STORMWATER
SOLUTIONS

LID

Low Impact Development:
Protecting Oregon's waters as we grow





LID

Low Impact Development (LID) is an approach to land development that preserves natural resources and mimics natural systems for managing stormwater runoff while meeting development goals.

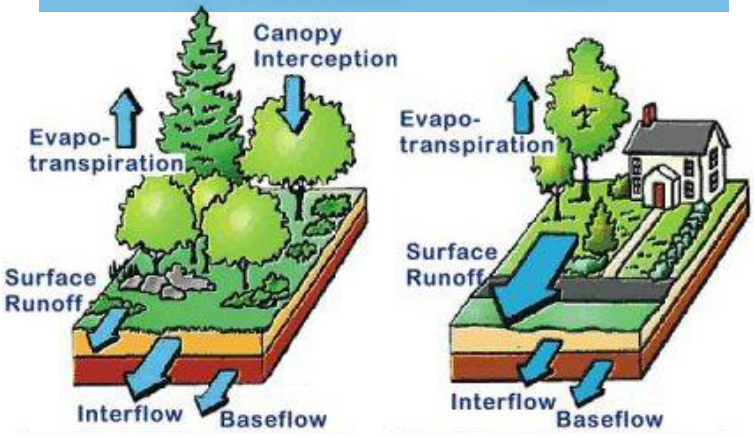
In undeveloped areas, very little rainwater or snowmelt runs off the land like it does in cities. Trees, plants and soil capture much of the precipitation, and some of it evaporates back into the air. Most of the precipitation that doesn't evaporate or get captured by vegetation soaks into the ground where soil and microbes remove pollutants naturally. The water slowly recharges streams, wetlands and groundwater. Very little runs off, except in very large storms.

This natural hydrologic cycle is radically changed when land is developed in the way it has been for decades. Typical development clears the land of vegetation and covers it with hard surfaces such as roads, parking lots and rooftops. Construction compacts soils, so that even landscaped areas can generate unnaturally high runoff volumes. Storm drains are installed to get water out of the way by sending it into local streams or injecting it underground without treatment. Development dramatically increases runoff volumes which, even when controlled by detention basins, causes flooding, damages fish and wildlife habitat, and delivers urban pollutants such as oils and pesticides to local waterways.

The decreased infiltration results in less cool, clean groundwater to recharge streams in the dry summer months.

LID mimics the natural hydrology of the site by using improved site design and careful construction practices, preserving trees and natural areas, careful construction practices, and managing water close to where it falls. LID can be used for public projects, residential and commercial development and redevelopment, and has proven to be a cost-effective way to manage runoff and protect the environment. It also increases livability by making communities greener and more attractive.

Conventional Development Increases Runoff



Before Construction | After Construction

THE BENEFITS

If implemented properly, LID practices can produce great outcomes all around.

For the environment

- Protects water quality
- Maintains natural stream flows in rivers, creeks and wetlands
- Provides and protects fish and wildlife habitat
- Improves air quality
- Maintains soil quality

For developers

- More attractive, sustainable neighborhoods that sell faster and for a premium
- Reduces stormwater utility fees
- Reduces the cost of clearing, excavation, compaction, erosion control, and infrastructure construction
- Can provide more buildable lots by distributing stormwater management around the site in small facilities instead of building a single large detention pond

For communities

- Helps prevent flooding and reduces the cost of associated damage
- Helps maintain clean drinking water supplies
- Can lower cost of streets, curbs, gutters and other infrastructure
- Increases the aesthetics of neighborhoods
- Reduces long-term maintenance costs

