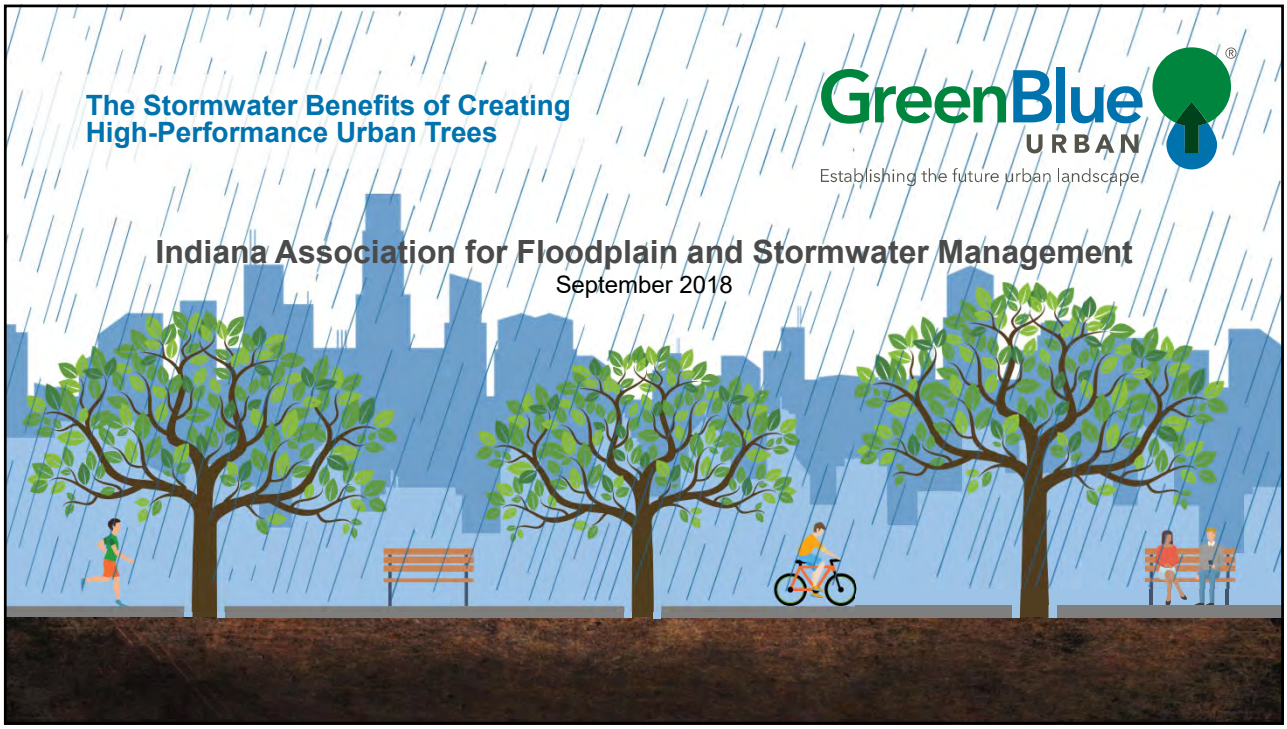
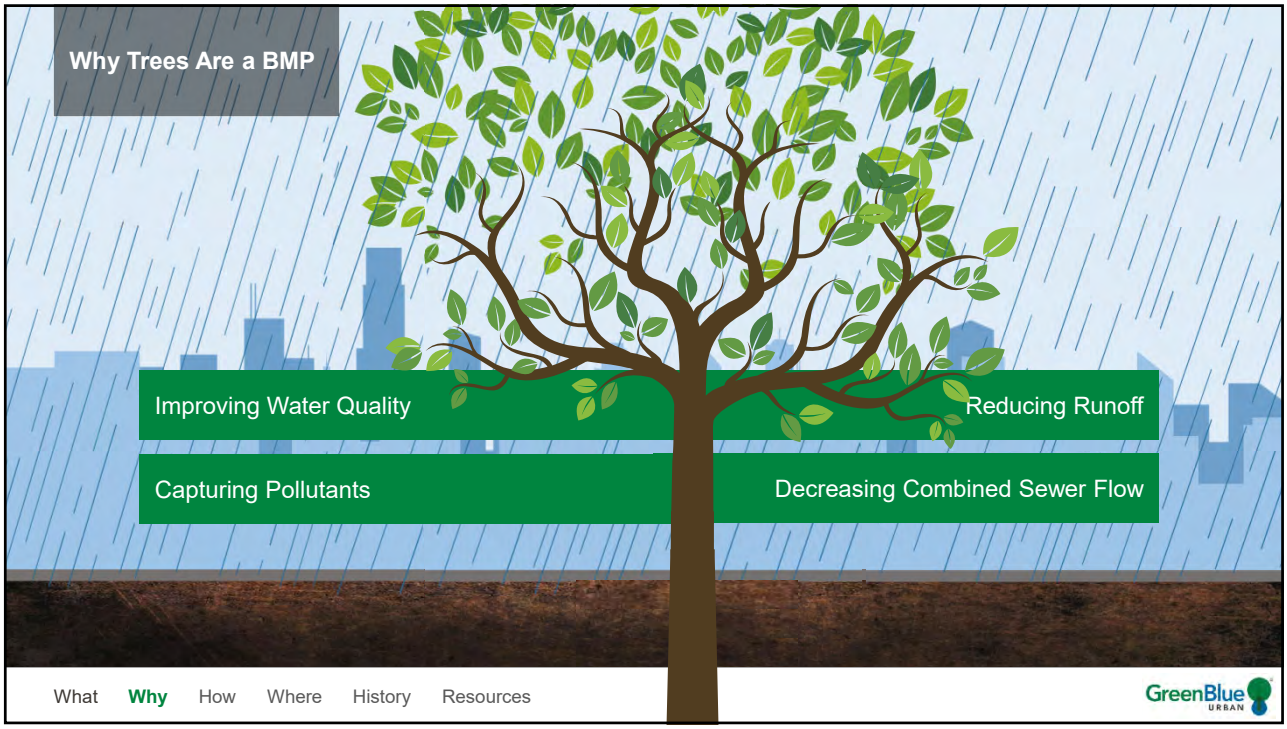
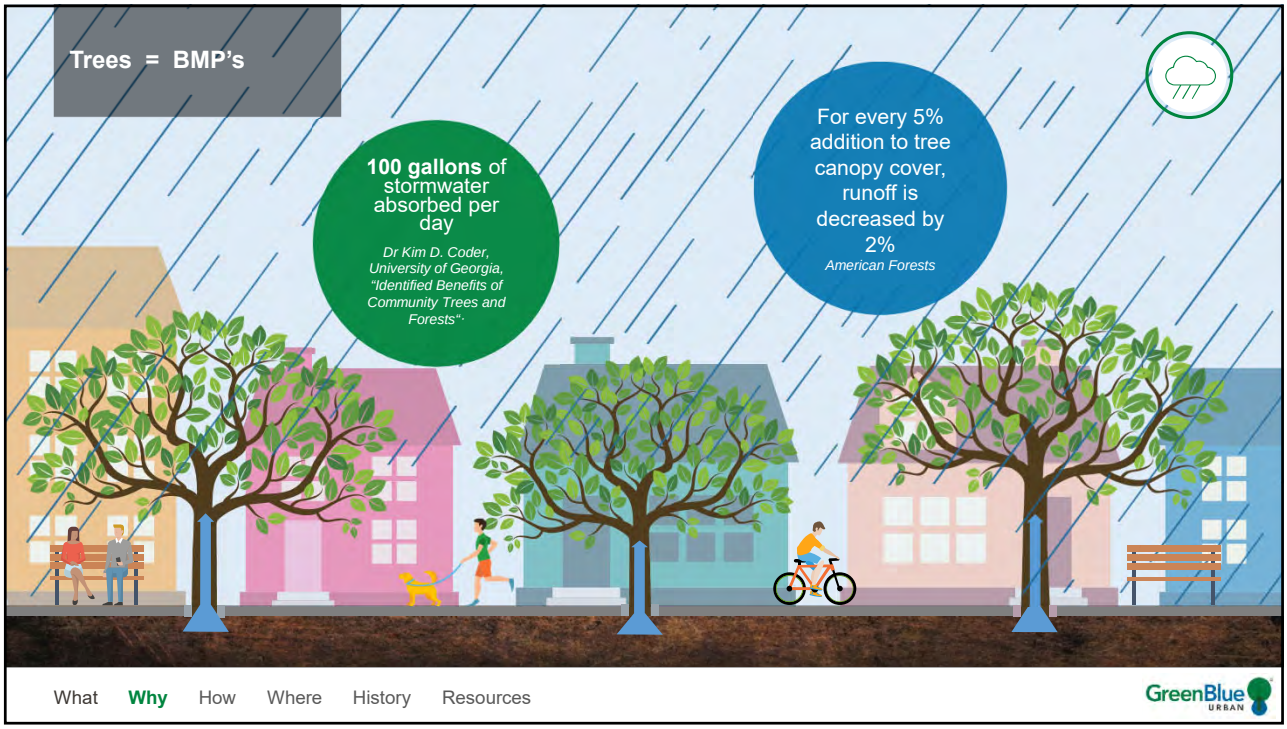
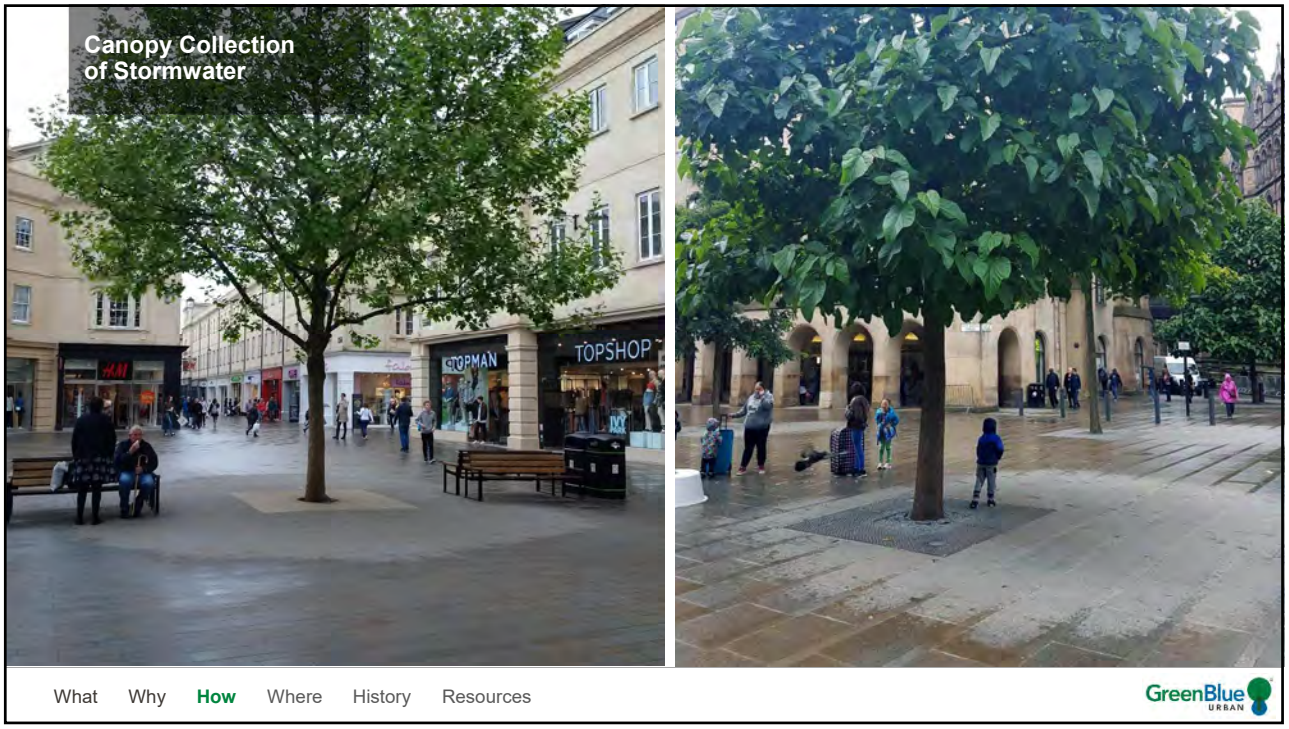

The Stormwater Benefits of Creating
High-Performance Urban Trees
GreenBlue
URBAN
Establishing the future urban landscape
Indiana Association for Floodplain and Stormwater Management
September 2018


Why Trees Are a BMP
Improving Water Quality
Reducing Runoff
Capturing Pollutants
Decreasing Combined Sewer Flow
What
Why
How
Where
History
Resources
GreenBlue
URBAN

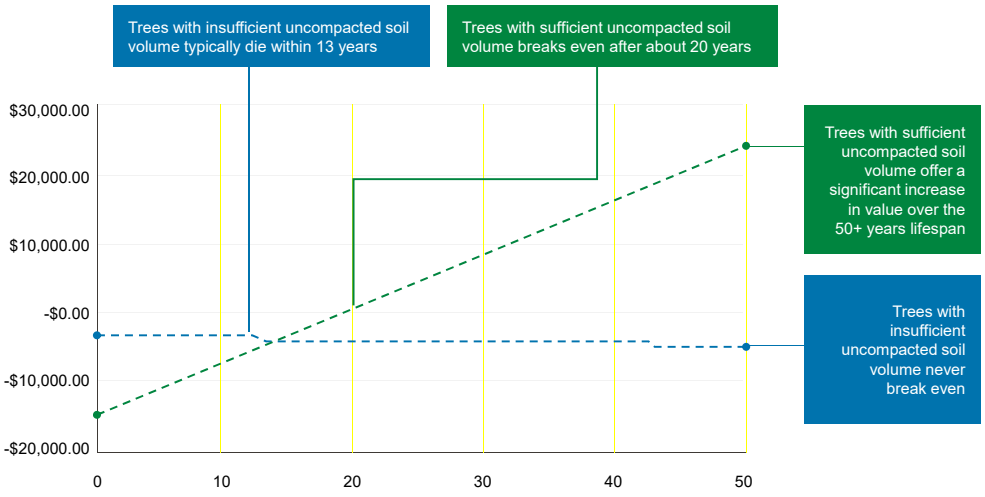

Trees = BMP's
100 gallons of stormwater absorbed per day
Dr Kim D. Coder, University of Georgia, "Identified Benefits of Community Trees and Forests"·
For every 5% addition to tree canopy cover, runoff is decreased by 2%
American Forests
What Why How Where History Resources
GreenBlue URBAN


