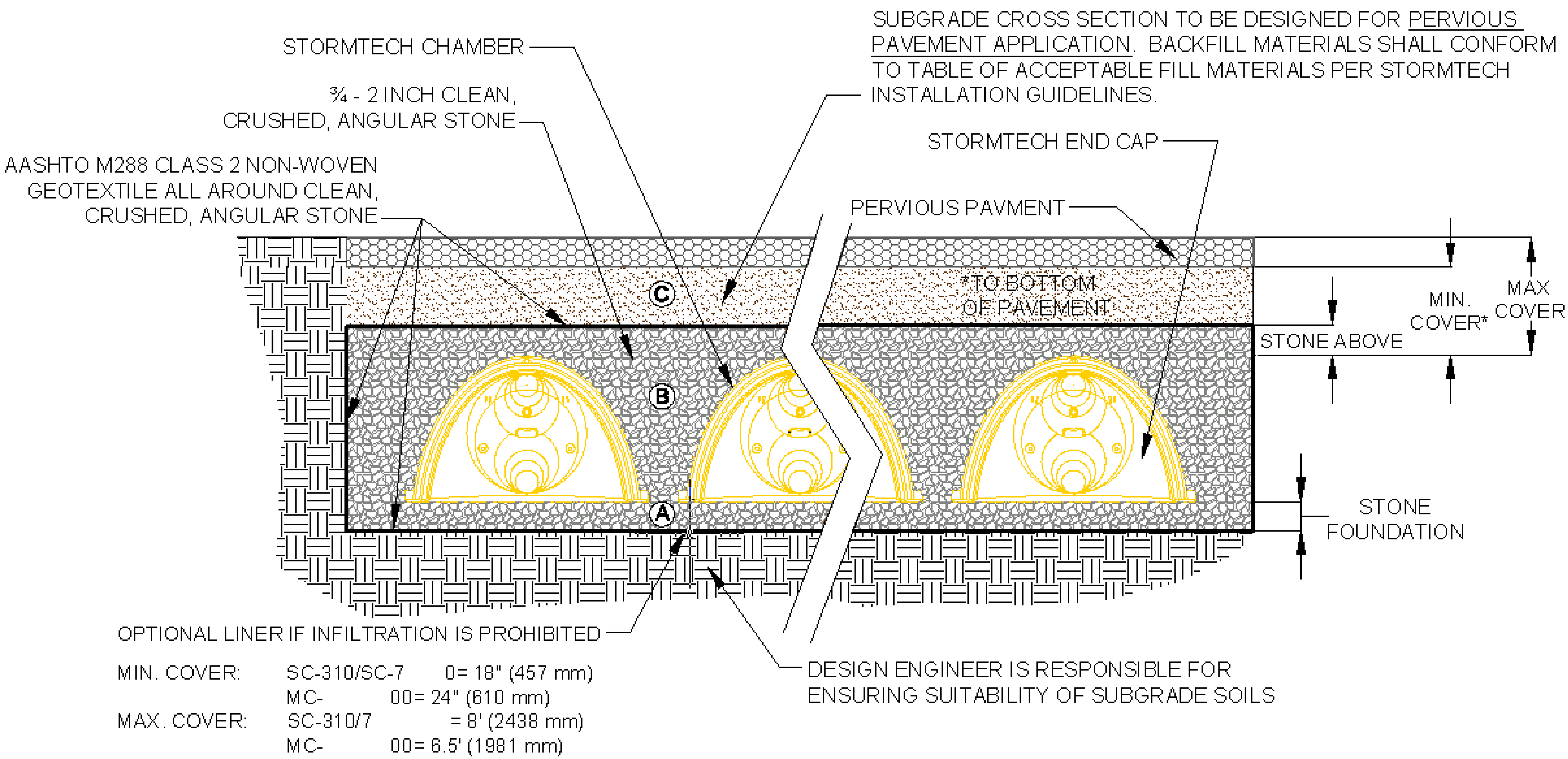
WHERE TO USE: May be applied in parking lots, parks or other private property settings with the permission of the property owner, but are not permitted for use within the ROW. Use for greater water storage capacity than can be provided by stone aggregate. Void space in prefabricated materials can often be greater than 90%. By comparison, the void space available in stone aggregate ranges from 30 to 40%. Can be used under permeable pavement as a mechanism to transfer water from the stone storage bed to an outlet structure and used in lieu of perforated underdrains. These types of systems have been approved by Ohio EPA as an alternative stand-alone BMP when standard BMPs are not feasible due to various constraints. Ohio EPA requires a proven pretreatment mechanism and maintenance plan to protect the long term function of the product.