For agencies

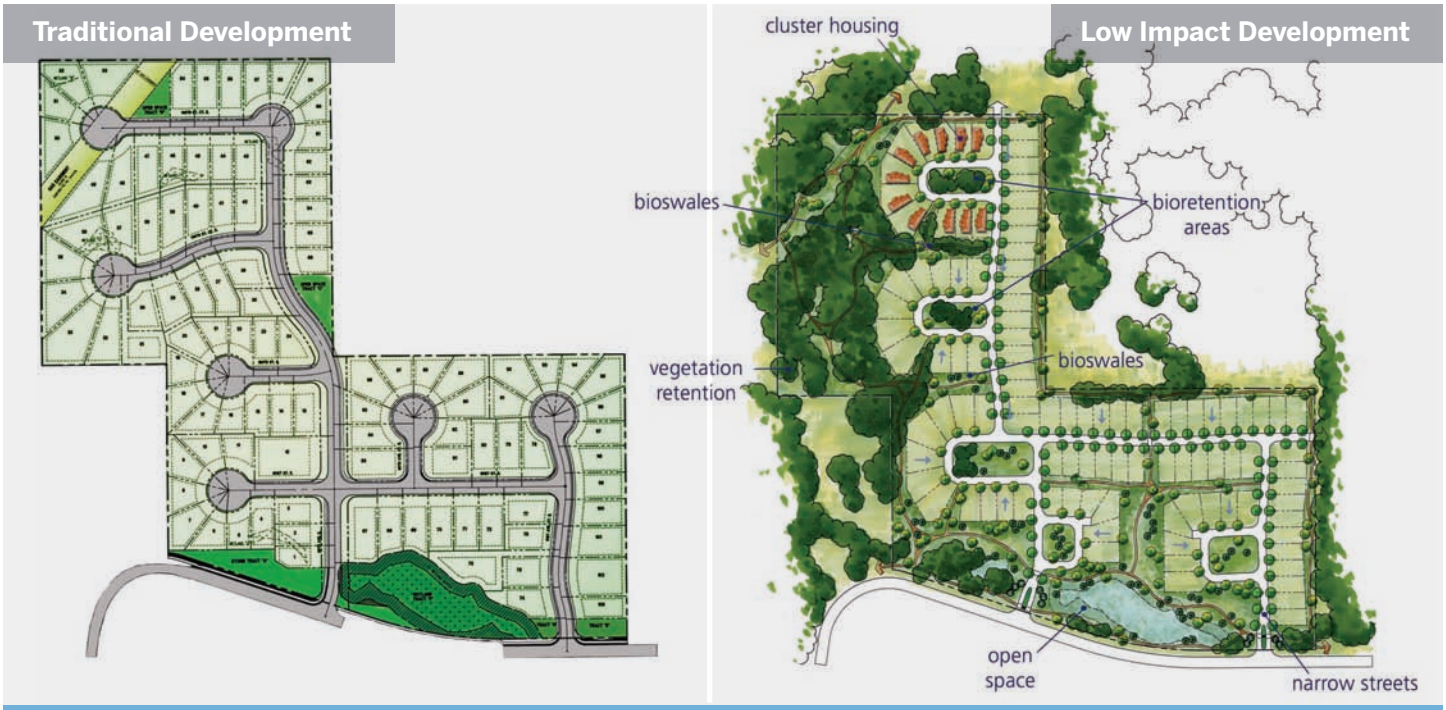
- Helps meet regulatory requirements, including the Federal Clean Water Act (MS4 permits and TMDL plans), Endangered Species Act, Safe Drinking Water Act, and state land use planning goals 5 and 6

LID BEST PRACTICES

1

Improved site design

- Cluster development on a smaller part of the site to preserve areas with native vegetation.
- Minimize impervious surfaces by using narrower streets, shared driveways, and fewer parking spaces.
- Trees are an important part of site design. They provide great aesthetic value to communities, and are vital in capturing stormwater. Plan to give root systems room to grow, so they can be effective.



LID minimizes impacts throughout the development process.

