Stormwater Mitigation Utilizing Suspended Pavement in Uptown Normal, IL



- I. Introduction -Inspirational Projects
- II. Research
- III. Sizing
- IV. Uptown Normal
- V. Q&A







#### Compaction, Filtration and Plant Health

#### Infiltration reduction



**Root Restriction** 

and

Compaction affects infiltration rate of soil and plant growth

Suspended pavement mitigates both issues

Source: James Urban; Up by Roots; Adapted from Daddow and Warrington USFS 1983

°S)

### What is suspended pavement?





#### Christian Science Center, Boston MA



Trees planted in 1968 in a custom system. Approximately 800 cubic feet of soil per tree

#### Traditional Rain Gardens

- •Use a lot of land
- •Collect Garbage
- •Low Installation Cost
- •High Maintenance cost

SCM Cost Comparison Bioretention Silva Cell™ System 0 10 20 30 40 50 60 Cost per ft<sup>2</sup> (\$)



#### Streetside Swales: Trees do not play a significant role

SW 12<sup>th</sup> Avenue Green Street Portland, OR by Kevin Robert Perry, *ASLA* ASLA General Design Award of Honor 2006

- •Uses Less land
- •Collects Garbage
- Higher Installation Cost
- High Maintenance Cost
- Forget ET and CI



#### Tree Boxes- Tree Replacement vs. Impervious? Zone of Rapid Taper 5:1 ratio DBH to Radius



Maryland National Capitol Park Planning Commission www.mcncpcc.org



Burbank Power and Water, Burbank CA 2012



Casey Trees HQ Washington, DC 2012

# Rain Garden Beneath Pavement

•Shared Land Use

•No Garbage problem

•High Installation Cost

•Low Maintenance cost



UNC Chapel Hill- Bell Tower Plaza- Porous pavers

#### Research:

How do you know it works?

## Field Monitoring of Two Silva Cell Installations Wilmington, NC

**Final Report** 

J.L. Page, R.J. Winston, W.F. Hunt III

January 27, 2014









Wilmington Silva Cell Monitoring Results Volume reduction and timing



Hydrograph from 12.7 mm (0.5 in) storm on 9/6/12, Ann Street

#### Demonstrated pollutant removal using Silva Cell®



Source: Page, J.L., R.J. Winston, and W.F. Hunt, III. 2013. Field Monitoring of Two Silva Cell<sup>™</sup> Installations in Wilmington, North Carolina: Preliminary Monitoring Report.

- NCSU performance monitoring study in Wilmington, NC
- Removal rates <u>at or above</u> peer mean bioretention mixes
- Particularly good nutrient removal
  - Nitrogen: 72-74% removal vs. typical 14% leaching (nitrates)
  - **Phosphorus:** 35-60% removal vs. 70% leaching

#### Summary of Conclusion

Silva Cell systems are a viable option to provide sustainable stormwater management in urban areas, by providing tree rooting volume under paved areas with HS20 loading:

 Silva Cell systems performed better or about the same as the mean for bioretention systems in peer reviewed literature for TSS and heavy metals removal.

•Even though the Ann St. soil had twice as much organic matter as the Orange St. soil, there was no significant difference between the effluent nitrate concentration of the two sites. While compost is generally thought to leach nitrogen (and phosphorus), the pine bark used in the Wilmington soil mixes does not appear to be leaching nitrogen or phosphorus.

•Maintenance to remove trash, sediment, and leaf litter from the inlet catch basins to the Silva Cell systems is crucial to prevent bypass. Inlet catch basins at these sites were cleaned every 2 months.

## 2007 – Present- Over 1500 installations



240 Myrtle Street, Redwood City CA 94062



# Mid West Projects



Cincinn





Award Winner: Normal, IL LAF; ASLA; EPA; FHA Wapankoneta, Minster, Findlay OH State Fair Grounds OSU Spirit of Women' Park Taylor and Emerald Avenue North High Street Horseshoe Casino



# Uptown Normal Redevelopment; Normal, Illinois



2010-2017

## Uptown Normal Redevelopment



# The Circle

















# Documented Increase in Retail Sales



Photos Courtesy of Uptown Normal Partners



#### Uptown Normal Redevelopment:

#### **Stormwater Management Benefits**

- On an annual basis, the project prevents 1.4 million gallons of stormwater from entering the municipal storm sewer by directing runoff from sidewalks into tree wells and planter areas augmented by underground structural cells
- Streetscape planting zones provide 85,000 gallons of stormwater storage capacity, the Silva Cells provide an additional 35,000 gallons of storage capacity
- The underground 75,000-gallon cistern captures street stormwater runoff storing and using that water for landscape irrigation and a water feature
- The trees serve to intercept and store stormwater in their canopies and release water into the atmosphere
- The highly legible system serves as a demonstration tool and heightens awareness of stormwater management in the community and beyond



#### Uptown Normal Redevelopment:

#### **Other Benefits**

- Has served as the **armature for multiple redevelopment projects** within the Uptown District
- Increase in footfall and retail revenue in Uptown District
- Increase in retail occupancy rates in the Uptown District
- Project saves in tree purchase and installation costs over 50 years by more than tripling the expected lifespan of street trees from 13 to 50+ years through the use of underground structural cells.
- Increased **biophilic** value to community adding much needed green space and vegetation to the district
- The community of healthy trees has resulted in a dramatic increase in the urban tree canopy and reduction of heat island effect within the district. >.5" per year



# Learning Objectives

1. Name the mechanisms through which tree/soil systems provide stormwater benefits.

Alleviate Compaction and Increase filtration

## 2. What are the differences in the construction of suspended pavement systems, and point to examples in the state

Tree Boxes, PIP Systems, Post and Beam systems- Ohio State Fair Grounds; Marathon Oil; Minster, Columbus; Don't ingor the tree!

#### 3. Research that has quantified stormwater benefits of tree/soil systems

NCSU Research- Dr. Ryan Winston-others as well

## 4. How tree/soil systems can be integrated into landscapes of to maximize ecological services

Urban areas: Sufficient Soil Volume for Trees Growth

### Thank you!







Albert L. Key, Jr Aff. M. ASCE <u>alkey@deeproot.com</u> M (917)991-3121 DeepRoot Green Infrastructure, LLC @deeproot\_al



### Lincoln Center Bosque, New York City

In April of 2009, 970 Silva Cell frames and 620 Silva Cell decks were installed at the Lincoln Center Bosque (Barclay Capital Grove) in New York City, New York to support 30 new trees that were planted that spring. Each tree receives a total of 450 cubic feet (12.7 cubic meters) of soil. The project site, formerly known as the North Plaza, rests entirely on a parking garage.

> Approx Cost: \$7,500.00/tree



## Sundance Square, Fort Worth, TX

The trees of Sundance Square plaza after three growing seasons. In October of 2013, 960 Silva Cell frames and 480 Silva Cell decks were installed beneath the Sundance Square Plaza in Fort Worth Texas to support the 18 Cedar Elm trees that were planted later that autumn. Each tree receives 800 cubic feet of soil, and water efficient irrigation techniques were employed in the design to ensure that the trees would thrive in the often arid desert climate.

Approx Cost: \$12,000.00/tree



## Sugar Beach Toronto, ON

The trees at Sugar Beach in Toronto, Ontario after 5 growing seasons. These trees are supported by 3,150 Silva Cell frames and 1,960 Silva Cell decks, which help them to receive over 1,236 cubic feet (35 cubic meters) of soil each. The Silva Cell system was installed in winter 2010, and the trees planted in spring 2010 as part of the Waterfront Toronto revitalization project.

Approx Cost: \$18,000.00/tree (US\$)

