Botanizing the City

Low Impact Development as an Adapatation Strategy for Coastal Resilience in Southeast Florida

Jeffrey E. Huber, AIA, NCARB, LEED AP
Assitant Professor, Florida Atlantic University School of Architecture
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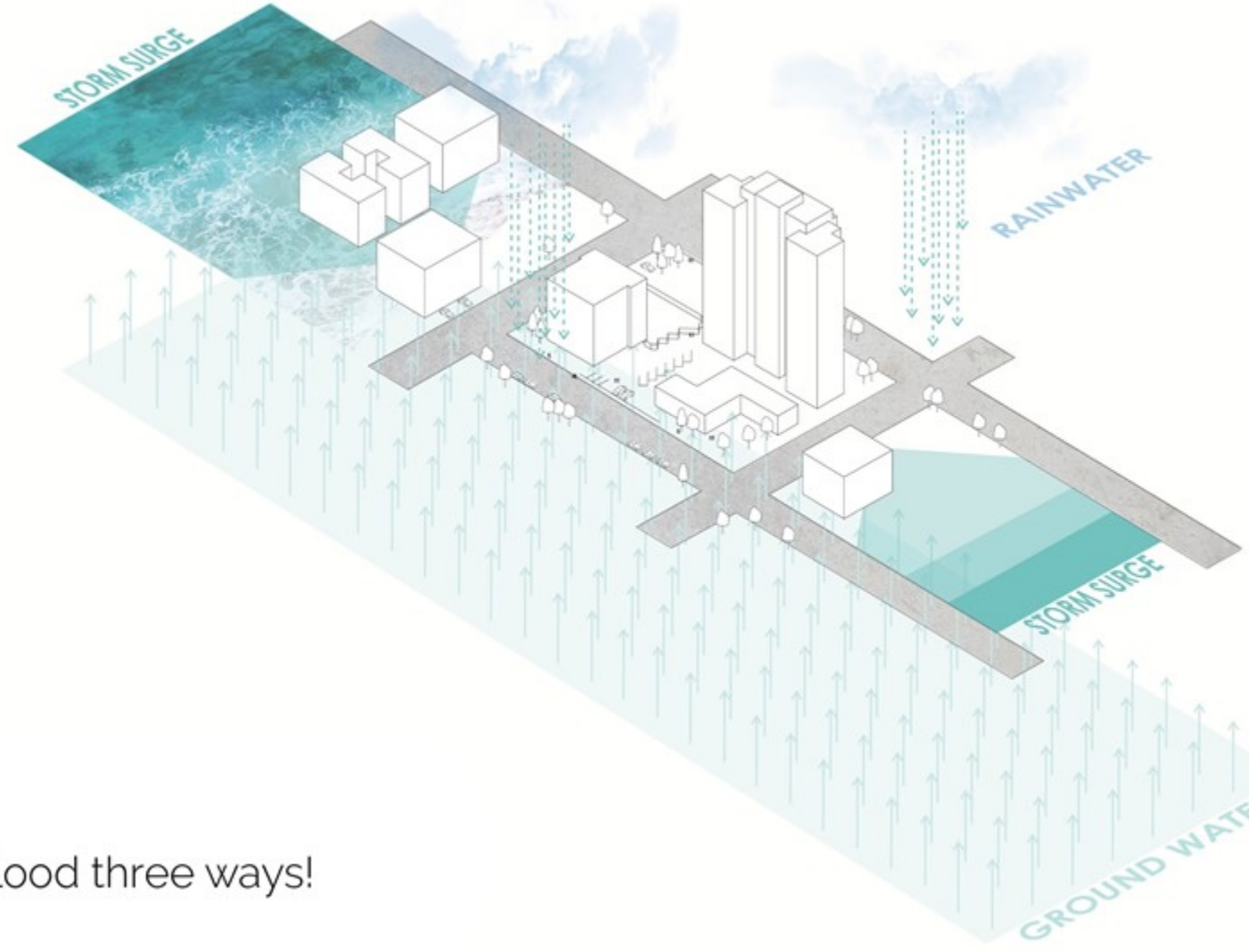

We flood three ways!