Prefabricated Buried Infiltration Structures (Source: CDM Smith)

SPECIFICATIONS:

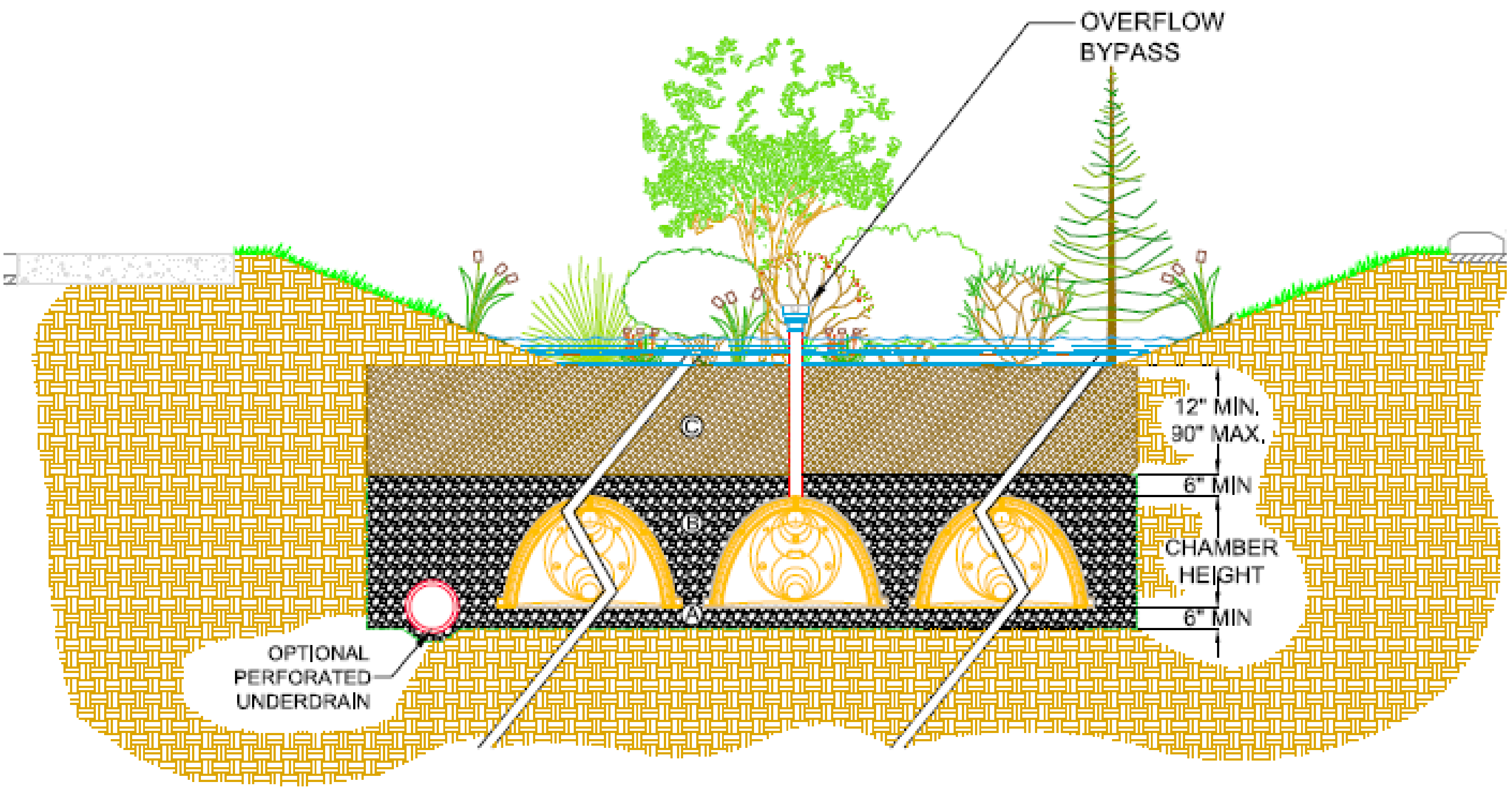
- Specifications and details related to materials, aggregate, geotextiles, sizing, installation and maintenance are manufacturer specific. Follow all manufacturer specifications, details and recommendations for use.
- Meet the ASTM requirements of F 2787, Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers
- Meet the ASTM requirements of F 2418 (polypropylene chambers) and F 2922 (polyethylene chambers) Meet the soil-structure interaction design standards of the AASHTO LRFD Bridge Design Specification, Section 3 and Section 12.