2

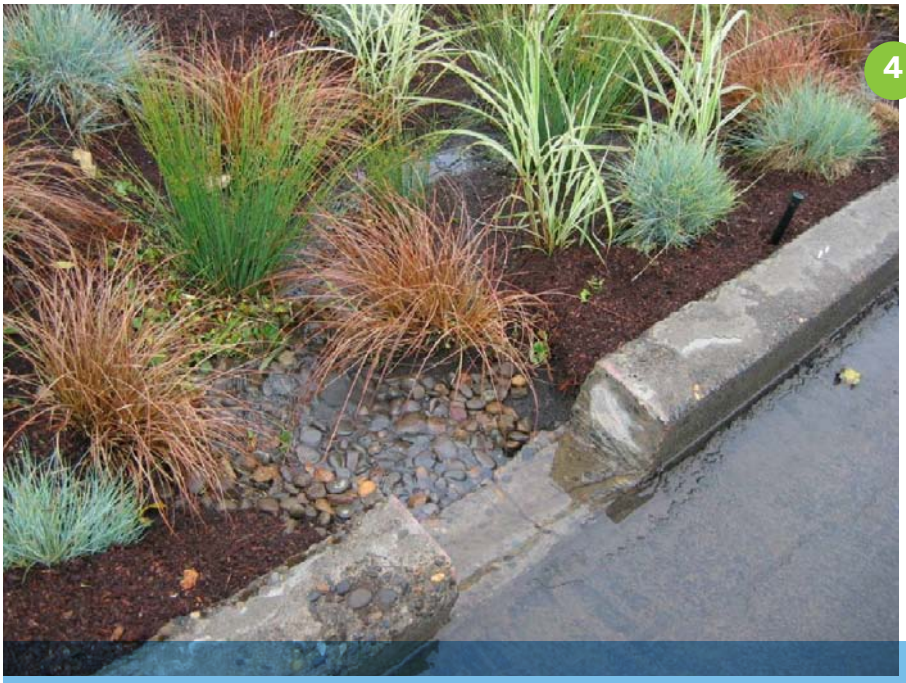
Careful construction practices

- Avoid compacting soils so they retain the ability to absorb stormwater.
- Prevent / control erosion by mulching exposed soils and using compost berms, compost socks or wattles (in photo, at left) instead of sediment fences, which are ineffective.
- Protect trees by fencing them off around the dripline. Trees are often killed by soil compaction and root disturbance.
- Use compost to restore the health of soils disturbed by construction.

3

Maintenance and education

- Develop reliable and long-term maintenance programs with clear and enforceable guidelines.
- Educate property owners and landscape crews on the purpose of LID facilities and how to maintain them properly.



4

Bioretention facilities

Shallow, landscaped basins use soil and plants to soak up runoff and filter out pollutants. Examples include: tree wells, rain gardens, swales, filter strips, and stormwater planters.

LID manages water close to where it falls.

On areas of the site that are developed, LID uses small-scale stormwater facilities that are integrated into the landscape and reduce reliance on traditional storm sewers, pipes, and detention ponds. These practices can also be used to retrofit already developed sites.

Porous pavement

5

A variety of alternative surfaces for walking, driving or parking can remove pollutants as water passes through before soaking into the ground. Examples include permeable pavers, pervious concrete, porous asphalt, and porous flexible paving systems filled with grass or gravel.

6

Rainwater harvesting

Runoff can be collected and treated for use in irrigation, toilet flushing or drinking. This reduces runoff and demand for treated municipal water.

Photo: Tammie Stark

Vegetated roofs

7

These green roofs have a waterproof layer, lightweight growing media, and plants. They reduce runoff through evaporation, provide insulation as well as wildlife habitat, improve air quality, and outlast conventional roofs.

LID ECONOMICS

Even though LID is in its infancy, there are over 200 best practices that provide **practical, viable and economical solutions** to development projects of any type or scale.

Reduced hard infrastructure
LID can reduce traditional costs for hard infrastructure, like paving for roads and driveways and installing curbs and gutters. This can reduce the size of, or completely eliminate the need for detention ponds, resulting in more buildable lots. LID can also offset costs associated with regulatory requirements for stormwater control, like permits for drywells or Underground Injection Controls (UICs).