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2909
Nuisance flooding occurs at
every king tide event.
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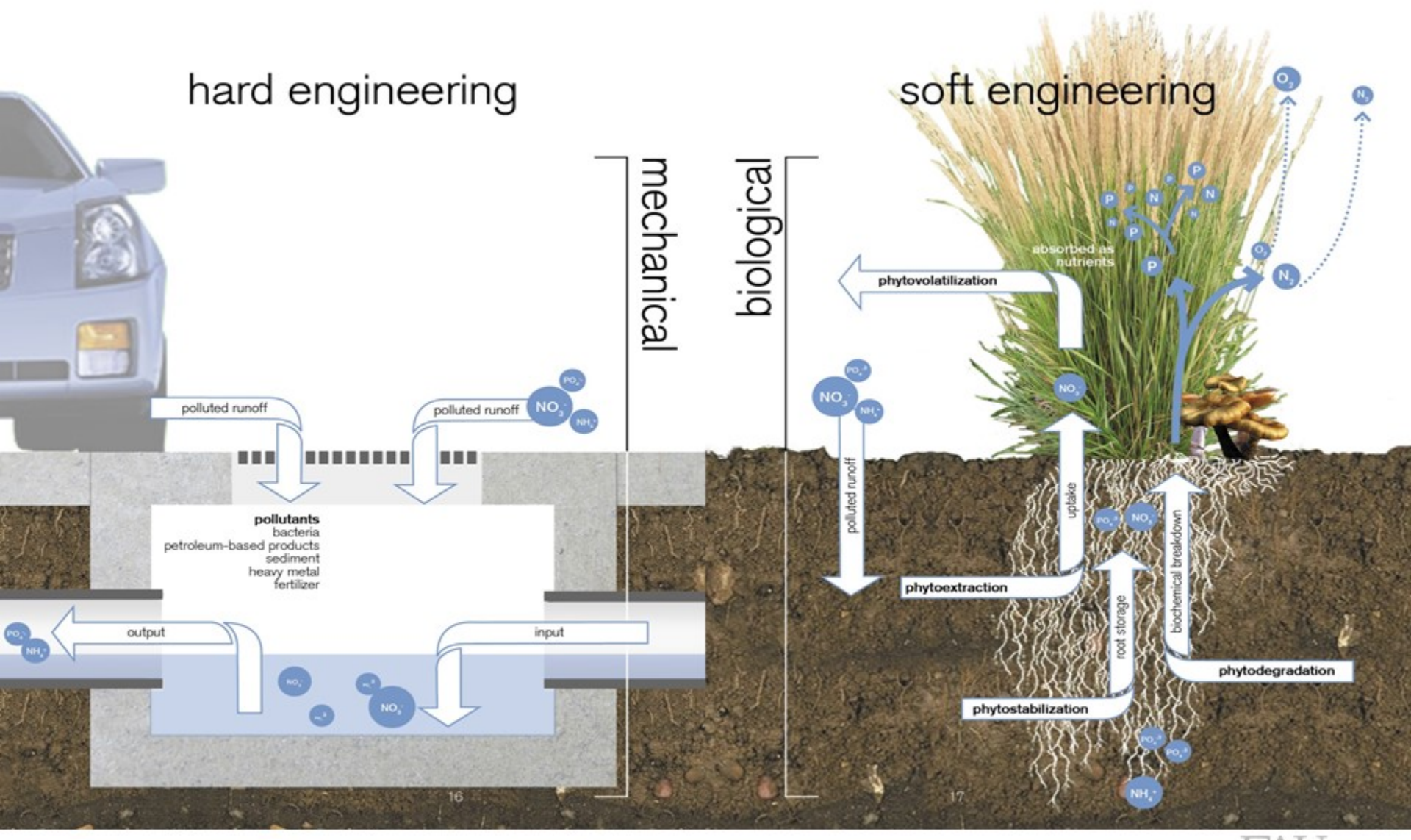
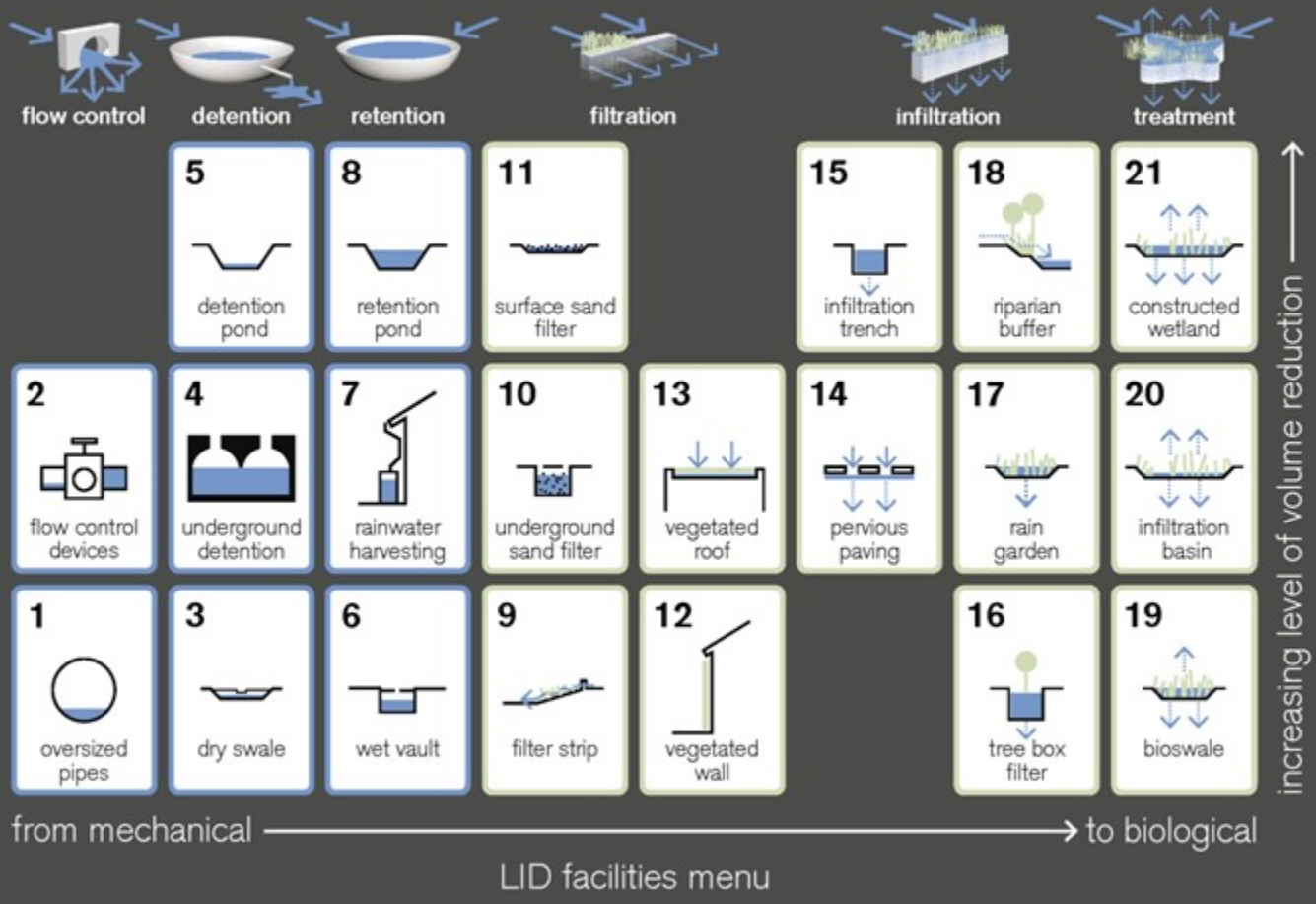
“...in many cases the first flush of stormwater in an urban area may have a level of contamination much higher than normally present in sewage...”
Craig Campbell and Michael Ogden,
Constructed Wetlands in the Sustainable Landscape
What if urban stormwater infrastructure enhanced ecological functioning to serve as a civic asset rather than an environmental liability?
impervious surfaces