Canopy Collection of Stormwater
TOPSHOP
What Why How Where History Resources
GreenBlue URBAN

The ROI of High-Performance Urban Trees

Tree with insufficient uncompacted soil volume

Tree with sufficient uncompacted soil volume



What Why How Where History Resources

GreenBlue URBAN

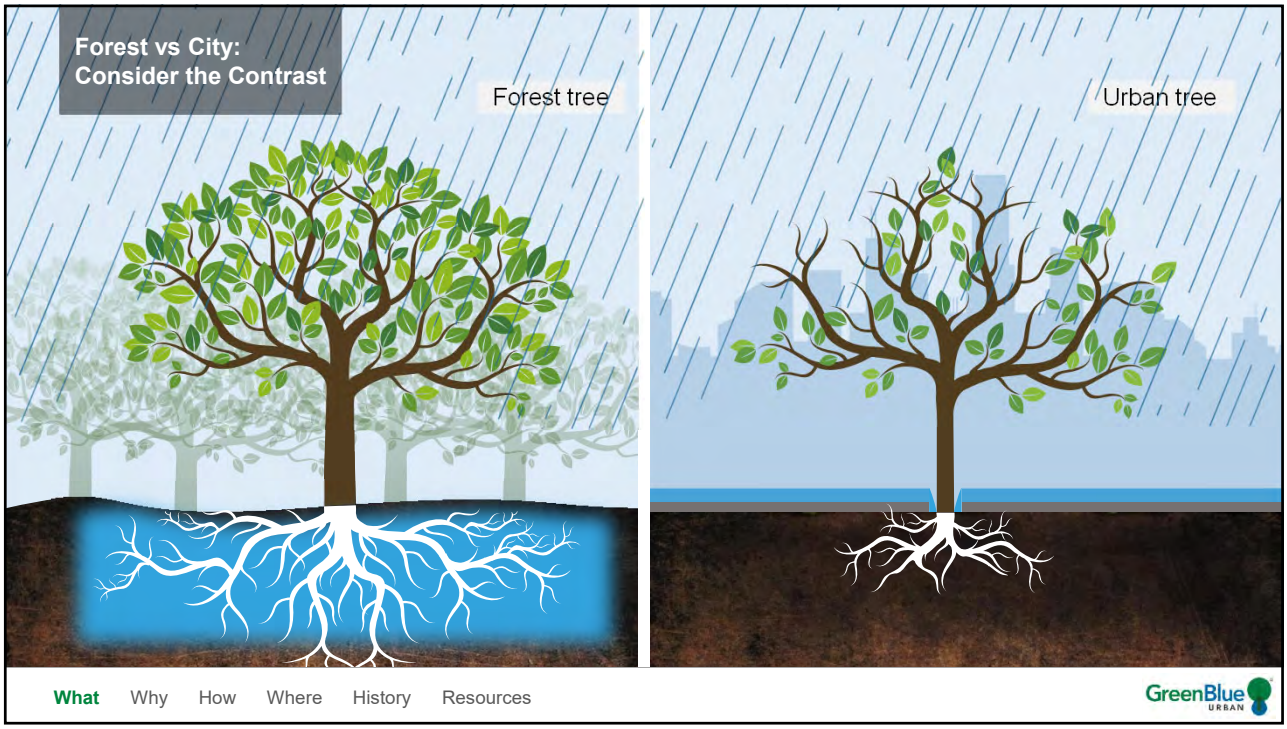
More Roots Mean More Stormwater Management

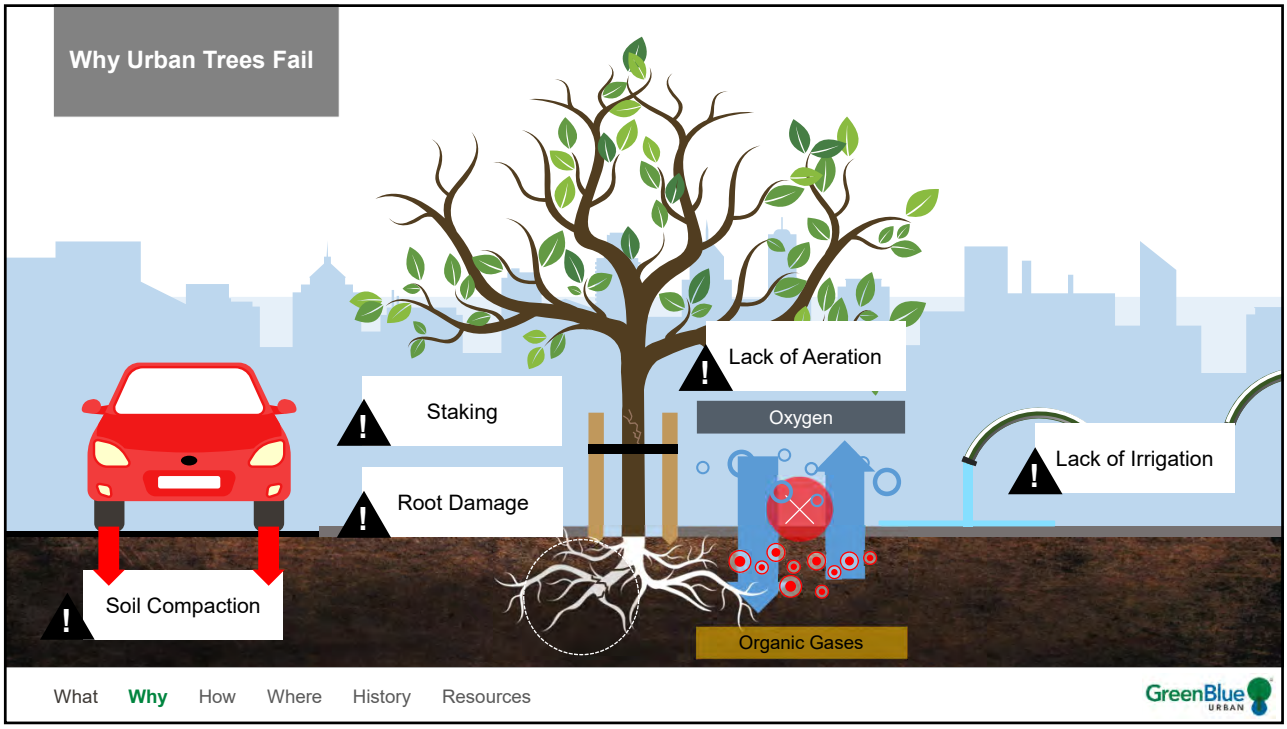
GreenBlue URBAN

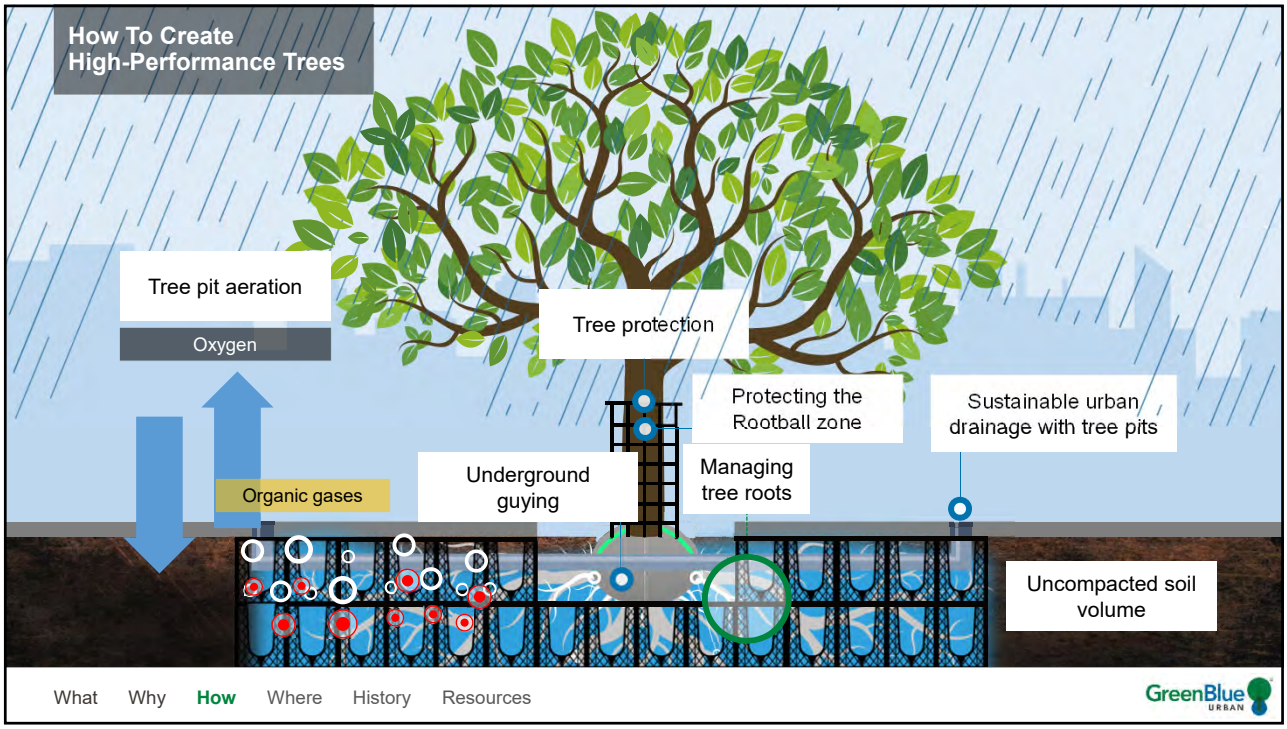
More Roots Mean More Stormwater Management

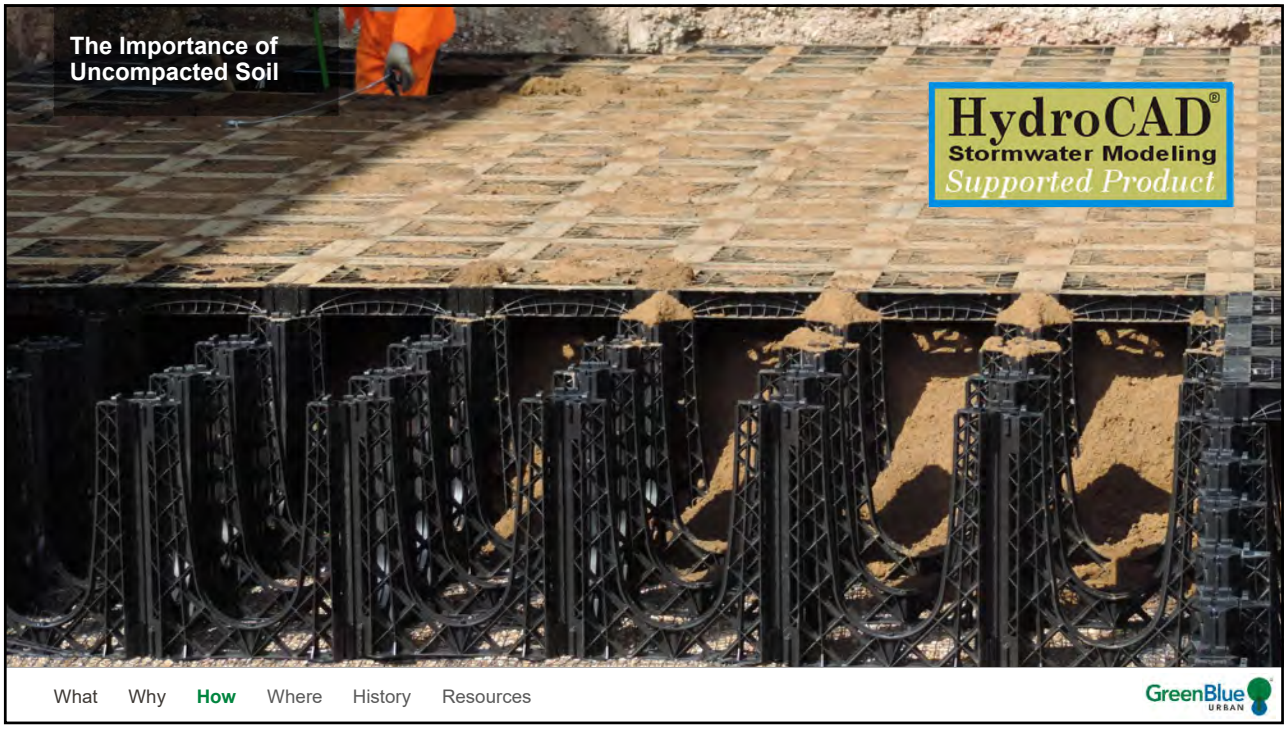
What Why How Where History Resources

GreenBlue URBAN

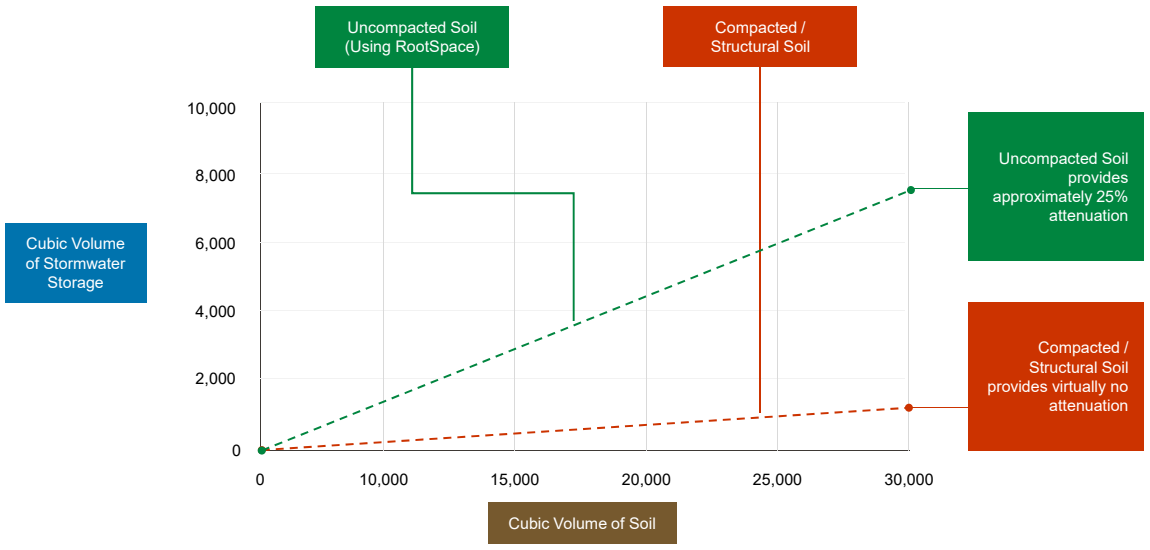

Forest vs City:
Consider the Contrast
Forest tree
Urban tree
What
Why
How
Where
History
Resources
GreenBlue
URBAN


