NC COOPERATIVE EXTENSION - WATERSHED EDUCATION FOR COMMUNITIES AND OFFICIALS

Low Impact Development - an economic fact sheet

Low Impact Development mimics the natural water cycle of the landscape, reducing the negative impacts of storm water runoff pollution on streams and rivers.

Communities first learning about Low Impact Development (LID) often ask, "Does it cost more than conventional development?"

Decision makers may ask "How can we communicate the costs and benefits of LID to developers and citizens?"

The purpose of this factsheet is to provide basic economic information on Low Impact Development. This simplified overview of a complicated topic is intended to help citizens, developers, and policy-makers have an informed discussion about the costs, benefits, and trade-offs of LID in their community.

The importance of recognizing long-term benefits of LID and those benefits that are not easily monetized are also highlighted.

The factsheet is a summary of information from multiple sources, including some examples of LID economic studies. We are thankful for the original researchers' and writers' time and effort.

Every LID site will have different costs and benefits based on many things including the site itself, the development design, and construction costs. There is a perception that any change to traditional development norms, including new technology will have higher costs and less profit. Numerous examples in this factsheet prove otherwise. In addition, protecting natural ecosystems through sound LID practices provides numerous benefits to communities.

This fact sheet results from a project in Transylvania County, NC. A US Environmental Protection Agency grant provided through the NC Division of Water quality allowed NC Cooperative Extension and other partners to work with the Transylvania Natural Resources Council to involve the community in open discussions about the use of Low Impact Development to allow growth and protect natural resources.

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A brief definition of LID

The purpose of LID is to mimic the natural water cycle of the landscape, reducing the negative impacts of storm water runoff pollution on streams and rivers. LID includes the following five basic strategies, with multiple techniques for each strategy:

Conserve resources. At the watershed, subdivision, project, and individual lot level, retain natural resources (trees, water, wetlands), drainage patterns, topography and soils whenever possible.

Minimize impact. At all levels, attempt to minimize the impact of construction and development on natural hydrologic cycles and ecological systems by conserving native vegetation, reducing grading and clearing, and decreasing impervious surfaces.

Optimize water infiltration. To the maximum extent practicable, slow runoff and encourage more infiltration and contact time with the landscape by retaining natural drainage patterns, reducing channelization, using vegetative swales, lengthening flow paths and flattening slopes.

Create areas for local storage and treatment. Rather than centralizing stormwater storage, distribute storage across the landscape, adjacent to areas of flow. Use small-scale best management practices (BMPs) such as raingardens and swales which allow for collection, retention, storage, infiltration, and filtering on-site.

Build capacity for maintenance. Develop reliable, long term maintenance programs with clear and enforceable guidelines. Educate homeowners, management companies, and local government staff on the operation and maintenance all practices, and about protecting water quality.

Are conservation developments (and cluster developments) LID?

A **conservation development** sets aside land in permanent easement that will not be developed. The remaining land is usually developed at higher densities, possibly allowing the same or more lots on less area. Typically, conservation developments protect 40% - 50% of the available land on a parcel. Many communities are familiar with the term cluster development. A **cluster development** places homes closer together on smaller lots. Whether or not land is set aside for protection depends upon the local government's ordinance or subdivision regulations.

LID may include conservation development and vice versa, but neither completely incorporates the goals of the other. For example, LID may be used within a highly developed downtown urban area. It is also possible for conservation developments to protect land while at the same time using conventional stormwater management practices that may not optimize water infiltration and treatment.

Defining the terms and goals of various types of development will help a local community to clarify whether they are meeting these goals.

Assessing the economics of LID [8]

Three methods are mainly used to assess the economics of LID.

Most often **cost comparisons** are performed using the initial construction costs only. By not including benefits of improved stormwater management and reduced maintenance costs, this method gives an incomplete assessment. However a cost comparison is the simplest to perform and therefore the most widely available.

The next type of assessment is a **life-cycle cost analysis**, which includes planning, design, installation, operation and maintenance (O&M) and decommissioning. This analysis, although more complete than construction cost only, still excludes economic benefits and ignores differences in effectiveness. The third analysis, **benefit-cost analysis**, considers the full range of costs and benefits, including the long term life cycle costs of the construction, but also the economic benefits resulting from LID. This analysis requires more data and time, costs more to produce, and is therefore less often undertaken.

Environmental goods and services, such as clean air, clean water, or healthy fish populations, are not easily measured in monetary terms because they aren't traded in markets like consumer items such as houses, oil or timber. Yet, environmental goods and services are at the heart of our quality of life, and have value even if we don't observe "market prices" for them. Benefit-cost analysis of LID programs needs to include the value of these goods and services to society in order to be accurate. Estimation of these values is called **non-market valuation.**

What are some economic benefits of LID?

Example benefits to homeowners:

- Reduced flooding – onsite stormwater management reduces downstream flooding. A marginal reduction in flooding increases floodplain property values by up to 5%.[5]
- Reduced cooling costs – reduced pavement and increased natural vegetation reduced home energy bills by 33-50% compared to surrounding neighborhoods in Davis CA.[6]
- Increased amenity values – a preliminary analysis concluded that Seattle's BMP retrofitted "greenstreets" added 6% to the value of properties.[8]
- Significant improvement in water quality can increase market value by 15% for properties bordering the water body.[5]
- Reduced stormwater fees if local government charges fees based on impervious surface.
- Reduced cooling needs because more trees and greenspace are retained.