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optimal level of service
filtration or infiltration
(depends on which system is used)

location in LID network
upstream of major treatment systems,
and in place of street trees
(not in swales or other filter devices)

scale
a single tree box to a
large urban tree box network

management regime
occasional removal of trash and raking
of surface to maintain permeability;
replacement of tree after seven years

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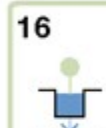
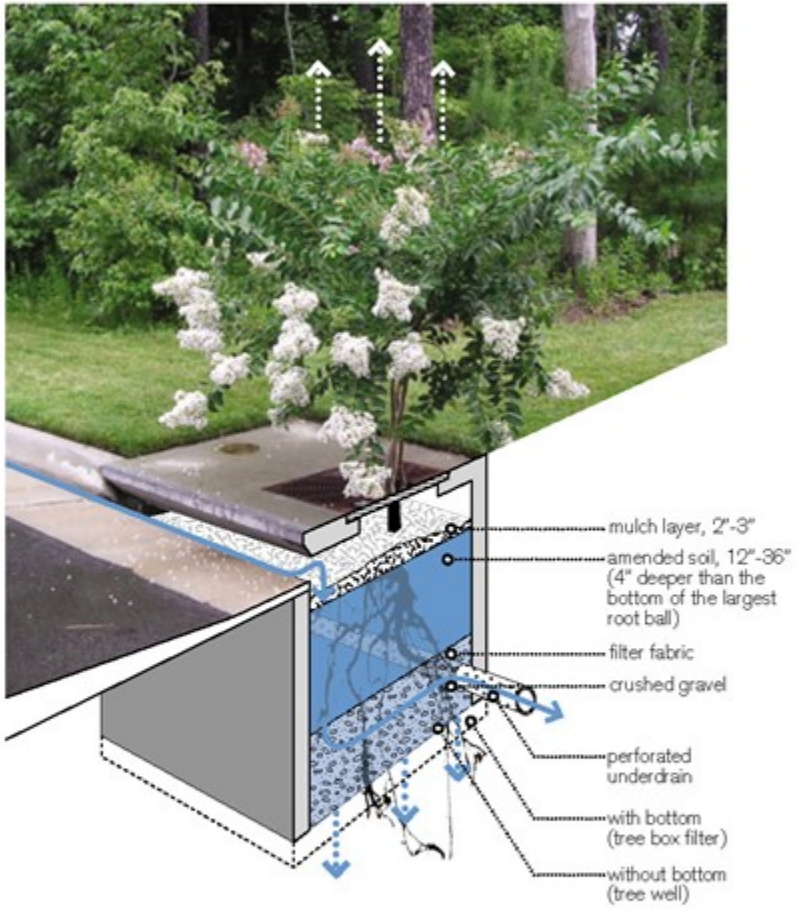


Tree Box Filter

A tree box filter or well consists of a container filled with amended soil and planted with a tree, underlain by crushed gravel media.

Tree root systems treat and uptake stormwater runoff captured from the street into the box filter. An underdrain carries treated runoff to either a surface discharge location or a larger retention system for secondary treatment. The life of the tree is short as trees will need to be replaced every five to ten years. The unit can also be planted with hardy shrubs and herbaceous plants tolerant of inundations.

Tree box filters and wells can be incorporated into urban retrofits with the added benefits of water quality improvement and reduction of the urban heat island effect. As with other filtration devices, tree box filters require occasional inspection to remove large debris and/or trash.



References:
Low Impact Development Manual for Michigan
Urban Design Tools-Low Impact Development
Minnesota Urban Small Sites BMP Manual

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optimal level of service
filtration/infiltration/treatment

location in LID network
downstream of filtration components, but upstream of larger detention, retention, or treatment facilities

scale
2'-8' wide with 2"-4" optimal water depth

management regime
occasional removal of trash and pruning of vegetation

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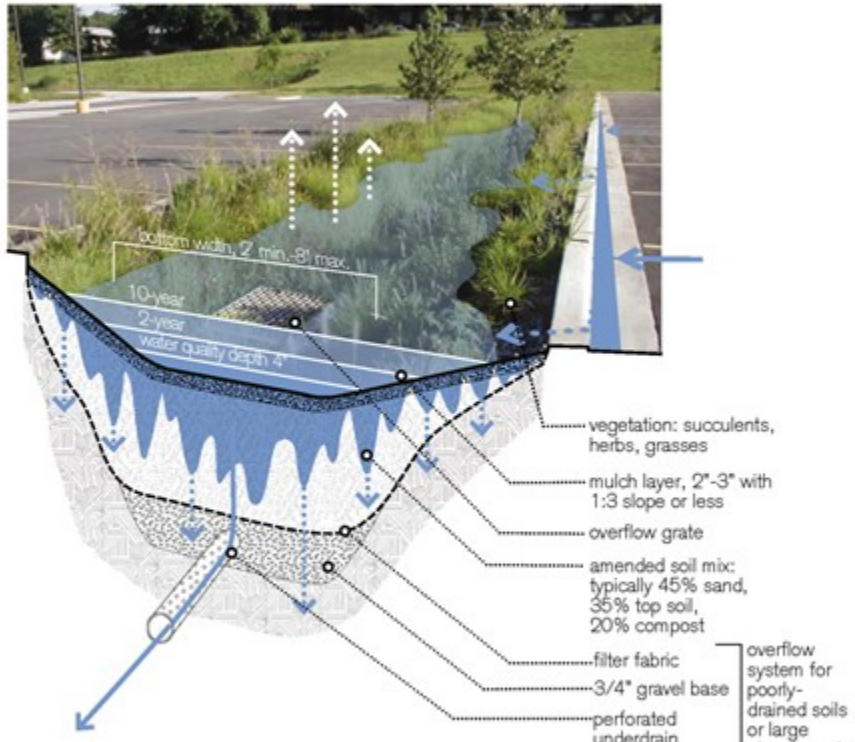
bioswale