Why Urban Trees Fail
Lack of Aeration
Oxygen
Staking
Root Damage
Lack of Irrigation
Soil Compaction
Organic Gases
What
Why
How
Where
History
Resources
GreenBlue
URBAN


How To Create
High-Performance Trees
Tree pit aeration
Oxygen
Organic gases
Tree protection
Protecting the
Rootball zone
Underground
guying
Managing
tree roots
Sustainable urban
drainage with tree pits
Uncompacted soil
volume
What
Why
How
Where
History
Resources
GreenBlue
URBAN


The Importance of
Uncompacted Soil
HydroCAD®
Stormwater Modeling
Supported Product
What
Why
How
Where
History
Resources
GreenBlue
URBAN

Stormwater Storage in Soil Volumes

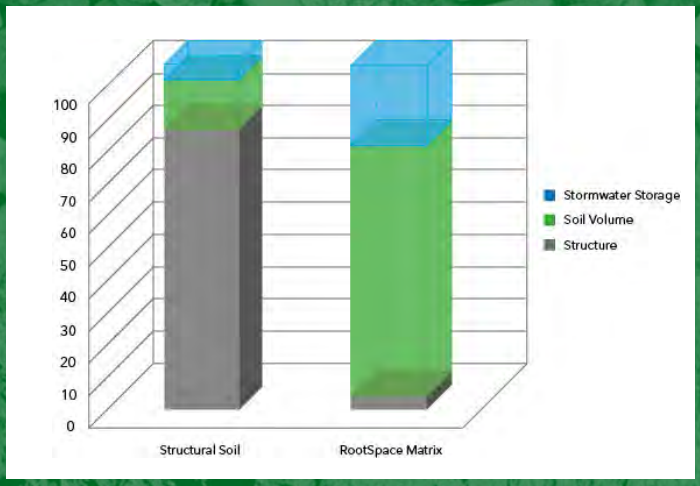


GreenBlue URBAN

Uncompacted Soil: Structural Soil vs Soil Cells

GreenBlue URBAN

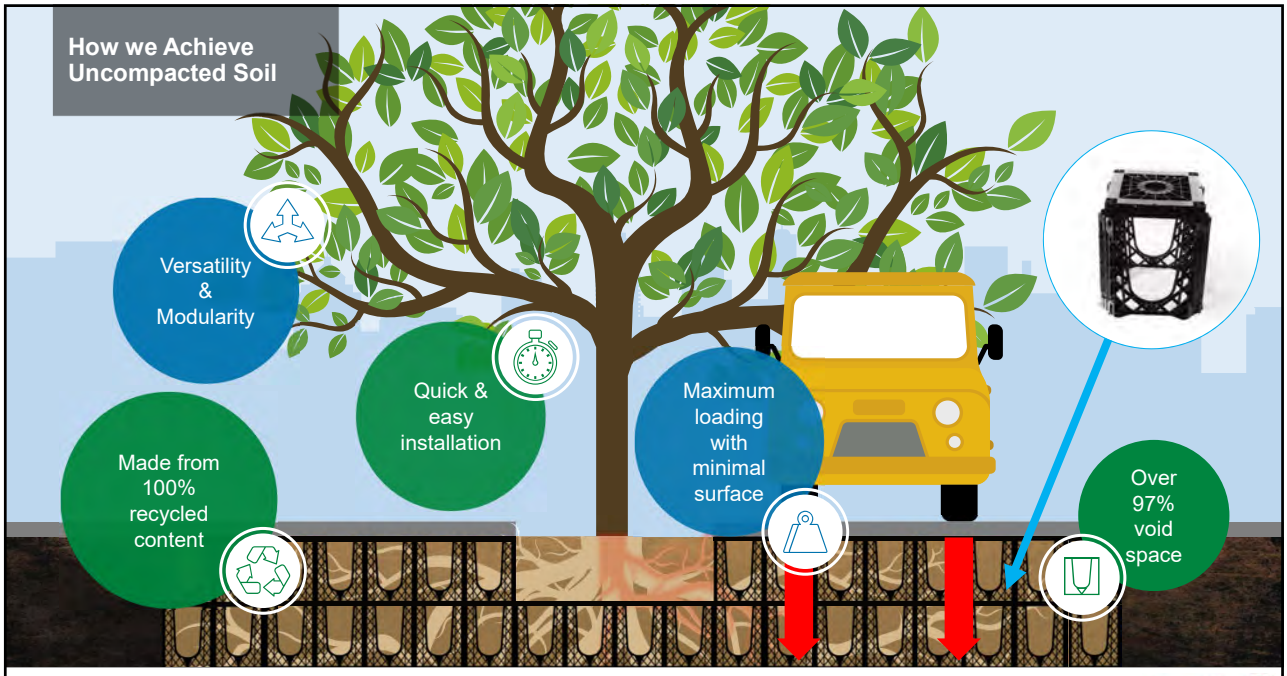
Uncompacted Soil: Structural Soil vs Soil Cells



