Introduction to Low Impact Development

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Low Impact Development (LID)

- **Low impact development** (LID) is a term used to describe a land planning and engineering design approach to managing stormwater runoff. LID emphasizes conservation and use of on-site natural features to protect water quality. This approach implements engineered small-scale hydrologic controls to replicate the pre-development hydrologic regime of watersheds through infiltrating, filtering, storing, evaporating, and detaining runoff close to its source

Low Impact Development (LID) Continued

Low Impact Development (LID) is a type of smart growth that simultaneously conserves green space and manages stormwater effectively. Unlike traditional land use designs, LID promotes natural stormwater management techniques that minimize runoff and help prevent pollutants from getting into the runoff. In some cases, these practices decrease the size of traditional retention and detention basins and can be less costly than conventional stormwater control mechanisms.

http://www.duffnet.com/wp-content/uploads/2013/05/Mall-Bio-069-EDITED-300x225.jpg

Examples of LID:

Conserved Green Space
Natural terrain protects soils from disturbance and compaction.

Permeable Pavement
Hard, yet penetrable, surfaces reduce runoff by allowing water to move through them into groundwater below.

Reduced Roadway Surfaces
Reducing roadway surfaces results in more permeable land area.

Examples of LID Continued:

Disconnected Impervious Areas

Separate localized detention areas help limit the velocity and amount of water that must be handled by end-of-pipe water quality and quantity facilities.

Vegetated Swales

An alternative to curb and gutter systems, vegetative swales convey water, slow runoff, and promote infiltration. Swales may be installed along residential streets, highways, or parking lot medians.

Green / Eco-roof Systems

These systems can significantly reduce the rate and quantity of runoff from a roof and provide buildings with thermal insulation and improved aesthetics.

https://ffl.ifas.ufl.edu/lowimpactdev.htm

Examples of LID Continued:

Stormwater Reuse

Surface ponds, underground catchment devices, or surficial aquifers store rainfall for future irrigation reuse. Smaller scale reuse systems include cisterns and rain barrels.

Bio-Retention Basins & Rain Gardens

Small vegetated depressions in the landscape collect and filter stormwater into the soil.

Clustered Homes

Concentrating structures to smaller areas preserves more open space and natural areas to be used for recreation, visual aesthetics, and wildlife habitat.

http://www.bethesdamagazine.com/Bethesda-Beat/2018/Montgomery-County-Aims-To-Overhaul-Stormwater-Management-Program/aGreenstreetstormwatertreatmentvegetationonDennisAve.jpg

University of Wisconsin Study: Calculating Stormwater Volume and Total Suspended Solids Reduction under Urban Tree Canopy in Wisconsin Using Available Research, by Goffield, Wudel and Kuehler

Urban forest systems are a combination of tree canopy cover, ground cover (vegetative or mulch), and belowground water-storage capacity from which tree roots have access to water and nutrients.

These systems intercept rainfall (retaining a portion on foliage and stems), help to reduce rainwater intensity and decrease runoff velocity, and increase soil water-holding capacity.

Current research has shown that urban trees can contribute significantly to stormwater volume control by retaining on average 20% of annual rainfall in the canopy of trees (depending on rainfall volume and intensity) and increase infiltration by up to 3.5 time compared to open-space not having tree cover (Teague and Kuchler 2016: Berland et al. 2017;Kuchler et al. 2017).

Using urban forest systems with other green stormwater infrastructure practices such as bio-retention, can help to restore predevelopment hydrology and reduce the amount of stormwater needing to be treated.

Florida Land Development Conventional Practices:

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“Conventional” Planning and Design

- Style of suburban development over the past 50 years
- Generally involves larger lots
- Clearing and grading of significant portions of a site
- Wider streets and larger cul-de-sacs
- Enclosed drainage systems for stormwater conveyance
- Large detention ponds