Bioswale

A bioswale is an open, gently sloped, vegetated channel designed for treatment and conveyance of stormwater runoff.

Bioswales are a type of bioretention device in which the primary pollutant removal mechanisms are filtration by grass blades and other facultative vegetation that enhance sedimentation through adhesion of pollutants to the grass and thatch. Bioswales combine treatment and conveyance functions, reducing development costs by eliminating the need for separate conveyance systems. Their main function is to treat stormwater runoff, while the main function of rain gardens is to infiltrate runoff. Bioswales are usually located along roads, drives, or parking lots where the contributing acreage is less than five acres.

Bioswales require curb cuts, gutters or other devices that direct flow to them. They may require an underdrain where soil permeability is limited, as well as an overflow grate for larger storm events.



References:
Low Impact Development Design Strategies–An Integrated Design Approach
Low Impact Development Manual for Michigan
Low Impact Development Technical Guidance Manual for Puget Sound
United States Department of Housing and Urban Development
Minnesota Urban Small Sites BMP Manual

How do we adapt Low Impact Development to Southeast Florida?

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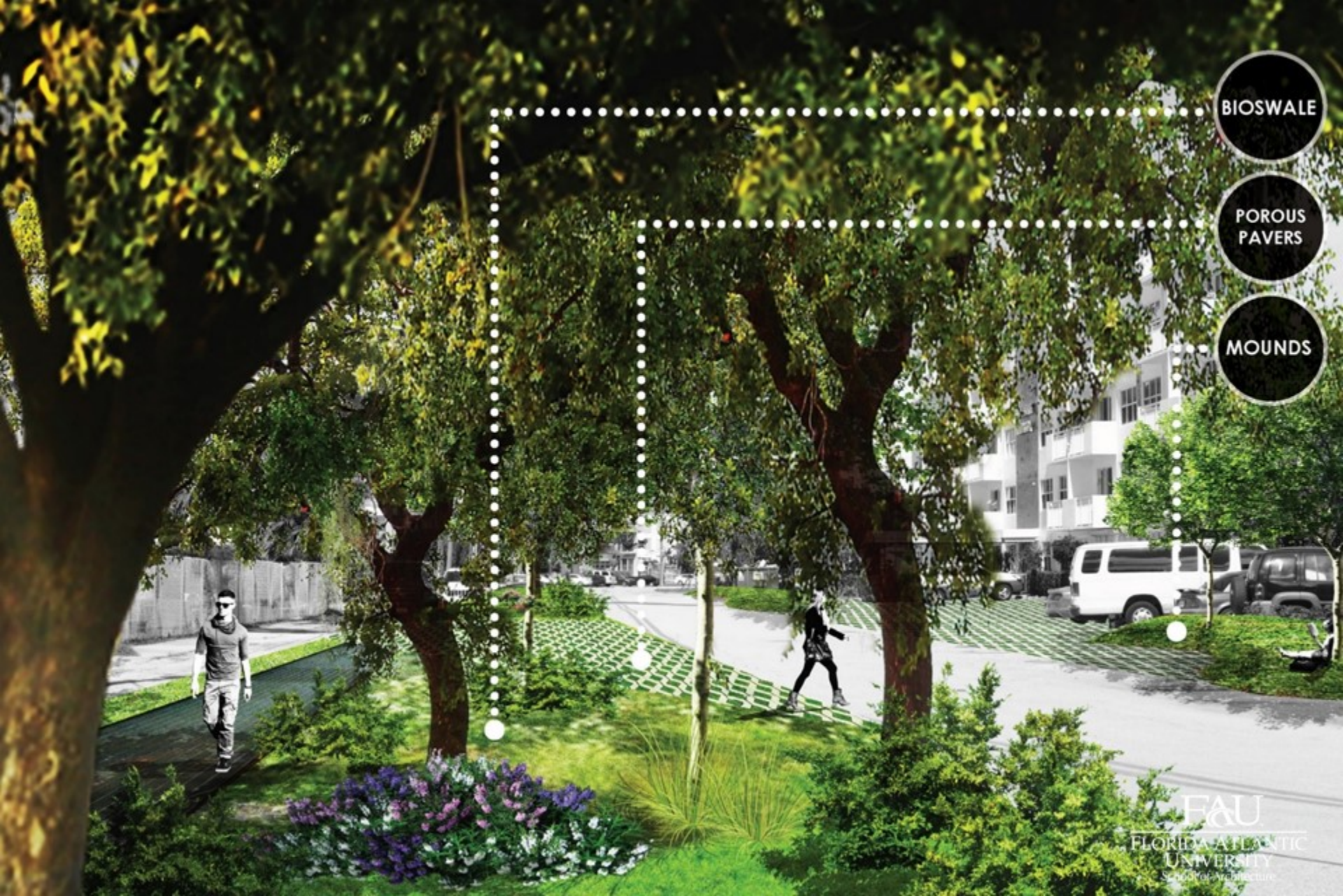
BIOSWALE
POROUS PAVERS
MOUNDS
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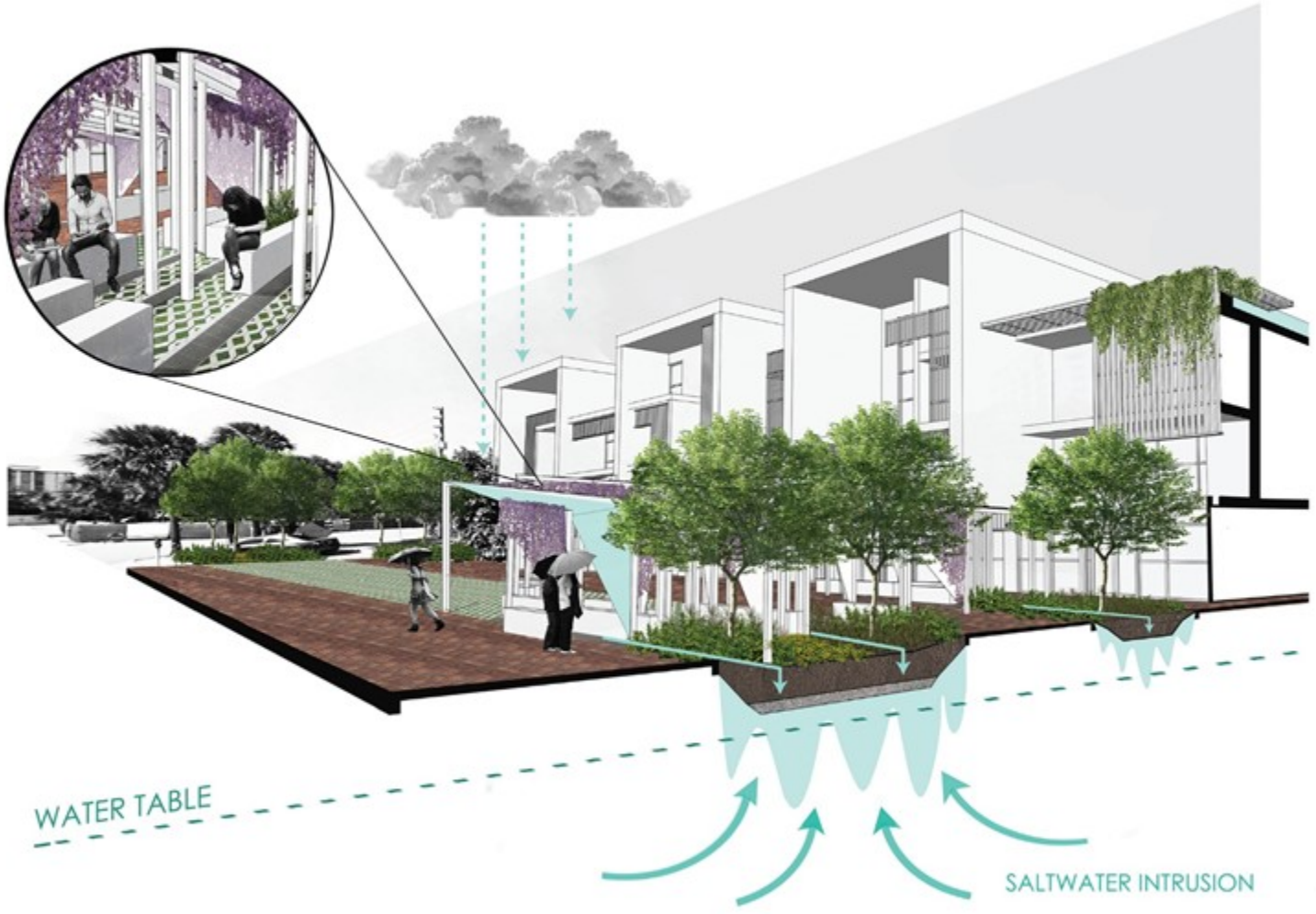