Example benefits to local governments:

- Protecting water quality helps protect real estate values, which protects tax revenues.
- Reduced inflow and infiltration – less stormwater leaking into sanitary sewers means less volume of water reaching sewage treatment plant.
- Reduced filtration costs – bioretention instead of piped stormwater and sand filters saved $250,000 along Anacostia River in Washington, DC.[6]
- Reduced public expenditures on stormwater infrastructure including expensive retrofits.
- Reduced system-wide operations and maintenance costs of pipe infrastructure.
- Extension of the useful life of central pipe infrastructure as populations increase.
- Reduced regulatory costs associated with water-quality impacts, such at threats to sensitive species, TMDL compliance, etc.

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What are some economic benefits of LID?

(Continued from page 4)

Example benefits to developers:

- Increased number of buildable lots – reducing the need for stormwater retention ponds may result in more lots available for homesites.
- Less spent on infrastructure - replacing curb, gutter, and storm sewers with roadside swales saved one developer $70,000 per mile, or $800 per residence.[8]
- Increased property values – lots in LID neighborhoods sold for $3000 more than lots in competing areas not using LID.[8]
- Initial savings from LID are usually accomplished through less conventional stormwater infrastructure, less paving, and lower site preparation costs.

Example benefits to the community:

- Protecting natural ecosystems through sound LID practices provides benefits to communities such as: reduced flooding, improved water quality, increased groundwater recharge, improved air quality, enhanced aesthetics, enhanced property values, increased open space, and carbon sequestration. These are all **ecosystem services.**
- Protecting water quality through LID maintains the value of clean water, which is usually less expensive than cleaning contaminated water. Not having to clean contaminated water is an **avoided cost**.
- Clean water is a quality of life benefit: although difficult to quantify, its value may rival or exceed more tangible benefits. For example, protecting human health is the driving force behind the nation's water supply protection program.
- Reduced flooding, reduced stream erosion, and reduced pollutant loading to downstream waters.

A sampling of economic studies

- In the Central Valley of CA, for every 1,000 deciduous trees, stormwater runoff is reduced nearly 1 million gallons – a value of almost $7,000 per storm event.[6]
- In Maryland and Illinois studies show new residential development using LID infrastructure stormwater controls saved $3500 - $4500 per lot (1/4-1/2 acre) compared to new development with conventional stormwater controls. In addition to lowering costs for developer, these sites discharged less stormwater than conventional developments.[6]
- Pilot project estimates suggest LID projects can be completed at a cost reduction of 25-30% over conventionally developed projects. The need for costly stormwater ponds, drainage pipes, curbs, gutters, wide streets is eliminated or greatly reduced. These costs are usually much higher than the LID costs of relatively inexpensive features such as bioretention raingardens, wetlands, cisterns, etc.[2]
- Homebuyers' willingness to pay for amenity values in the Shepards Vineyard housing development, Apex NC, added $5000 to the price of 40 homes adjacent to the regional greenway, and those homes were still the first to sell.[13]
- The Auburn Hills subdivision in Wisconsin used LID stormwater management, preserved 40% of the site as open space, and saved $761,396 even with the inclusion of higher landscaping costs for LID development.[3]
- The Gap Creek subdivision in Sherwood, Arkansas revised an original subdivision plan and included LID concepts. Open space was increased from 1.5 acres to 23.5 acres. Lots sold for $3000 more and cost $4,800 less to develop, resulting in $2.2 million additional profit to the developer.[3]
- The Prairie Glen Subdivision in Germantown, Wisconsin preserved 59 % of the site as open space, incorporating LID and conservation subdivision design. Hiking trails within the site gave residents easy access to the natural areas. Savings resulted from LID stormwater management, reduced infrastructure for roads, utilities, and water distribution. The design resulted in a savings of over $600,000 compared to conventional subdivision design.[3]
- Implementing LID in Lockwood Folly, Brunswick County, NC would reduce the size of the required stormwater pond, making room for an additional home, and increasing developer revenues by up to $91,000. [4]
- The Congaree Bottom Hardwood Swamp outside Columbia, SC is a natural water quality improvement facility, filtering toxins, sediment and nutrients from runoff. Replacing this with man-made infrastructure would cost $6.7 million in 2003 dollars. [9]

Thinking about the tradeoffs: discussing the economics of LID

- Operation and maintenance (O&M) of stormwater management systems is not paid by developers, but by local government, homeowners, or HOAs. It is important to consider these costs and who bears them.
- Traditional development removes rainfall from sites as quickly as possible, increasing environmental and management costs. Which is more costly: (1) a private landowner handling rain where it falls, or (2) all private landowners passing the rain to a public entity to handle?
- When development causes damage to natural resources and diminishes ecosystem services, the true costs of that development may be hidden. Historically these costs are paid by citizens in the form of increased water filtration, reduced aesthetics, and decreased property values.
- Communities have two types of stormwater management assets - natural (wetlands, forests, etc) and structural (pipes, facilities). Reducing natural assets may require an increase in structural assets. Protecting natural systems provides multiple benefits at lower costs.
- Recent research at Duke University shows that it is cheaper to build conservation developments than conventional developments in western NC.[15]
- Consider retrofitting existing development with LID practices during regular operation and maintenance.
- Shifting storm water maintenance to the private landowner may be problematic. Some local governments handle this by requiring stormwater management to occur on jointly held homeowner association property with easements, as compared to on private landowner lots. Regular inspection is necessary.
- A benefit-cost analysis provides decision makers and stakeholders with a more complete picture for evaluating trade-offs of different development types.
- When considering the tradeoffs of development it is imperative that all benefits and costs associated with each option are measured. Non-market values for ecosystem services are becoming more available and should be considered when discussing the relative benefits and costs of LID and traditional development.

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