Permeable Pavements with Infiltration/Storage Chambers



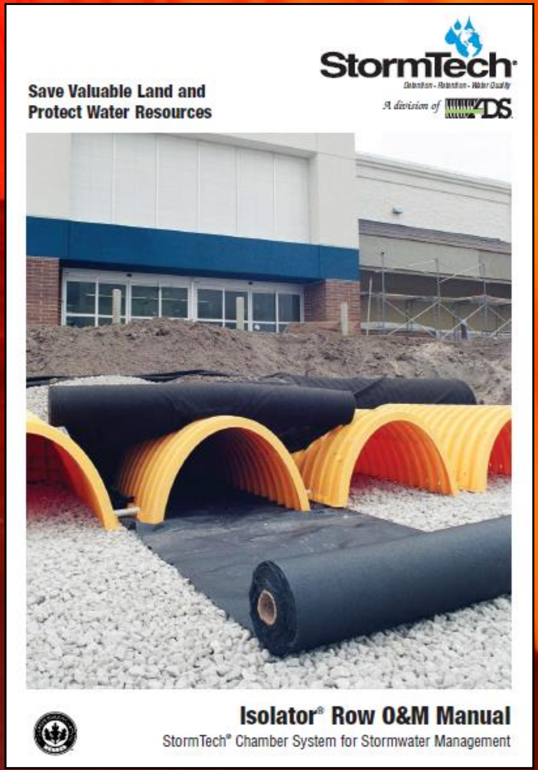
Permeable Pavements with Infiltration/Storage Chambers

Bioretention with Infiltration/Storage Chambers




BOWLING
CUE CLUB

ISOLATOR ROW
Water quality through filtration fabric



Water Quality with a Filtered Chamber Row

Parameter	Units	# of paired samples	Influent (median values)	Effluent (median values)	% Reduction	P-Value	Significant at 0.05
Ammonia Nitrogen	**mg/L**	**14**	**0.32**	**0.09**	**71.5%**	**0.0182**	**Y**
Nitrite + Nitrate	mg/L	14	0.28	0.35	0%	0.9713	N
TKN	**mg/L**	**13**	**1.10**	**0.45**	**59.5%**	**0.0001**	**Y**
Total Nitrogen	**mg/L**	**13**	**1.24**	**0.78**	**37.1%**	**0.0001**	**Y**
Total Phosphorus	**mg/L**	**14**	**0.19**	**0.06**	**68.1%**	**0.0001**	**Y**
SSC	**mg/L**	**13**	**98.0**	**5.90**	**94%**	**0.0017**	**Y**
TSS	**mg/L**	**14**	**54.0**	**5.60**	**89.6%**	**0.0001**	**Y**
Turbidity	**NTU**	**13**	**18.0**	**6.85**	**61.9%**	**0.0001**	**Y**
Chromium	ug/L	14	2.11	*	*	*	*
Copper	ug/L	14	10.20	9.50	0%	0.6047	N
Lead	ug/L	14	1.55	*	*	*	*
Zinc	**ug/L**	**14**	**54.50**	**13.0**	**76.1%**	**0.0001**	**Y**

* Data set contained too many non-detect values to accurately calculate summary statistics or provide statistical analysis

Figure 6: Cherry Gardens Apartments – Storm Tech Chambers - Data Analysis Results

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