Phreatophytic Bosques
are water-loving, deep-rooted trees (e.g., Cottonwoods, Poplars, Willows, etc.) that provide flow **regulating services** by pumping, storing, and evapotranspiring groundwater where a high water table limits runoff retention. An acre of these trees can pump more than a million gallons of water annually.
Underground Filtration Basins
are rock-filled trenches with bio-films beneath porous pavement that filter sediment and infiltrate stormwater runoff providing water **regulating services** in streets.
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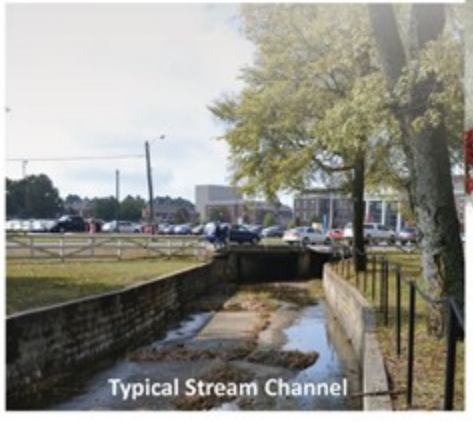
Channel Retrofit Gardens

introduce biologically active zones into urban streams that have undergone hard-engineered drainage solutions. The gardens comprise submergent and emergent plant guilds whose growth is controlled through structural meshes akin to espaliers. Cellular meshworks provide flow attenuation and restoration of sinuosity in flow patterns important for water **regulating services.** Plant guilds support microbial communities in root zones for water treatment, and the return of nutrient cycling, refugia, and food provisioning in riparian zones constituting **supporting services** and **provisioning services.** Meshworks are sculpted—and lighted—as signature retrofit installations to provide **cultural services.**



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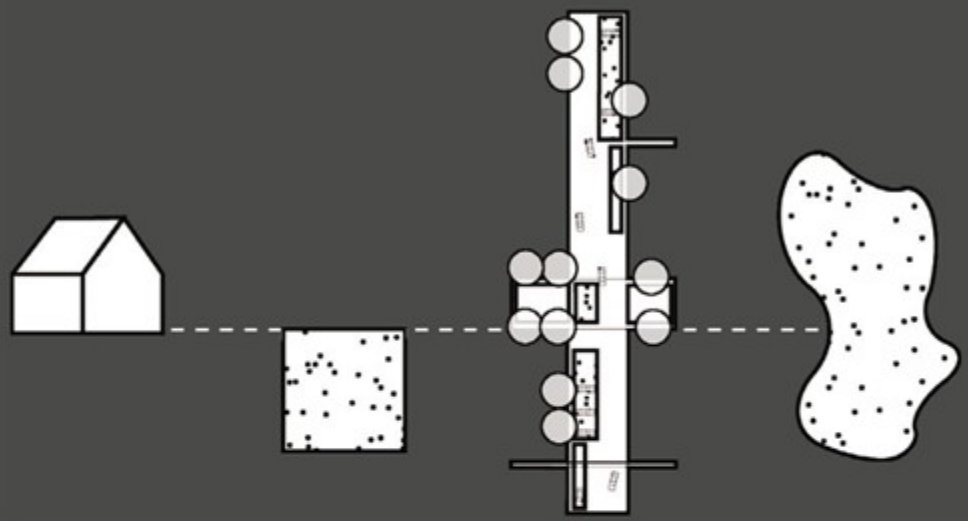

building	property	street	open space
design the building as a net energy producer that recharges groundwater and harvests rainwater	substitute an ecologically-based stormwater treatment system for an otherwise decorative landscape	design the street as a garden to achieve traffic calming and stormwater management	comprehensively plan open space as a green network that delivers vital ecological services at the scale of a watershed

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