What Why **How** Where History Resources

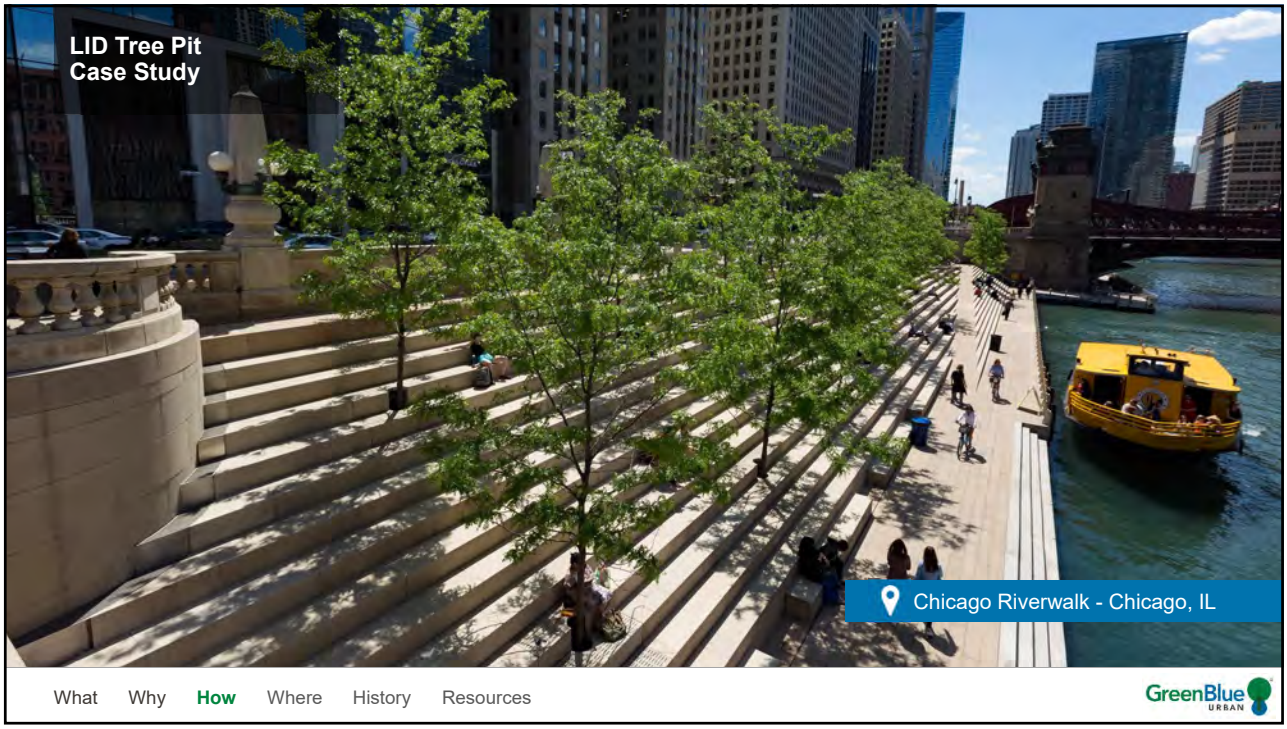
GreenBlue URBAN

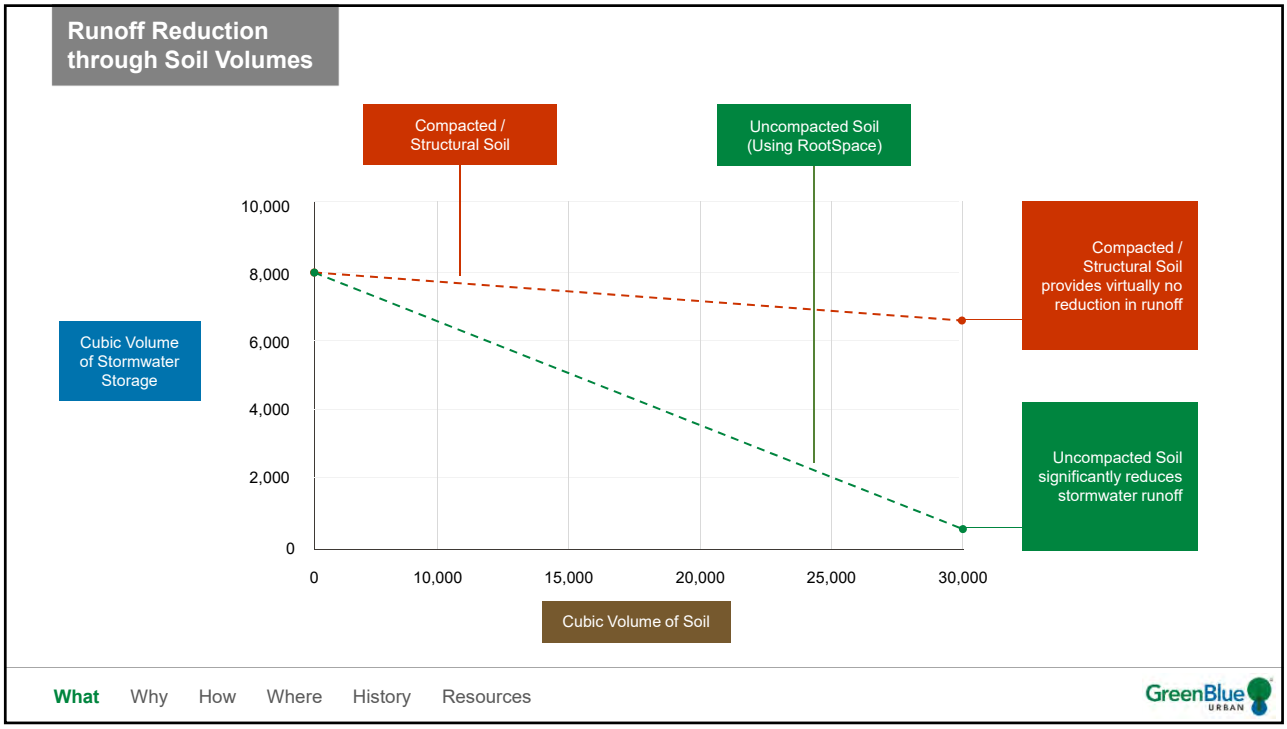
How we Achieve Uncompacted Soil

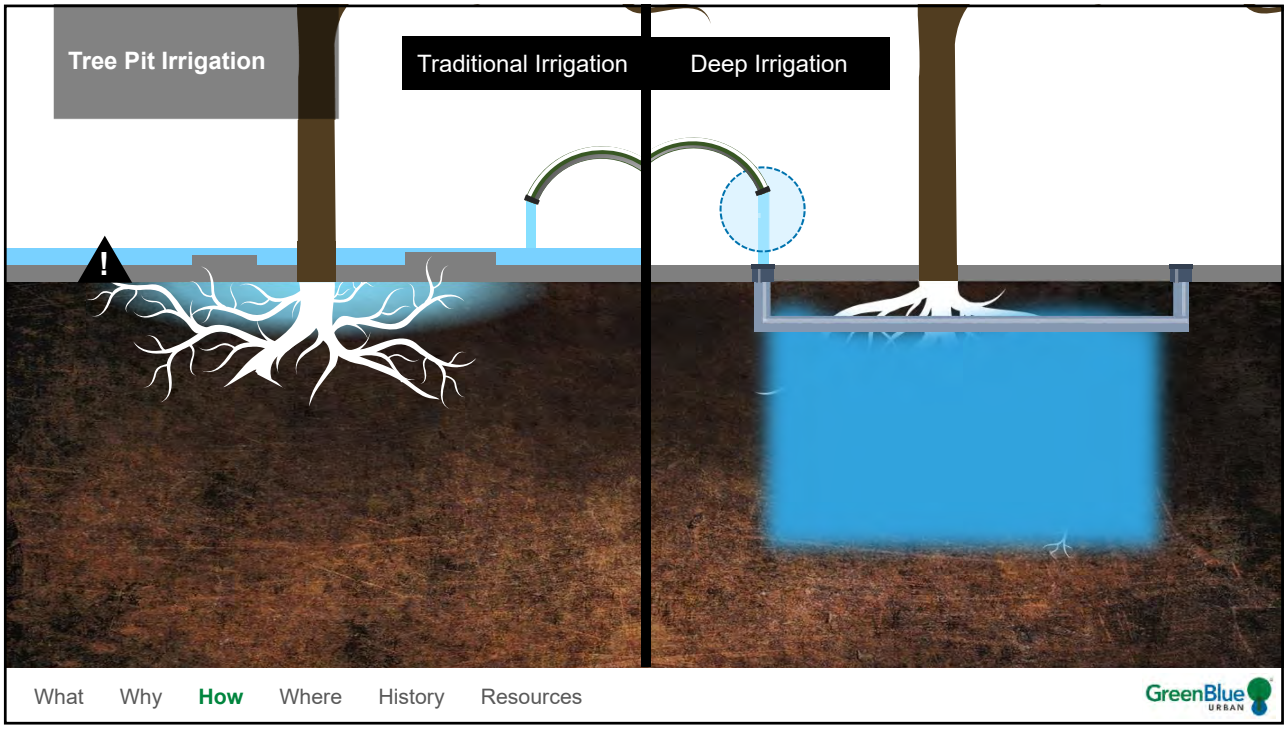


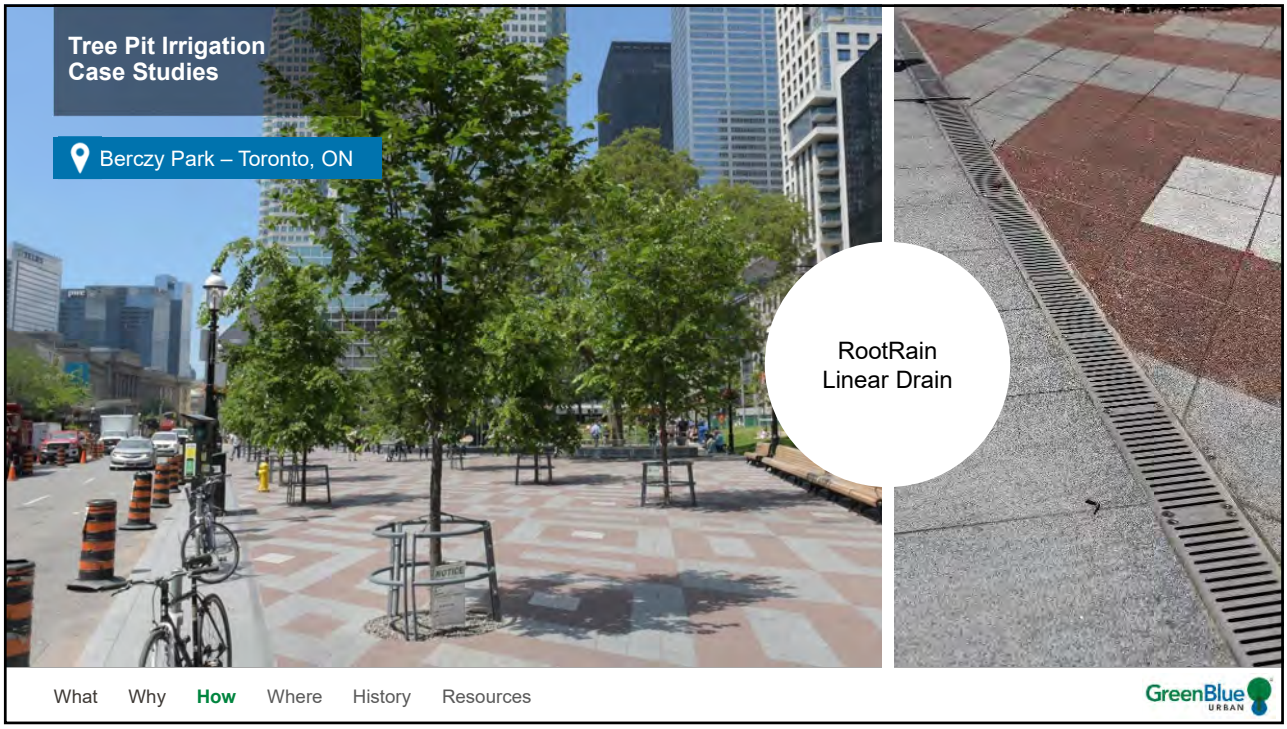
What Why **How** Where History Resources

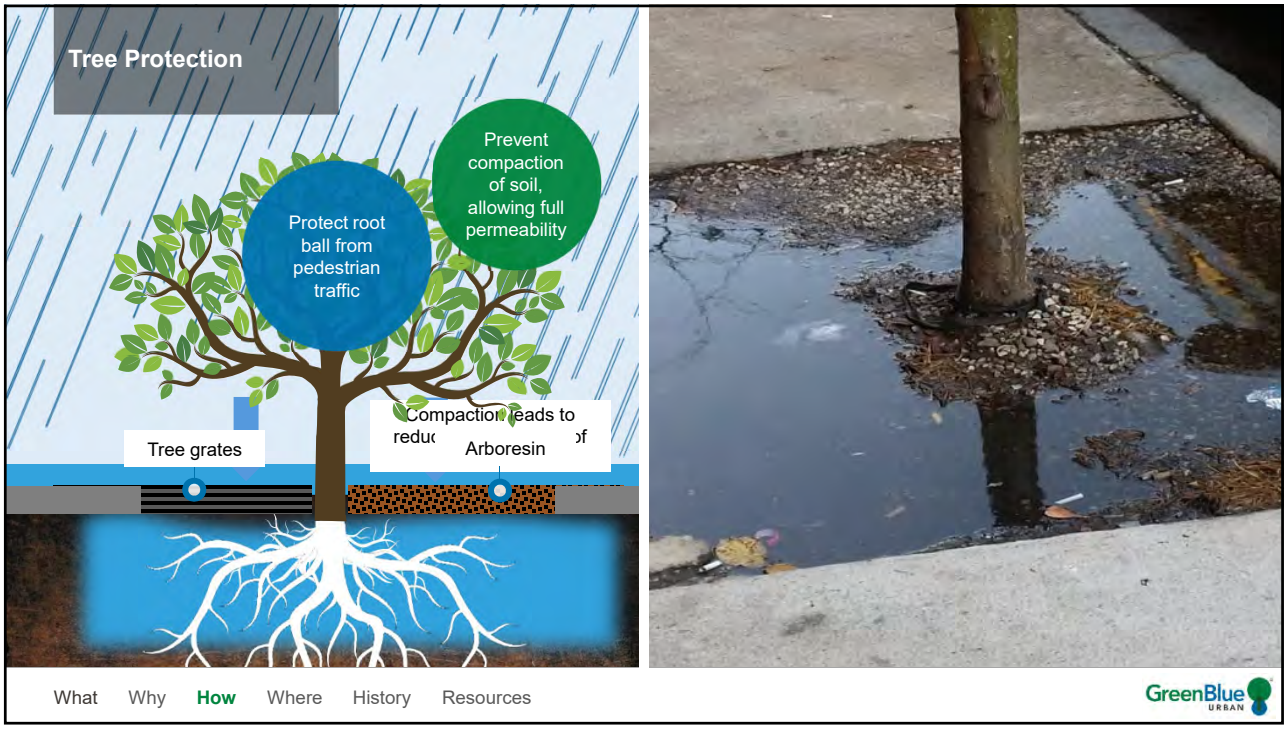
GreenBlue URBAN

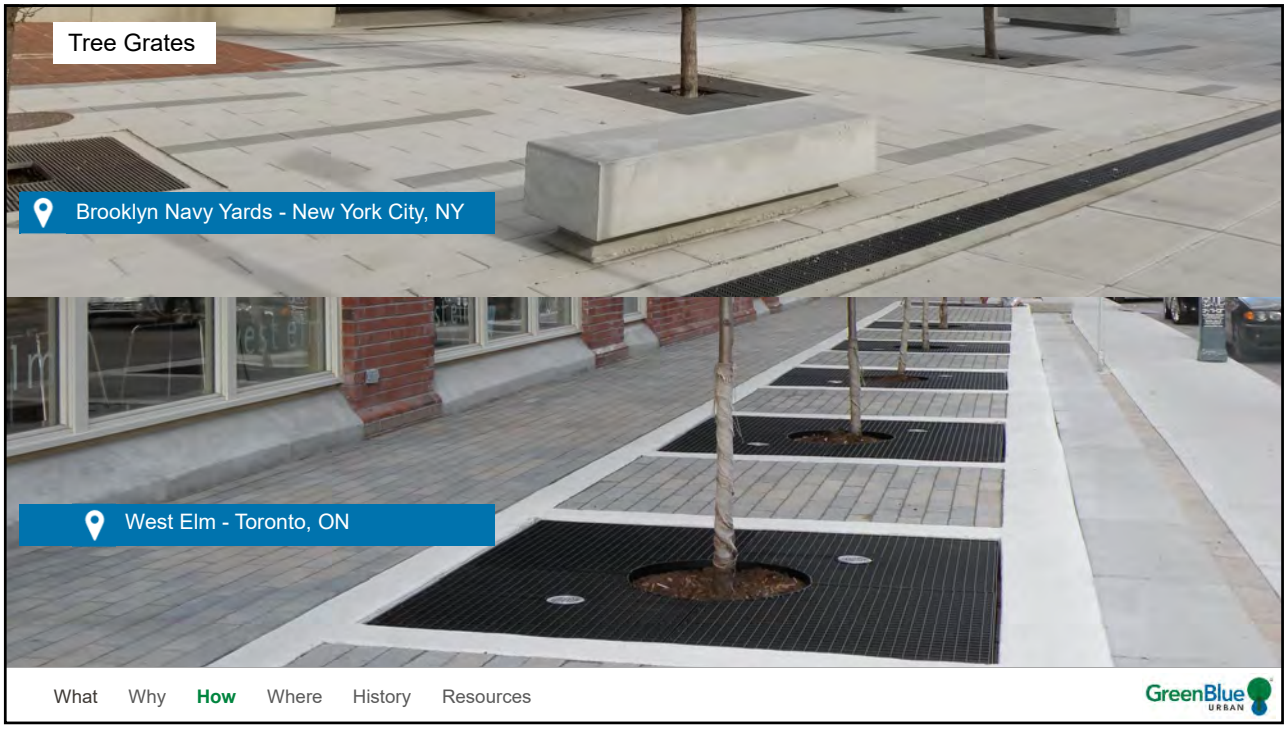

LID Tree Pit
Case Study
Chicago Riverwalk - Chicago, IL
What Why How Where History Resources
GreenBlue URBAN


Runoff Reduction through Soil Volumes
Compacted / Structural Soil
Uncompacted Soil (Using RootSpace)
Cubic Volume of Stormwater Storage
10,000
8,000
6,000
4,000
2,000
0
0
10,000
15,000
20,000
25,000
30,000
Cubic Volume of Soil
Compacted / Structural Soil provides virtually no reduction in runoff
Uncompacted Soil significantly reduces stormwater runoff
What Why How Where History Resources
GreenBlue URBAN

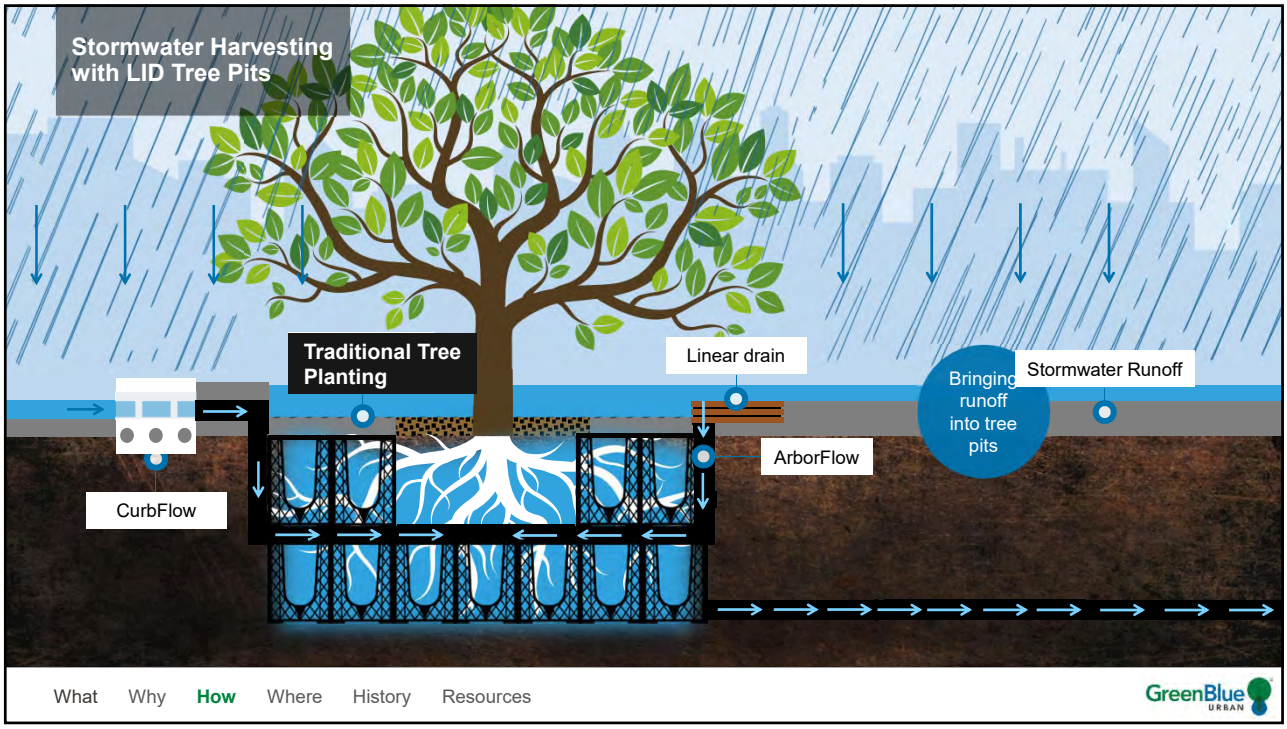

Tree Pit Irrigation
Traditional Irrigation
Deep Irrigation
!
What
Why
How
Where
History
Resources
GreenBlue URBAN