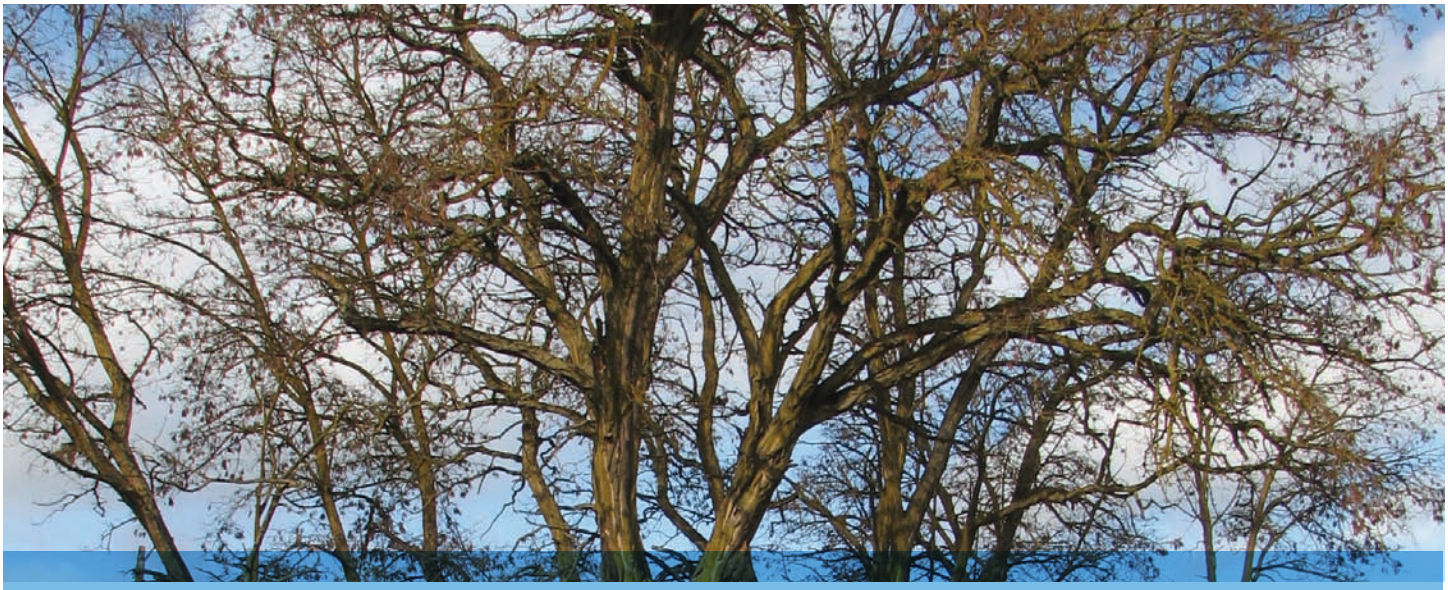
Reduced costs
A City of Portland study found that in retrofit projects for sewer overflows and flooding, bioretention facilities were much less expensive than pipe-only solutions, and also benefitted community aesthetics.[1]

An EPA analysis of 17 developments with conventional stormwater management requirements around the U.S., found that, in most cases, LID project costs were lower than the compared conventional solution. Total capital cost savings ranged from 15-80% when LID methods were used.[2]

Techniques like minimizing impervious surfaces, building over previously disturbed areas, reducing excavation, limiting compaction and aligning utilities in one trench all reduce construction and landscape restoration costs, even in jurisdictions without stormwater management requirements.

Installation and design costs of LID will continue to decline over time as its users, suppliers and general practices becomes more widespread.

Environmental + community benefits
LID provides ecosystem services and economic benefits to the community that conventional stormwater controls do not.



