Module 2 – Introduction to Low Impact Development

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Learning Objectives 2.1

- **Define Low Impact Development (LID).**

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LID Philosophy

Hydrology is an organizing principle that is integrated into the initial site assessment and planning phases.

Source: Low Impact Development Center

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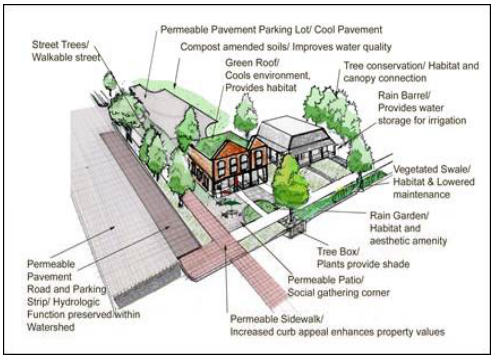
LID Philosophy

The LID approach protects the natural ability of the site to **capture** precipitation, keep it **clean** and allow it to **recharge** the local water table.

This is achieved by following a new paradigm of believing that ***storm water is not waste to be disposed.***



Source: Low Impact Development Center

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LID Definition

Retaining predevelopment hydrology and natural design approaches as a mechanism for pollutant removal and improvement in storm water quality and quantity.

Source: mass.gov

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LID Definition

LID is a stormwater management approach with basic principles modeled after nature.

The primary goal of LID is to mimic a site's pre-development hydrology by managing runoff close to its source through:

- infiltration
- filtration
- storage
- evaporation
- detention
- harvesting

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LID Strategy

The goal of LID site planning is to **allow for full development and function of the intended site activity** while maintaining the site's essential natural or existing hydrologic function.

LID techniques are used to modify hydrologic processes, such as infiltration or storage, to meet the specific water quality, water quantity, and natural resource objectives

LID Strategy

- LID strategies provide a **decentralized hydrologic source control** for stormwater.
- LID implementation is based on selecting integrated management practices, or best management practices, that are **distributed small-scale controls** that can closely **maintain or replicate hydrological behavior of the pre-project site** for a defined **design storm event**.
- **Non-structural** and **structural** LID techniques
- LID can be applied on a local scale or watershed scale
  - LID techniques can provide a micro-view of handling runoff at its source or point of origination, to mitigate adverse impacts from stormwater runoff and manage runoff on-site
  - Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions

LID – Green Infrastructure

- The green infrastructure movement began in the 1990's, when Florida, Maryland, and other states initiated programs to strategically identify, and protect connected open space systems.
- In 1999, the President's Council on Sustainable Development identified green infrastructure as one crucial element that provides a comprehensive approach for sustainable community development.
- Green infrastructure provides several benefits, including:
  - Enriched habitat and biodiversity
  - Maintenance of natural landscape processes
  - Cleaner air and water
  - Increased recreational and transportation opportunities
  - Improved health
  - Connection to nature and sense of place

LID – Green Infrastructure

The article "What is Green Infrastructure?" describes eight guiding principles to ensure green infrastructure is successful, including:

- Principle 1: Identify and protect green infrastructure before development.
- Principle 2: Involve many diverse people and organizations as stakeholders in the green infrastructure initiative.
- Principle 3: Linkage is the foundation of green infrastructure.
- Principle 4: Design green infrastructure systems that function at different scales, across political boundaries, and through diverse landscapes.
- Principle 5: Green infrastructure should be based on scientific and land-use planning theories such as: biology, ecology, urban and regional planning, geography, and landscape architecture.
- Principle 6: Fund green infrastructure up-front as a primary public investment, using the full range of available financing options.
- Principle 7: Emphasize that green infrastructure provides a diversity of both natural and human benefits.
- Principle 8: Make green infrastructure the framework for conservation and development.

LID – Green Infrastructure

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Learning Objective 2.2

- Recognize why LID is important.

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LID Importance

LID can be applied to new development, redevelopment, or as retrofits to existing development.

LID measures are more cost effective and lower in maintenance than conventional, structural stormwater controls.

LID practices perform both runoff volume reduction and pollutant filtering functions.