Tree Pit Irrigation Case Studies
Berczy Park – Toronto, ON
RootRain Linear Drain
What
Why
How
Where
History
Resources
GreenBlue URBAN


Tree Protection
Prevent compaction of soil, allowing full permeability
Protect root ball from pedestrian traffic
Tree grates
Arboresin
What Why How Where History Resources
GreenBlue URBAN


Tree Grates
Brooklyn Navy Yards - New York City, NY
West Elm - Toronto, ON
What Why How Where History Resources
GreenBlue URBAN


Stormwater Harvesting
with LID Tree Pits


Stormwater Harvesting
with LID Tree Pits
Traditional Tree Planting
Linear drain
Bringing runoff into tree pits
Stormwater Runoff
ArborFlow
CurbFlow
What
Why
How
Where
History
Resources
GreenBlue URBAN

ArborFlow Test Plot

GreenBlue URBAN

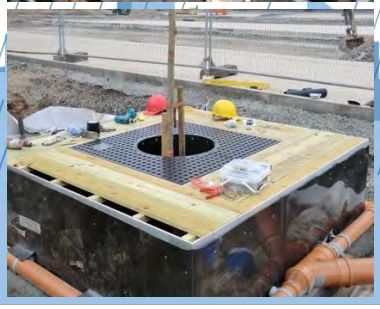
ArborFlow Test Plot

GreenBlue URBAN

ArborFlow Test Plot







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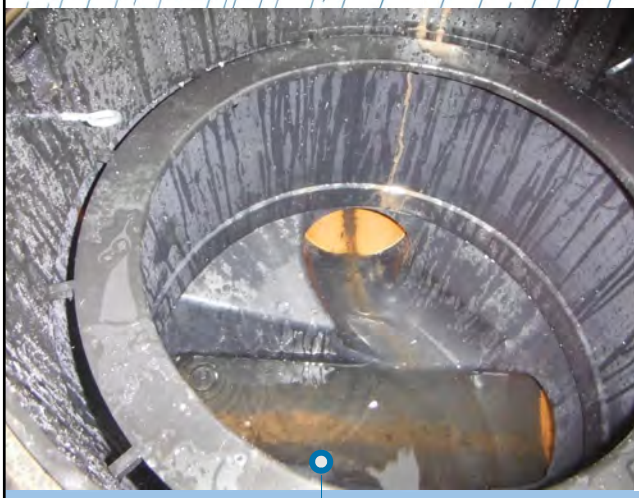
ArborFlow Test Plot

GreenBlue URBAN

ArborFlow Test Plot

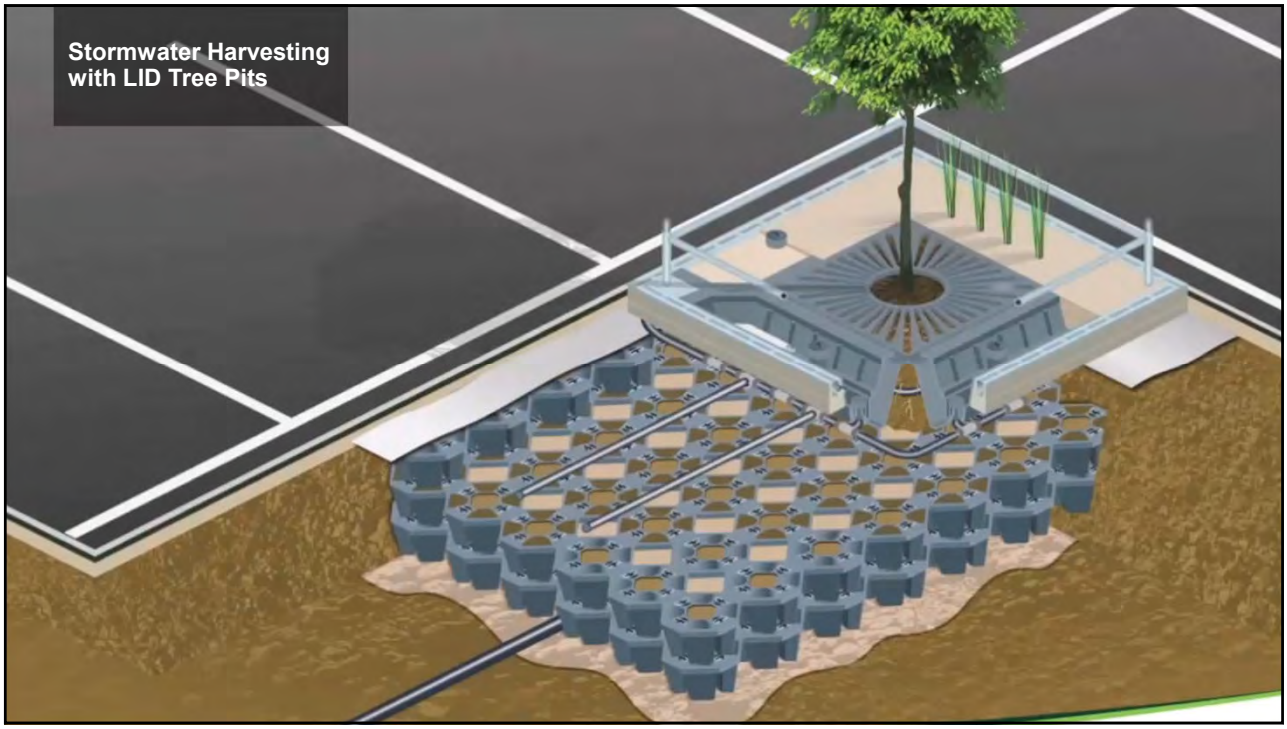


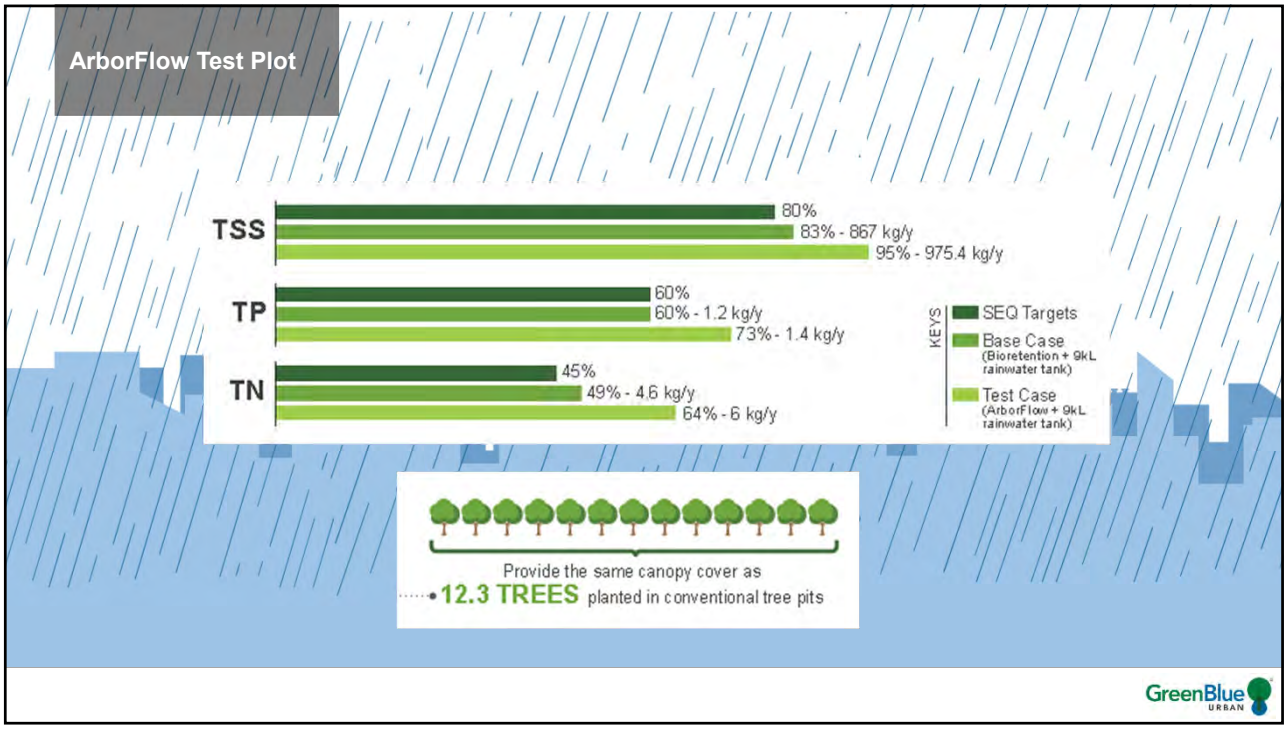
Inlet – showing water flowing into the system from linear drain

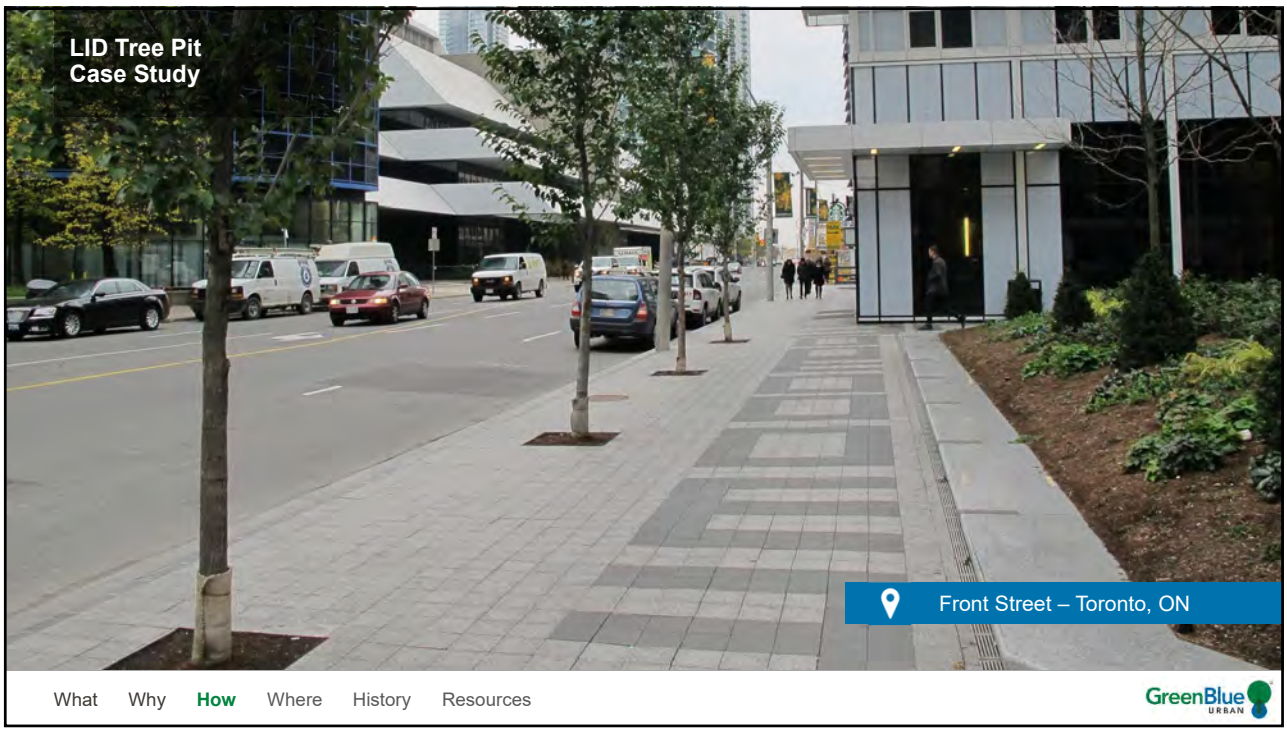
Outlet – showing no water leaving system after 2 hours of rain fall, demonstrating attenuation in action. Some post installation debris visible.