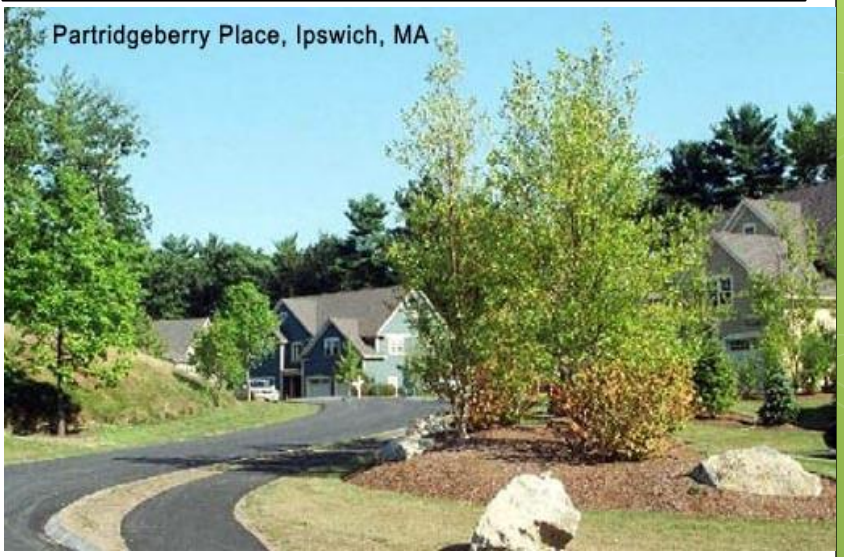
Site Design Planning Process

#1 **AVOID IMPACTS** – Preserve Natural Features and Use Conservation Design Techniques

#2 **REDUCE IMPACTS** – Reduce Impervious Cover

#3 **MANAGE IMPACTS** – Utilize Natural Features and Natural Low-Impact Techniques to Manage Stormwater

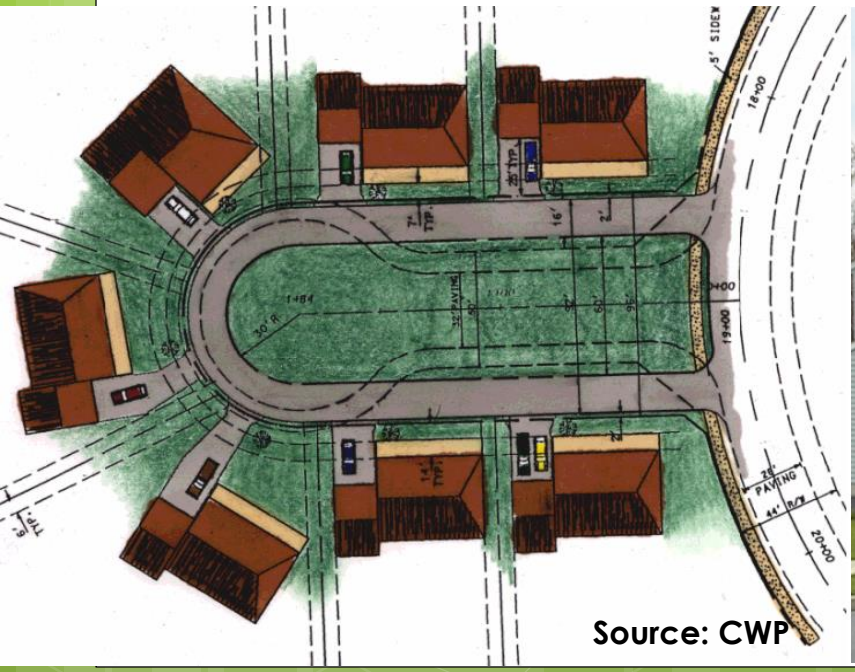
- Conservation of natural hydrology, trees, and vegetation
- Minimized impervious surfaces
- Dispersal of stormwater runoff
- Conservation of stream & wetland buffers
- Ecological landscaping