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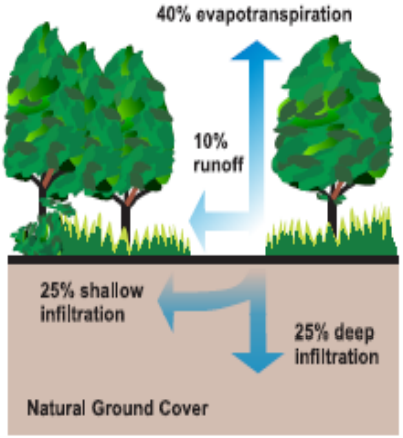
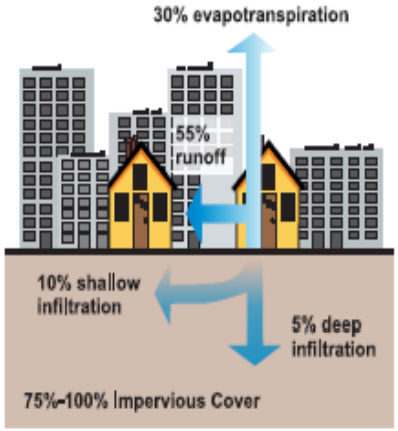
LID Importance





Source: EPA Technical Guidance Manual, 2009

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Learning Objective 2.3

- Compare the differences between conventional and LID techniques of stormwater management.

Conventional Conveyance

There are several issues related conventional storm water conveyance systems, including:

- Site changes/re-grading
- Loss of recharge
- Increased water temperature
- Decreased water quality
- Higher run-off volumes
- Expensive costs
- Infrastructure repair

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Conventional Conveyance

Conventional storm water management techniques direct all of the storm water to storm drains to remove it from the site as quickly as possible.

End-of-pipe facilities are typically designed to store and detain runoff to reduce peak flows for storm events that are infrequent, such as the 10 year, 24-hour storm.

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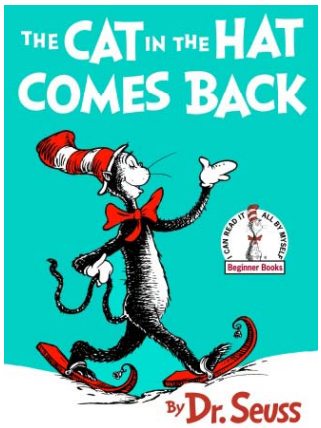
Stormwater Quality (NPS)

Dr. Seuss – *The Cat in the Hat Comes Back*



Learn from a children's classic.

- Once you get something dirty, the only way to get it clean is to make *something else* dirty.
- Thinking ahead can save us from lot of problems and prevention is better than cure.

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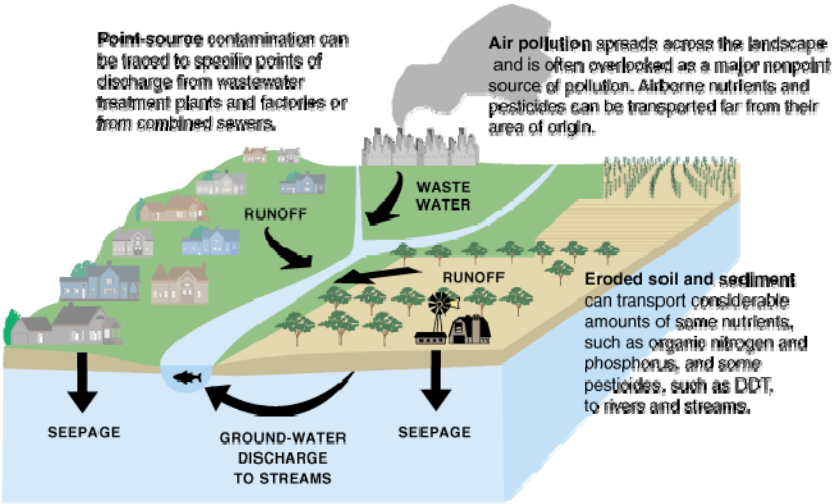
Stormwater Quality (NPS)

- Contaminated stormwater washed off of parking lots, roads and highways, and lawns (often containing fertilizers and pesticides) is called **urban runoff**.
- This runoff is often classified as a type of **Non-Point Source** pollution.

Source: ECO5280

"It goes with the flow. Keep it clean."

Stormwater Quality (NPS)



Source: USGS.gov

LID versus Conventional Stormwater Management

LID differs from the conventional stormwater management principle of conveying, temporarily storing, and releasing stormwater off site.

LID uses small scale practices to filter, infiltrate, evaporate, plant transpirate, and reuse stormwater.

LID practices treat runoff close to the source, improving water quality and retaining the additional runoff generated by development on site.