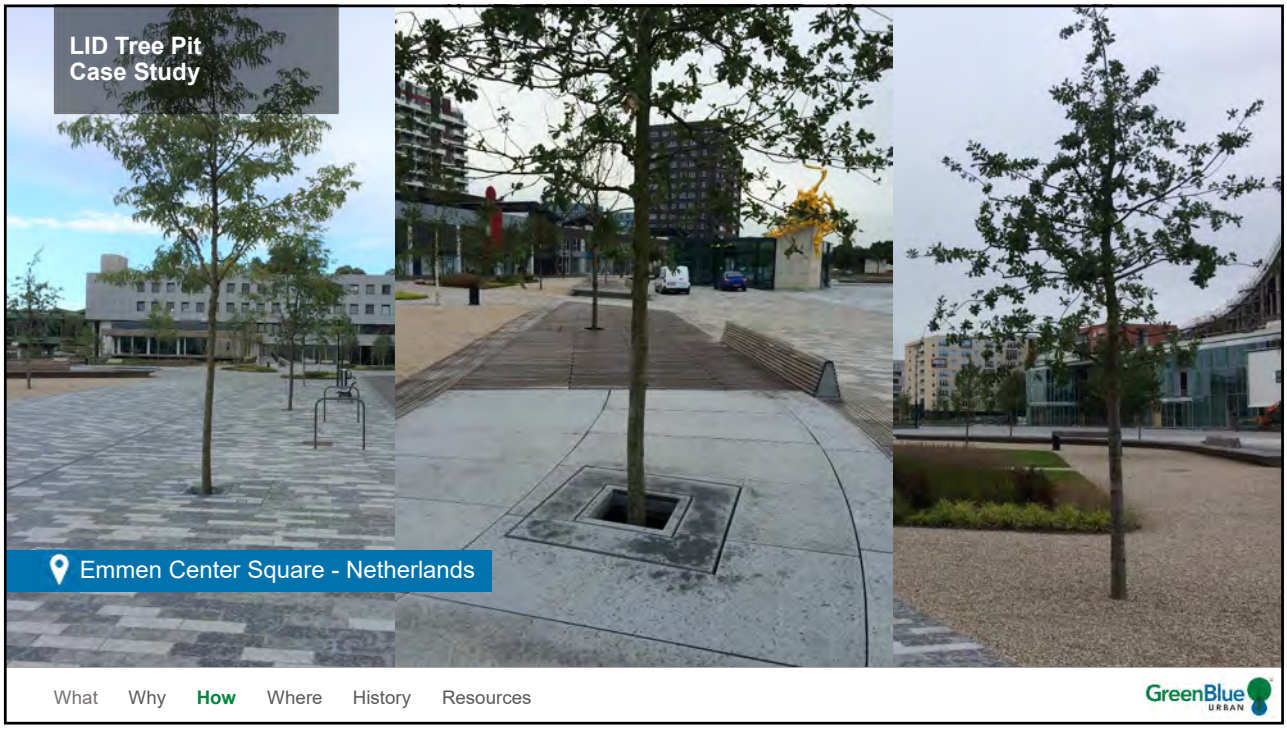
GreenBlue URBAN

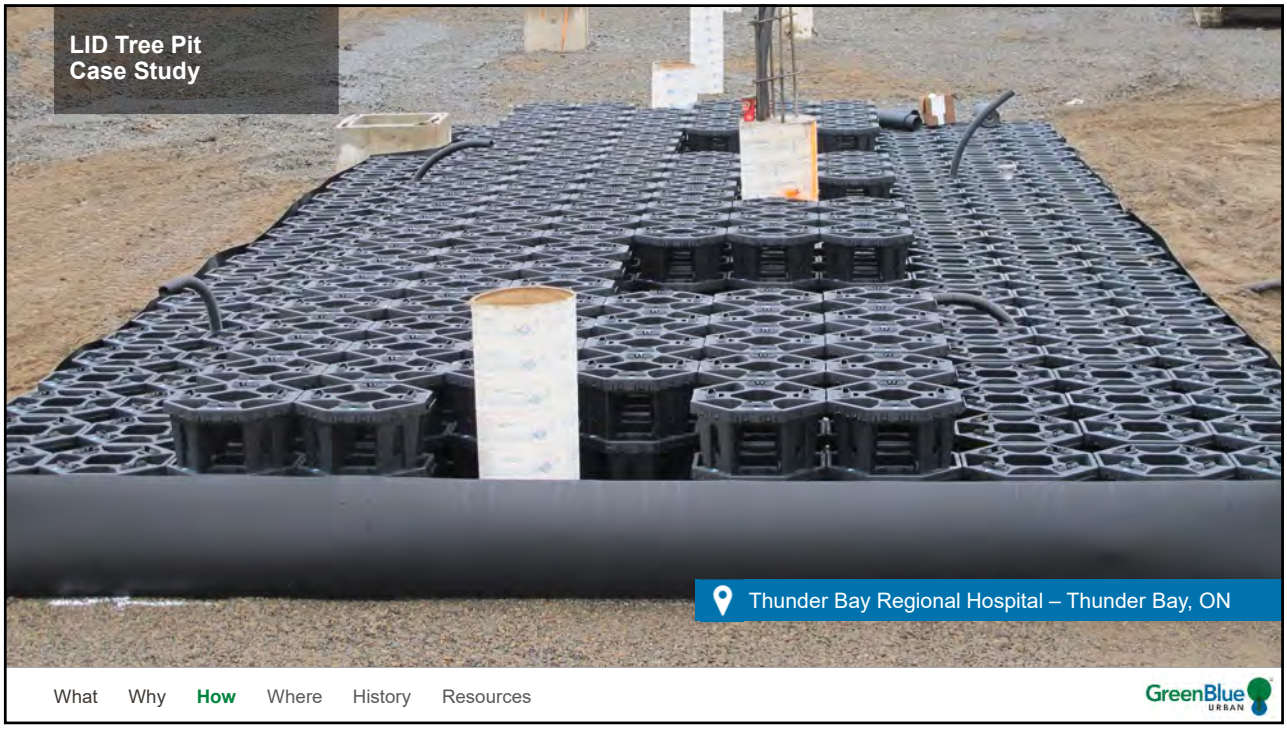
Stormwater Harvesting with LID Tree Pits

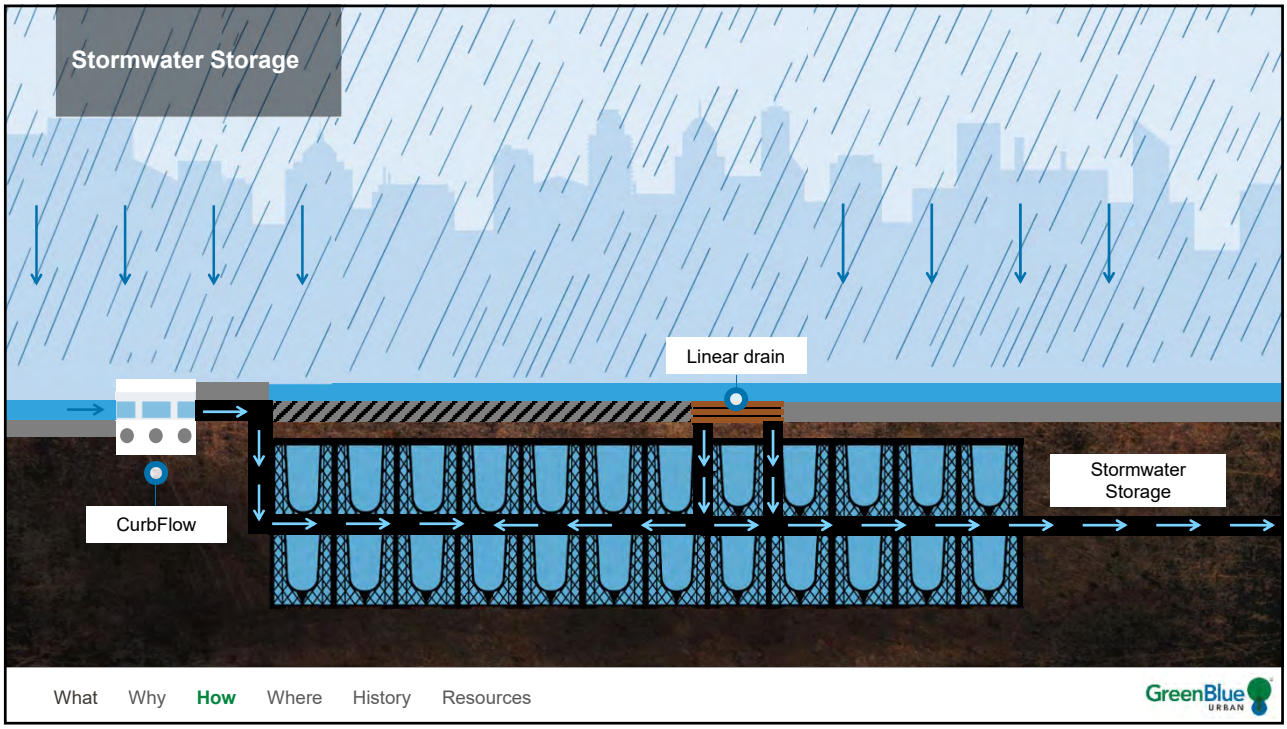



ArborFlow Test Plot
TSS
80%
83% - 867 kg/y
95% - 975.4 kg/y
TP
60%
60% - 1.2 kg/y
73% - 1.4 kg/y
TN
45%
49% - 4.6 kg/y
64% - 6 kg/y
KEYS
SEQ Targets
Base Case
(Bioretention + 9kL rainwater tank)
Test Case
(ArborFlow + 9kL rainwater tank)
Provide the same canopy cover as
12.3 TREES planted in conventional tree pits
GreenBlue URBAN


LID Tree Pit
Case Study
Front Street – Toronto, ON
What
Why
How
Where
History
Resources
GreenBlue URBAN

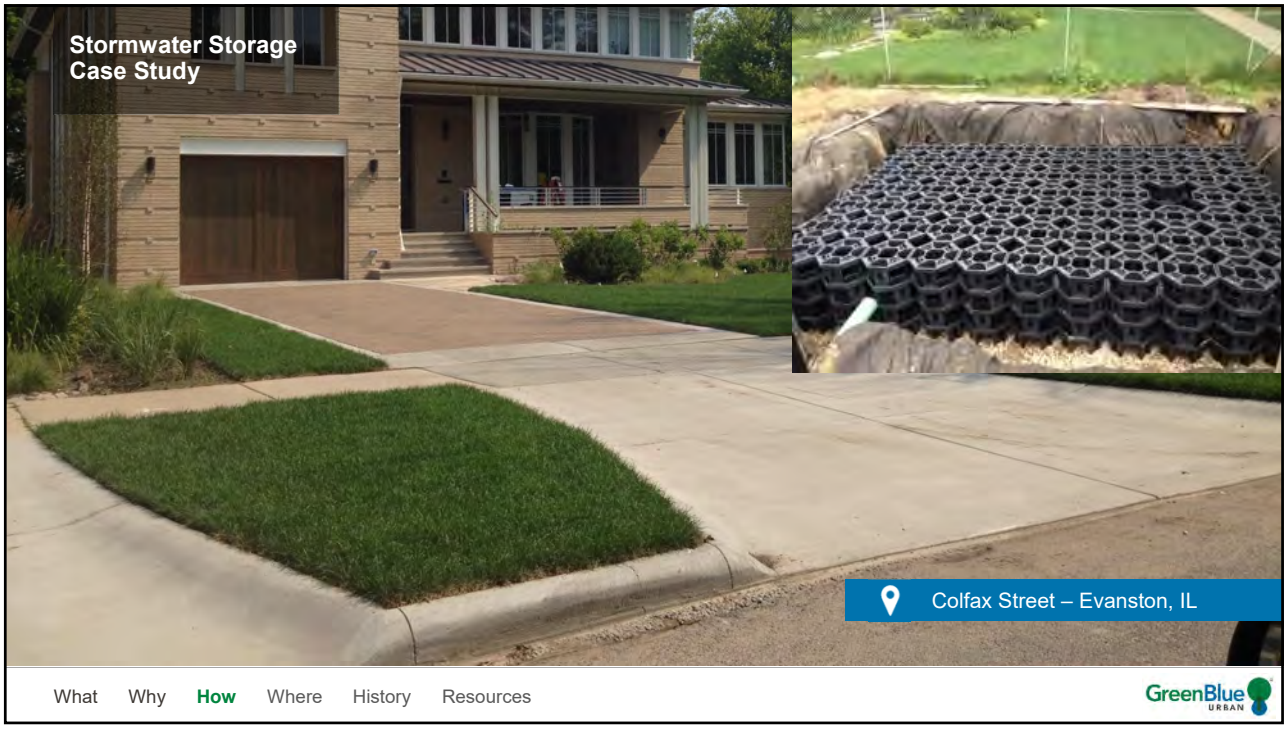

LID Tree Pit
Case Study
Emmen Center Square - Netherlands
What Why How Where History Resources
GreenBlue URBAN


LID Tree Pit
Case Study
Thunder Bay Regional Hospital – Thunder Bay, ON
What Why How Where History Resources
GreenBlue URBAN


Stormwater Storage
Linear drain
CurbFlow
Stormwater Storage
What
Why
How
Where
History
Resources
GreenBlue URBAN