Better Site Design on Roadways and Driveways

- Narrower streets
- Alternative cul-de-sacs
- Shared driveways


Source: City of Portland, OR


Source: CWP

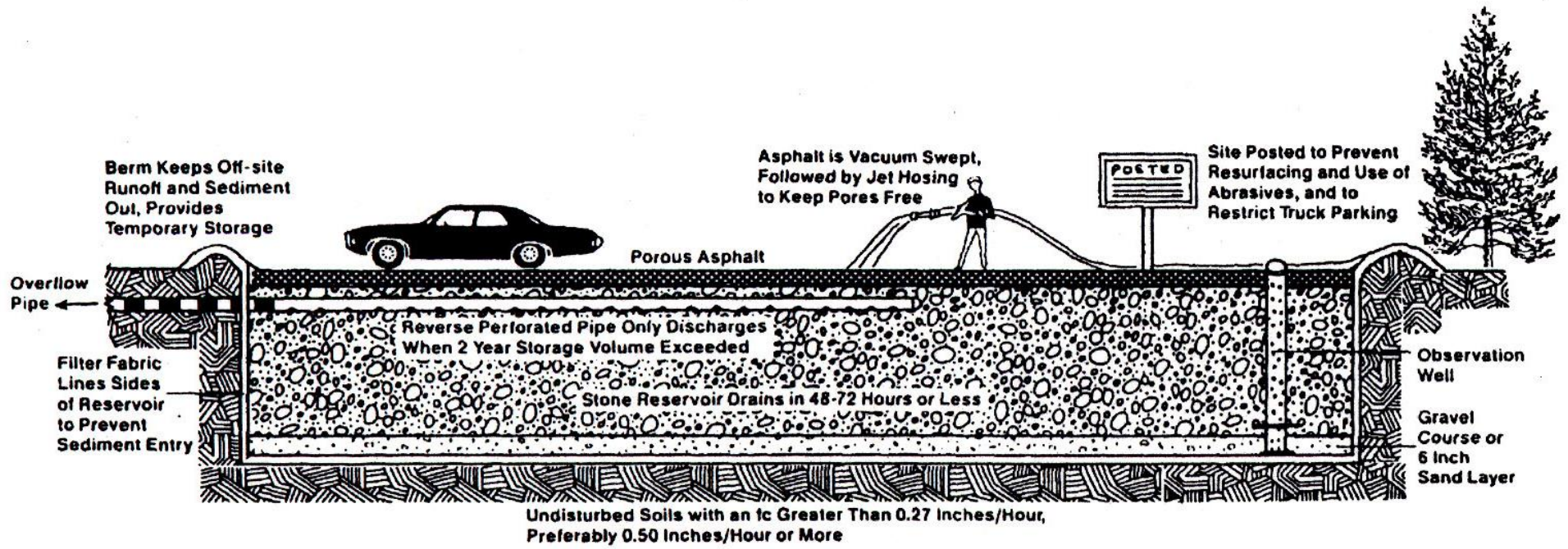

Source: R. Claytor

Lake Alice Stormwater Pond, University of Florida, Gainesville Campus

Lake Alice

- 129 acres of forest, wetland and open water
- Most of UF campus drains to Lake Alice
- 23,000 parking spaces used daily on campus
- Ten percent of cars leak fluids
- 2,3000 vehicles add hydrocarbons, heavy metals and other contaminants during rain events

Permeable Pavement



Capturing Roof Runoff

Vegetated Swales
Conveyance, Treatment, Infiltration

- Roadside swales
- For small parking lots

Bioretention Applications

- Parking lot islands
- Median strips
- Residential lots
- Office parks


Source: Larry Gavin


Source: City of Portland, OR


Source: LID Center

Bioretention Applications

- Urban retrofits
- High-density areas

Vegetated Filter Strips Pretreatment and Attenuation

- Mild vegetated slopes
- Adjacent to small parking lots
  and roadways
- Another opportunity for snow storage