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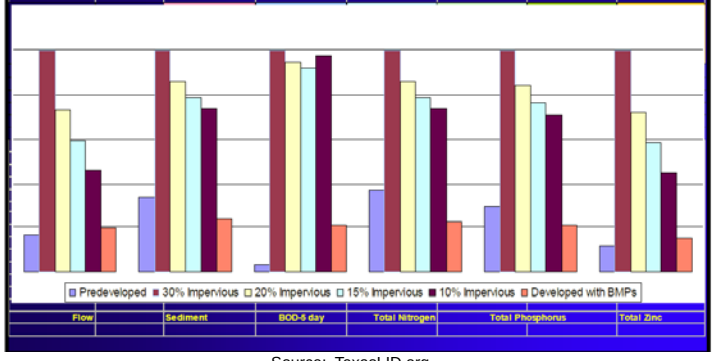
Indicators of LID Success

Indicator	Units	Predeveloped	Developed with 30% Impervious no BMPs	Developed with 20% Impervious no BMPs	Developed with 15% Impervious no BMPs	Developed with 10% Impervious no BMPs	Developed with LID BMPs
Flow	ft3/yr	37,346	225,135	164,371	133,989	104,157	44,727
Sediment	Tons/yr	0.644	1.872	1.607	1.474	1.384	0.441
BOD-5 day	lb/yr	5.15	165.70	156.85	152.42	161.40	34.42
Total Nitrogen	lb/yr	9.37	34.58	31.11	19.37	18.17	5.51
Total Phosphorus	lb/yr	1.029	3.550	2.994	2.715	2.522	0.741
Total Zinc	lb/yr	0.309	2.750	1.989	1.608	1.243	0.412



Source: TexasLID.org

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Learning Objective 2.4

- Stormwater is a resource, not a waste product. List the benefits of replicating natural watershed conditions through the use of LID technologies. List the limitations of LID.

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LID Benefits

In addition to the practice just making good sense, low impact development techniques can offer many benefits planning, economic, and environmental considerations.

Planning

- Protect regional flora and fauna
- Balance growth needs with environmental protection
- Reduce infrastructure and utility maintenance costs (streets, curbs, gutters, sidewalks, storm sewer)
- Increase collaborative public/private partnerships

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LID Benefits

Human Health and Safety

- Recharges groundwater (drinking systems)
- Reduces flooding (protects properties)
- Helps protect human health
- Protects drinking water supplies
- Increases the appearance and aesthetics of communities – quality of life
- Increases public safety

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LID Benefits

Economic

- Reduce land clearing and grading costs
- Potentially reduce infrastructure costs (streets, curbs, gutters, sidewalks)
- Reduce storm water management costs
- Potentially reduce impact fees (CWA)
- Increase aesthetics and create pride of ownership
- Lower long-term maintenance costs
- Provides cost-effective alternatives to system upgrades

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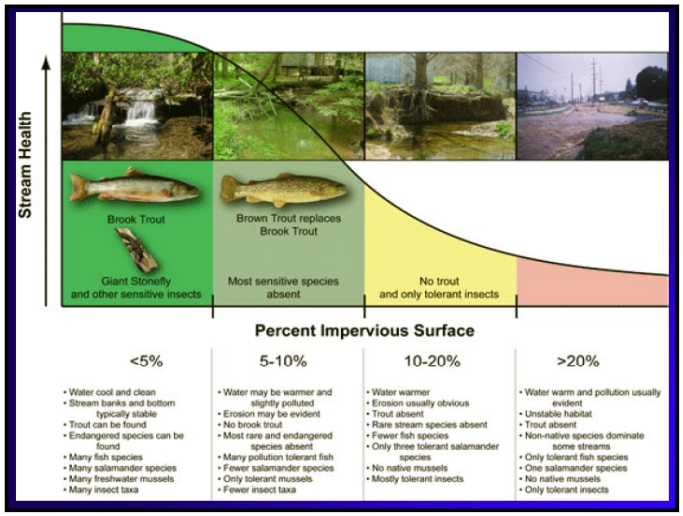
LID Benefits

Environmental

- Preserve integrity of ecological and biological systems
- Protect site and regional water quality by reducing sediment, nutrient, and toxic loads to water bodies
- Reduce impacts to local terrestrial and aquatic plants and animals
- Protects habitat (riparian buffers, wetlands, steep slopes, valuable (mature) trees, flood plains, woodlands, highly permeable soils)
- Preserve trees and natural vegetation
- Reduces flooding (protects properties)
- Recharges groundwater (aquatic systems)

LID Benefits



Source: TexasLID.org

LID Limitations

- Site conditions may limit the appropriateness of LID practices.
  - (Evaluation of soil permeability, slope and water table depth must be considered in order to effectively use LID practices.)
- Regulation limitations may necessitate the use of conventional structural BMPs in conjunction with LID techniques in order to achieve watershed objectives.
- Perception of the potential of flooding without conventional storm sewers may limit LID implementation.

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Learning Objective 2.5

- Identify who the candidates are for implementation of LID.

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LID Candidates

- Projects (MILCON and SRM)
- Redevelopment projects
- Retrofit projects
- Stewardship/Leadership/Technology
- Transfer/Interface with local communities
- State- and regional-level jurisdictions and agencies
  - Watershed-scale and project-scale opportunities

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