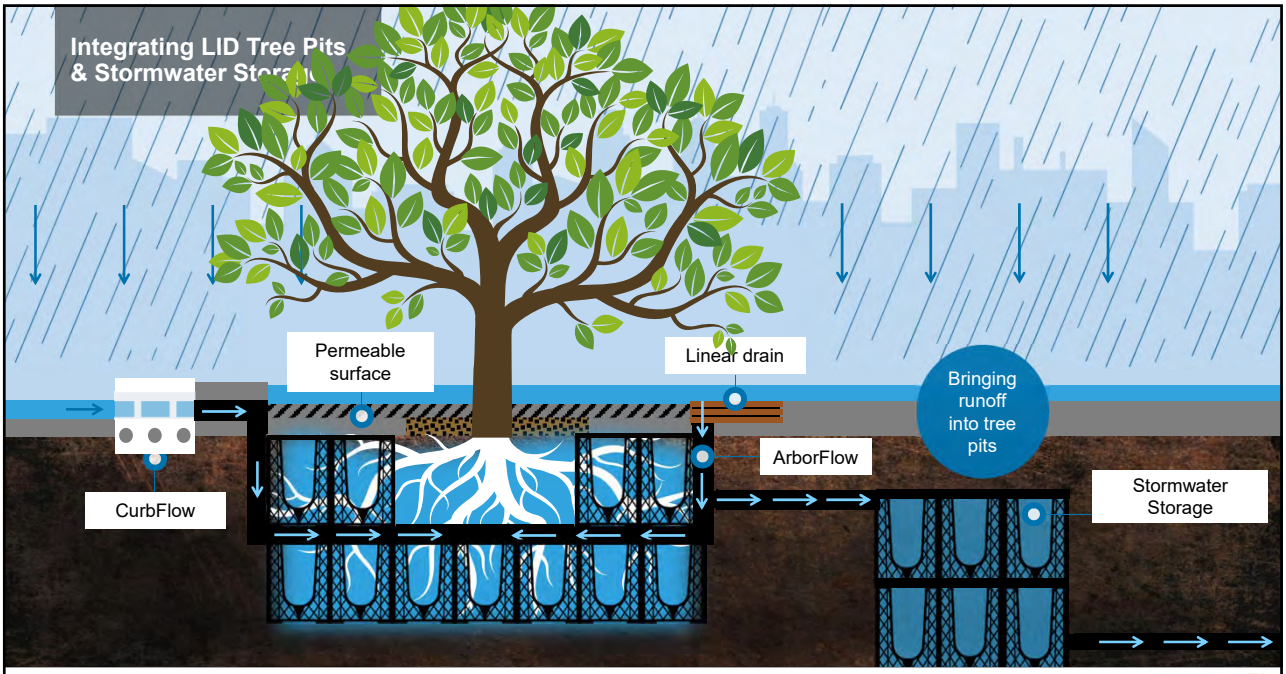

Stormwater Storage
HydroCAD®
Stormwater Modeling
Supported Product
What
Why
How
Where
History
Resources
GreenBlue URBAN

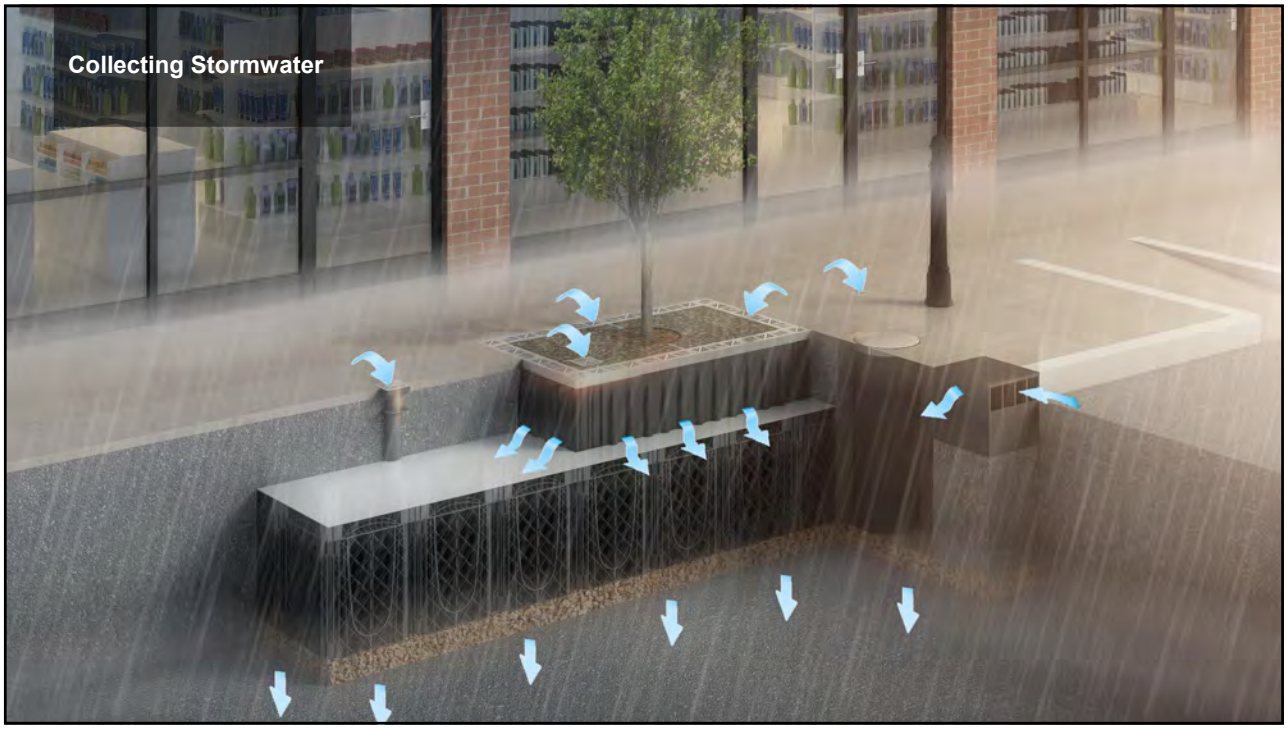

Stormwater Storage
HydroCAD®
Stormwater Modeling
Supported Product
What Why How Where History Resources
GreenBlue URBAN

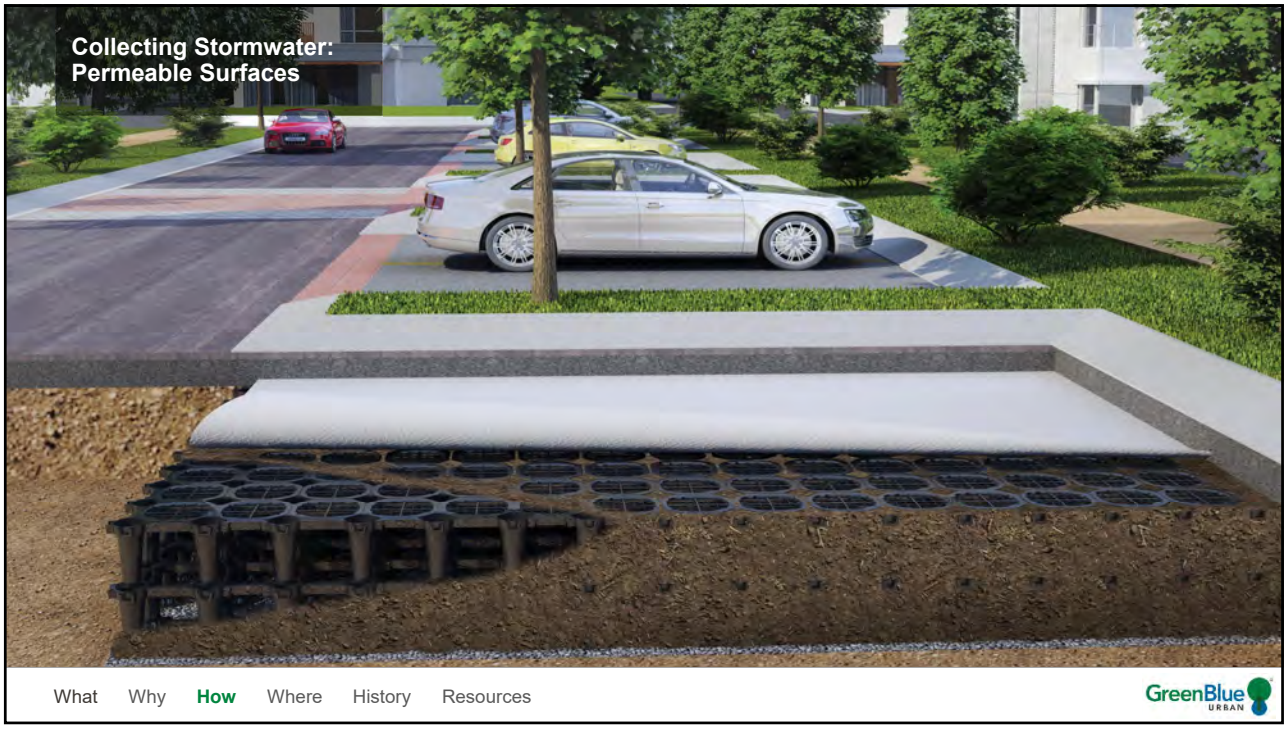

Stormwater Storage
Case Study
Colfax Street – Evanston, IL
What Why How Where History Resources
GreenBlue URBAN

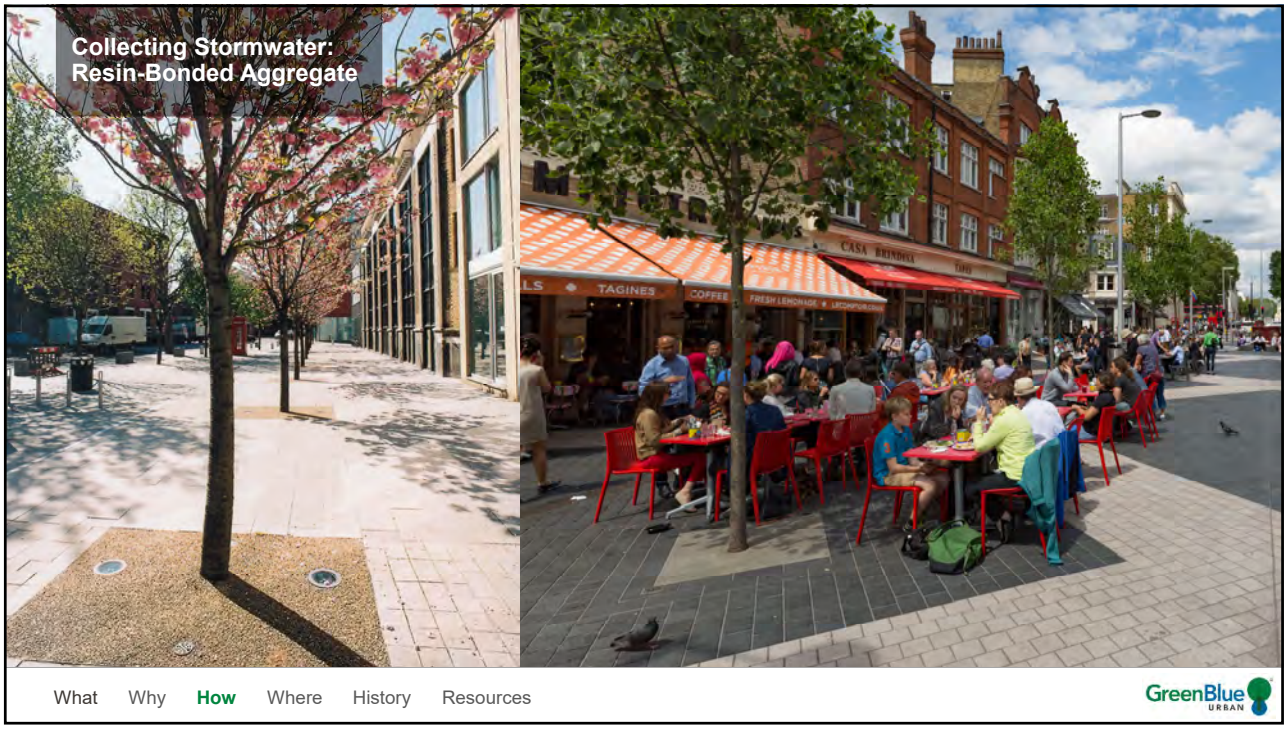
Integrating LID Tree Pits & Stormwater Storage

Integrating LID Tree Pits & Stormwater Storage




Collecting Stormwater


Collecting Stormwater:
Permeable Surfaces
What
Why
How
Where
History
Resources
GreenBlue
URBAN


Collecting Stormwater:
Resin-Bonded Aggregate
What Why How Where History Resources
GreenBlue URBAN


Collecting Stormwater:
Linear Drain
What Why How Where History Resources
GreenBlue URBAN