Source: City of Portland, OR

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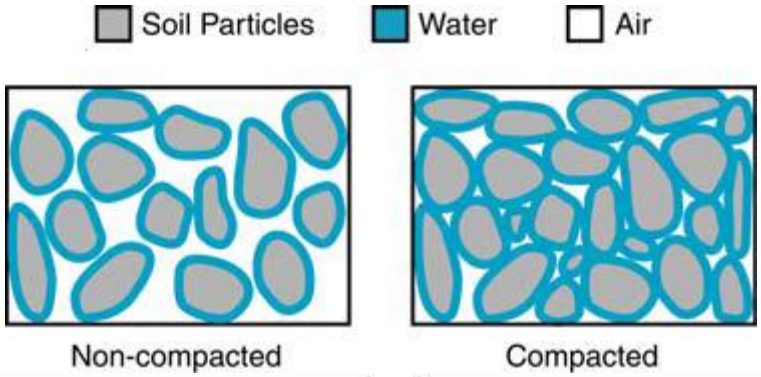
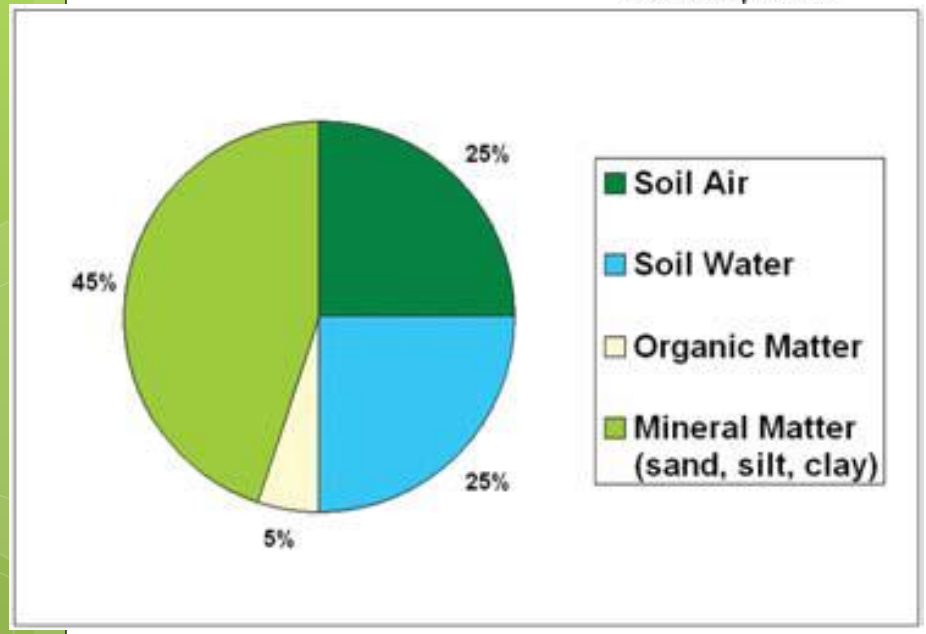
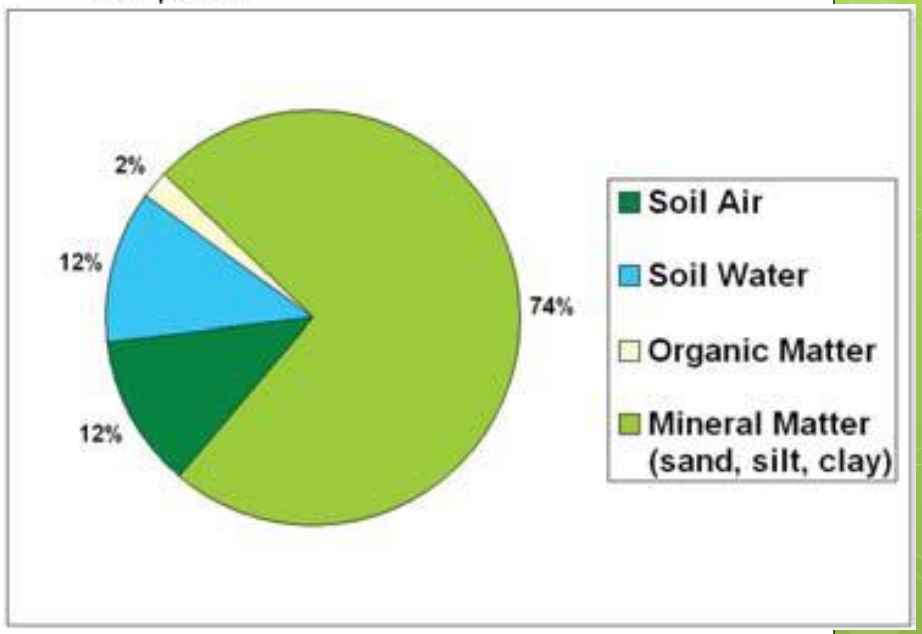

Soil Particles
Water
Air
Non-compacted
Compacted


25%
45%
25%
5%
Soil Air
Soil Water
Organic Matter
Mineral Matter (sand, silt, clay)


2%
12%
74%
12%
Soil Air
Soil Water
Organic Matter
Mineral Matter (sand, silt, clay)

Code Considerations

A landscaping plan shall show the dimensions of planted areas and proposed species.	The landscaping plan shall incorporate the storm-water management approach and grading plan for the site and shall indicate clearly the location and size of all landscaped and vegetated areas, green roofs, rainwater storage systems and areas of permeable surfacing that are intended to provide stormwater treatment or control functions.

Incorporating green infrastructure into site plan reviews. If the code language does not clearly state that green infrastructure is an acceptable or preferred approach to managing stormwater, green infrastructure will not likely be considered in development proposals, design plans or capital projects.

Shared or off-site parking with parking lot landscape to function as stormwater areas
Permit permeable materials for parking
Promote green roofs
Planter boxes for rainwater harvesting
Reduced roadway footprint
Work with WMD to ensure credit is allowed to entice green development practices

Existing Outside Regulations

- Are there regulations or requirements affecting your community?
- Your municipality may have regulatory requirements in addition to stormwater permits such as a total maximum daily load (TMDL) that requires the reduction of pollutants identified in a TDML implementation plan or combined sewer overflow problems.
- Removing barriers to green infrastructure practices could help mitigate specific pollutants identified in a TMDL, which would make codes relevant to that area a high priority for revision.

Other Hurdles to Overcome

- Get support from allies to educate community leaders
- Specify what is allowed to overcome negative complaints from neighbors
- Costs for green infrastructure is documented to be less costly.
- Include maintenance of green infrastructure installations