Common concerns have practical solutions

Clay soils There are many LID options for areas with low soil infiltration rates. Bioretention facilities can be designed to treat water quality with small amounts of infiltration. Green roofs manage runoff solely through evaporation. Porous pavements are ideal if the clays aren't expansive. They manage only the precipitation that falls directly on them, and are built on top of a base layer of crushed stone with high voids that provide space for water storage. There are many non-structural practices for clay soil sites, like roughening surfaces to delay overland runoff, compost amendment, rainwater harvesting, limiting compaction, and planting trees.

Local codes and standards Municipalities with outdated stormwater regulations typically require that builders file variances if they want to use LID practices. This can increase a builder's design and regulatory costs, delay construction and increase financing costs. Updating local development codes and standards to encourage LID can help reduce the regulatory risk and expense that builders sometimes face.

Maintenance Maintenance costs for well-designed vegetated LID facilities are 5-7% Maintenance of vegetated stormwater systems is similar to that of traditional landscapes with some added maintenance for conventional components like catch basins. Porous pavements require annual vacuum sweeping. Maintenance costs for well-designed vegetated LID facilities are 5-7% of the construction costs compared to 3-5% for conventional stormwater facilities.[2]

State plumbing code The state plumbing code does not preclude the use of LID.

Detention ponds are not LID
To protect streams from high flows, regulations sometimes require developers to install large ponds. Yet ponds don't reduce the overall volume of runoff, they don't recharge aquifers, and they don't remove pollutants as effectively as bioretention. Ponds also take up valuable land, are difficult to maintain, create mosquito breeding areas, and can be unattractive and unsafe for small children. In addition, stormwater released from ponds can be too warm for salmon. LID presents an improved set of tools for developing land and managing runoff.

STORMWATER SOLUTIONS

CHOOSE LID.

Improve Oregon's waters and communities.
Low Impact Development benefits all – developers, communities, agencies and the environement. Learn more about the many LID options that can be implemented on your projects, and how to implement them with success.

References

[1]City of Portland. (2009). Tabor to the River: Brooklyn Creek Basin Program. Retrieved December 10,2009 from http://www.portlandonline.com/bes/index.cfm?c=50500&a=230066.

[2]United States Environmental Protection Agency. (2009). Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices. Retrieved December 10, 2009 from http://www.epa.gov/owow/nps/lid/costs07/.

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Project Partners

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LID Around Oregon

The photos in this fact sheet highlight examples of public and private LID projects from around the state. Photo descriptions and credits:

Cover: Salmon (photo: Michael Brunk), Bottom row, left to right: Raingarden in North Portland (photo: OEC), Green street in SE Portland (photo: City of Portland), Preserved trees at Twin Creeks Community in Central Point (photo: OEC), RCC-SOU Medford Campus stormwater planter (photo: OEC), Villebois Residential Community, Wilsonville (photo: Costa Pacific Communities)

Page 2: Illustration: Maryland Department of the Environment

Page 4:
1. Graphic by AHBL for the LID Technical Guidance Manual for Puget Sound, 2005. Reprinted with permission from the Puget Sound Partnership
2. Erosion prevention example (photo: Green Girl Land Development Solutions)
3. City of Salem 12th Street bioswale (photo: OEC)

Page 5:
4. Left: Gresham green street bioswale (photo: City of Gresham) Boardman City Center bioswale (photo: City of Boardman)
5. Top: Port of Portland pervious asphalt (photo: Century West Engineering)
Porous pavers at Clean Water Services Field Operations Center in Beaverton (photo: OEC)
6. Cistern at a private home in Eugene (photo: Tammie Stark)
7. SeQuential Biofuels fueling station green roof in Eugene (photo: SeQuential Biofuels)

Page 6/7:
Porous pavers on a public street in Gresham (photo: City of Gresham), Rain garden at Lane Transit District Springfield station (photo: OEC), Twin Creeks Community, Central Point (photo: OEC)

To learn more about LID in Oregon, please visit our website: oeconline.org/stormwater http://extension.oregonstate.edu/watershed/

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