Collecting Stormwater: Curb Inlet

What Why **How** Where History Resources

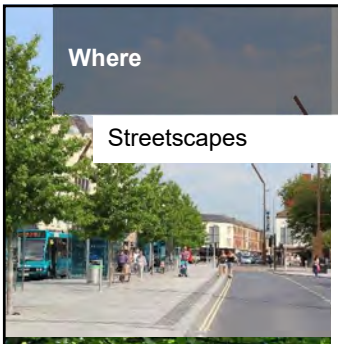
GreenBlue URBAN

Collecting Stormwater: Water Channel

What Why **How** Where History Resources

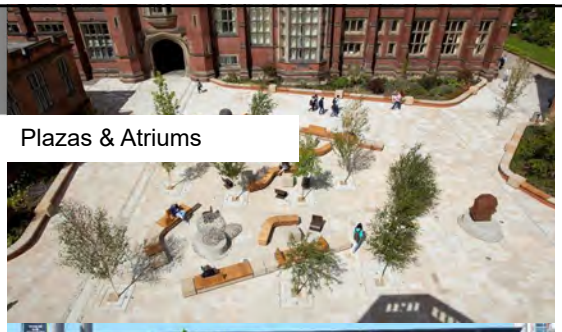
GreenBlue URBAN

Where



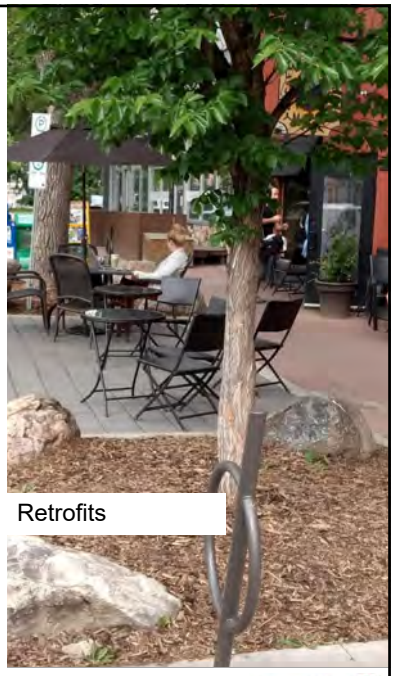
Streetscapes

Parking Lots



Plazas & Atriums

Roof-Tops & On-Structure



Retrofits

What Why How **Where** History Resources

GreenBlue URBAN

Streetscapes

2015

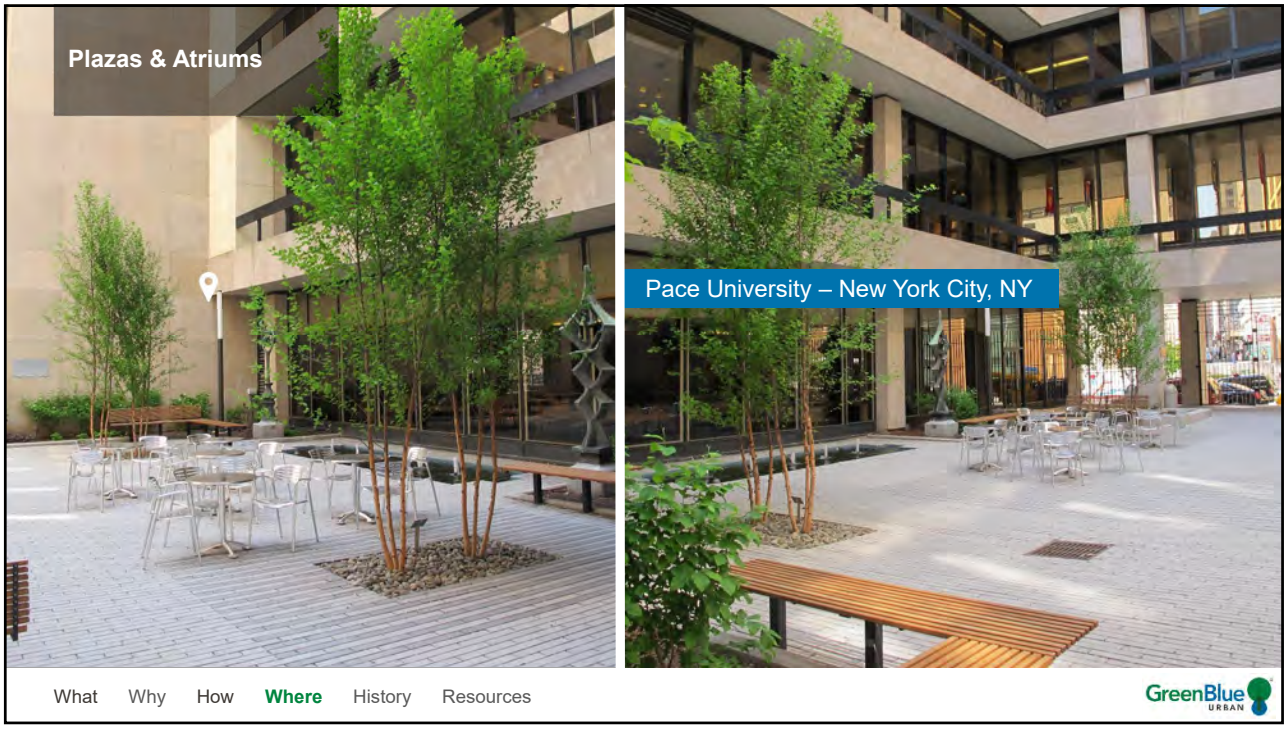
Hatcher Road – Phoenix, AZ

2016

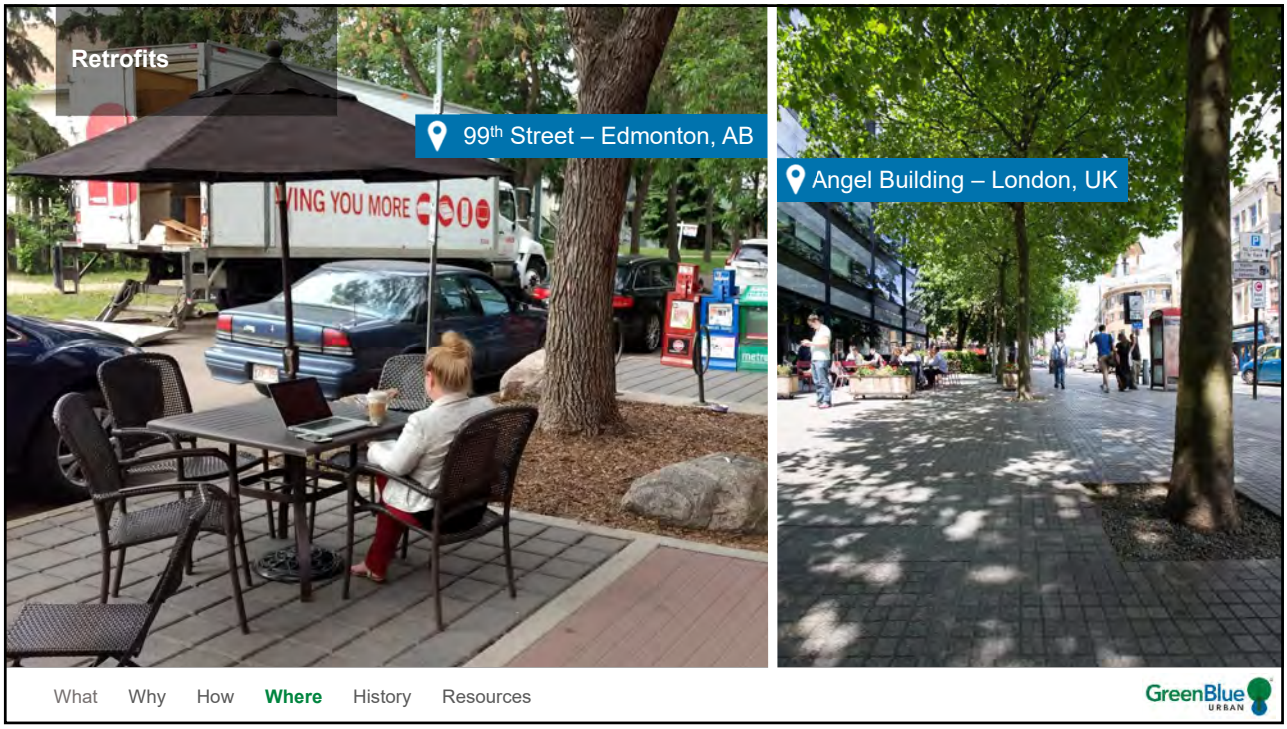
What Why How **Where** History Resources

GreenBlue URBAN


Parking Lots
What Why How Where History Resources
GreenBlue URBAN


Plazas & Atriums
Pace University – New York City, NY
What Why How Where History Resources
GreenBlue URBAN


Roof Tops &
On-Structure
Navy Pier - Chicago, IL
2
Years
Later
What Why How Where History Resources
GreenBlue URBAN


Retrofits
99th Street – Edmonton, AB
Angel Building – London, UK
What Why How Where History Resources
GreenBlue URBAN

Tree Plantings with the World's First Soil Cells

First tree ever planted in soil cells (1999)

Blackheath Hill – London UK (2001)

St Paul's Cathedral – London UK (2003)

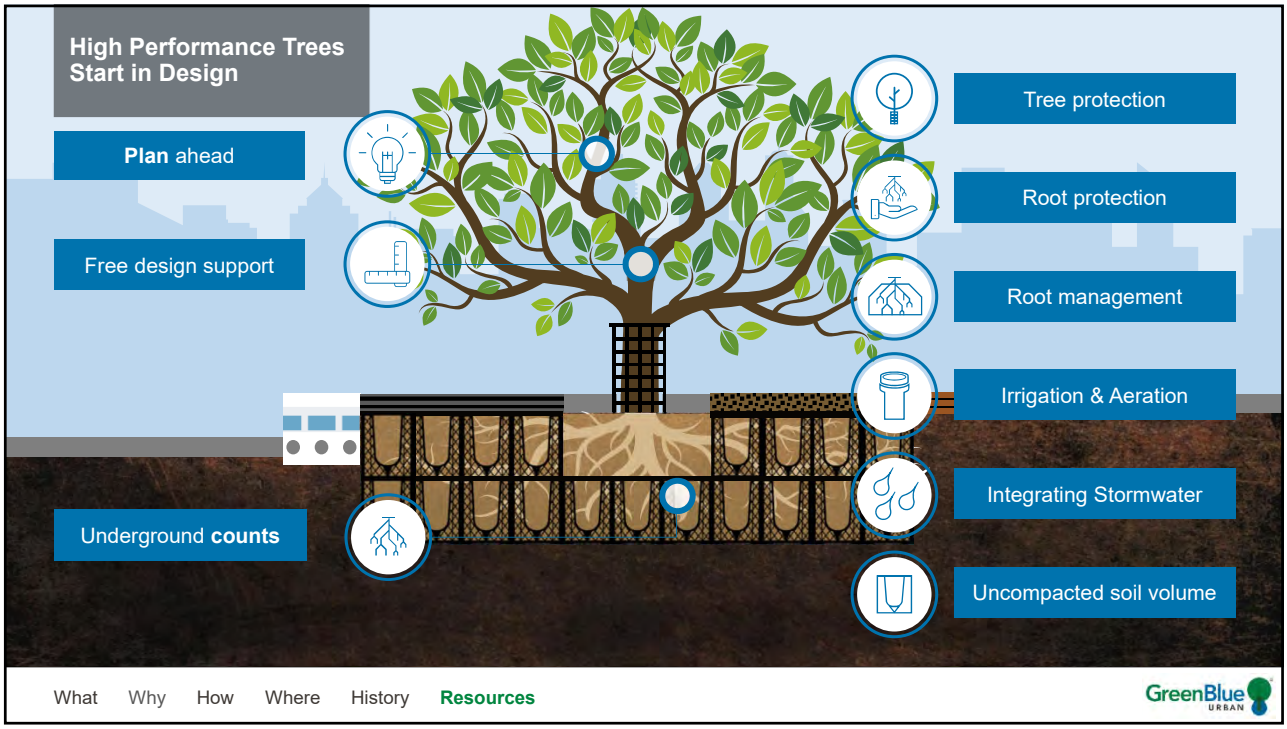
What Why **How** Where History Resources

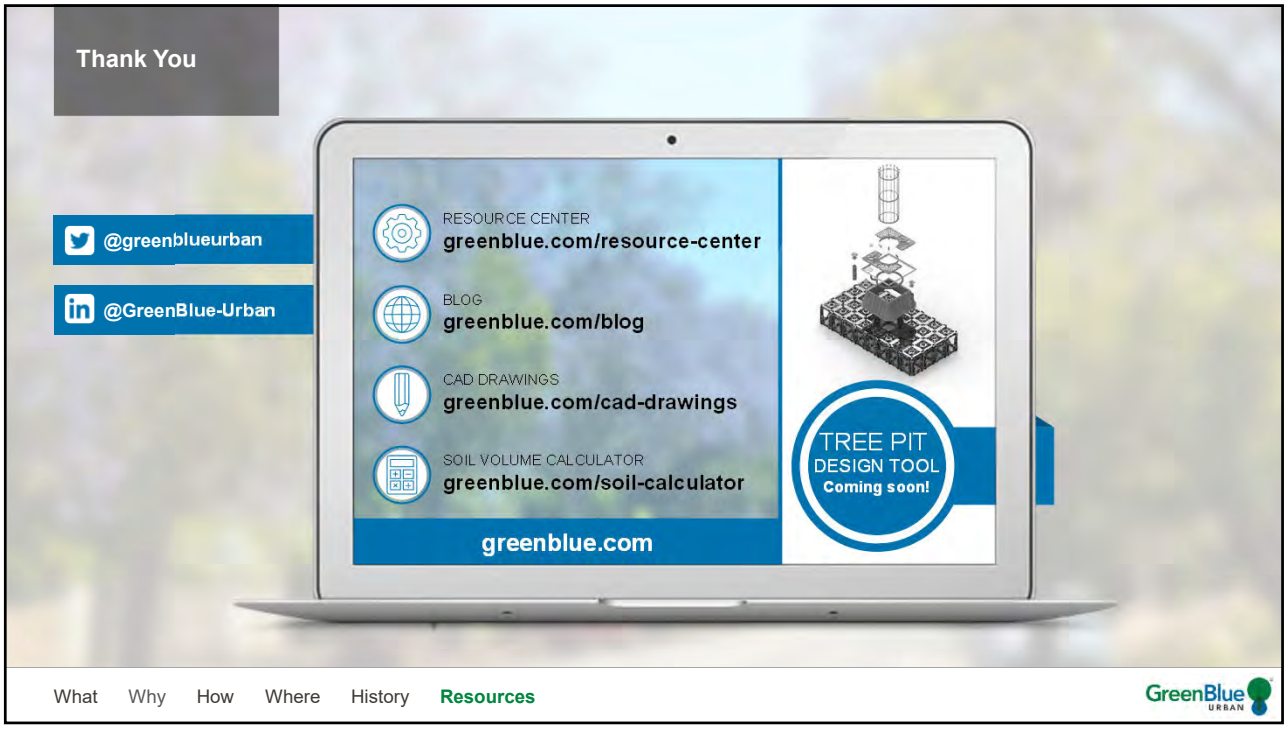
GreenBlue URBAN

Interdisciplinary Collaboration

What Why **How** Where History Resources

GreenBlue URBAN


High Performance Trees Start in Design
Plan ahead
Free design support
Underground counts
Tree protection
Root protection
Root management
Irrigation & Aeration
Integrating Stormwater
Uncompacted soil volume
What Why How Where History Resources
GreenBlue URBAN


Thank You
@greenblueurban
@GreenBlue-Urban
RESOURCE CENTER
greenblue.com/resource-center
BLOG
greenblue.com/blog
CAD DRAWINGS
greenblue.com/cad-drawings
SOIL VOLUME CALCULATOR
greenblue.com/soil-calculator
greenblue.com
TREE PIT DESIGN TOOL
Coming soon!
What Why How Where History Resources
GreenBlue URBAN