

## What is LID?

### Division of Water Quality (DWQ) Commitment to Low Impact Development (LID)

- DWQ shall establish and foster partnerships to identify and ameliorate, to maximum extent technically feasible, policies, procedures, programs, technical guidance, ordinances, and rules that affect and/or impede Low Impact Development (LID).
- DWQ shall work with our partners to identify and promote educational opportunities, identify internal and external outreach opportunities and activities, and identify opportunities for public involvement.
- DWQ shall identify and ameliorate, to maximum extent technically feasible, DWQ policies, procedures, programs, technical guidance, and rules that affect and/or impede LID.

### LID Works Everywhere

LID works everywhere and can be applied to new development, redevelopment, or as retrofits to existing development, whether you're building a road, developing or redeveloping commercial industrial, or residential property, or restoring a site's natural hydrology. LID has been applied to a range of land uses from high density ultra-urban settings to low density developments. On a broader scale, LID can maintain or even restore a watershed's hydrologic and ecological functions.

### Three principles that Distinguish LID from Traditional or Conventional Approaches

First, instead of designing SCM around a predetermined site plan, as often is the case, LID is a holistic approach that incorporates LID SCM and techniques as part of the site planning and site screening. LID works with the site's attributes to manage stormwater, employing principles such as preserving natural landscape features such as open space and tree cover, preserving soils with good infiltration rates, and minimizing effective imperviousness.

Second, LID decentralizes SCM. In lieu of traditional end of pipe SCM, LID treats stormwater runoff in smaller SCM placed throughout the site.

Third, LID is based on reducing stormwater runoff volume. LID reduces runoff volume by:

- Utilizing SCM and techniques that promote infiltration of flows and groundwater recharge for the purpose of maintaining stream base flow, i.e., amended soils, rain gardens, and bio-retention cells.
- Utilizing SCM that use and reuse stormwater runoff, i.e., cisterns, rain barrels, irrigating landscaping, etc.

### What Distinguished Traditional or Conventional Approaches from LID

First, SCM are typically added to the design rather than incorporated into the design. Second, SCM are generally placed in one or two low spots rather than placing smaller SCM throughout the site. And third, stormwater runoff is conveyed to one or two central SCM designed to meet pollutant removal standards. Where LID is not practical, traditional and conventional approaches can be used to meet NC standards – except in the Goose Creek, Waxhaw Creek and Six Mile Creek Watersheds.

## **Holistic Approach**

As a holistic approach to site development LID maintains a site's hydrology to the maximum extent technically feasible by creating a landscape that mimics natural hydrologic functions of infiltration, runoff, and evapotranspiration. To the maximum extent technically feasible, LID:

1. Promotes infiltration at or near the source, reuse and rainwater harvesting, and uses practices, such as soil amendments, that enhance infiltration. Integrated small-scale practices and controls distributed throughout the site, promoting infiltration, short term retention and storage, filtering and collection at the point of generation reduce or eliminate the need for a centralized structural stormwater control device. Design techniques may include rain gardens and bioretention cells, rooftop retention, directing rooftop runoff to an appropriately sized and designed rain garden, and rain barrels and cisterns. Designs can incorporate alternative stormwater management practices such as functional landscape that act as stormwater facilities, flatter grades, depression storage and open drainage swales. Disconnection practices may be applied in almost any location, but impervious surfaces must discharge into a suitable receiving area for the practices to be effective. Roof leaders, roadways and other impervious areas that are disconnected from stormwater conveyance systems allows runoff to be collected and managed on site or dispersed into the landscape.
2. Encourages site screening at the onset of the design. Preserving highly permeable Type A and Type B soils for infiltration and utilizing Type C and Type D soils for BUA.
3. Minimizes or reduces impervious surfaces. Design techniques may include permeable pavement, green roofs and locating pavement under existing (and preserved) tree canopies. Residential streets are designed for the minimum required width needed to support traffic, parking, and emergency and waste service vehicles. Practices include shared driveways and parking lots, alternative pavements for overflow parking areas, center islands in cul-de-sacs, alternative street designs rather than traditional grid patterns and reduced setbacks and frontages for homes.
4. Minimizes land disturbance, conserves natural areas and open spaces to maintain infiltration rates to the maximum extent practicable.
5. Maximizes vegetated and natural conveyances. Whenever possible preserve natural flow paths and existing vegetative features and direct stormwater flows across vegetated areas. Promote infiltration and more contact time with the landscape by saving natural drainage patterns, using sheet flow, vegetative swales, lengthening flow paths and flattening slopes. To the maximum extent technically feasible, plans should locate higher density areas in upland areas, away from surface waters, drainage ways and stormwater drains and use disconnected impervious surfaces to reduce piped and/or vegetative conveyances.

## **Restoring or Maintaining Pre-development Hydrology**

Restoring or maintaining pre-development hydrology has emerged as a control approach for several reasons. Most importantly, LID directly addresses the root cause of the impairment. Traditional SCM have been selected in an attempt to control the symptoms (peak flow, and excess pollutants), but this strategy is not fully adequate because of the scale of the problem, the cumulative impacts of multiple developments and the need to manage both site and watershed level impacts. With current approaches, it is also difficult to adequately protect and improve water quality because the measures employed are not addressing the main problem which is a hydrologic imbalance.

## **Benefits of LID**

By implementing LID SCM and LID techniques, stormwater can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Decentralized SCM not only improves water quality, but also eliminates the need for expensive piping and other infrastructure reducing the cost to build and maintain SCM. Reducing runoff not only improves water quality, but may also reduce the size of SMCs or even eliminate the requirement to provide an end of pipe SCM altogether. Finally, in addition to improved water quality, reduced construction and maintenance cost, an LID approach often allows the developer more opportunities to develop land that would otherwise be needed for a large end of pipe SCM. LID integrates site conditions to:

- Preserve and protect wetlands, surface waters, streams, flood prone areas and sensitive water bodies
- Minimize land disturbance
- Reduce stormwater runoff and stream bank erosion
- Promote infiltration and evapotranspiration
- Promote groundwater recharge
- Maintain stream base flow
- Maximize vegetated and natural conveyances
- Minimize or reduce imperviousness.
- Conserve natural areas and open spaces
- Disperse stormwater control measures into the landscape and manage stormwater runoff at or near the sources of the runoff thus provides flexibility and alternatives to a centralized stormwater control measure
- Improve aesthetics
- Reduce infrastructure, thus reducing capital expenses, maintenance cost, and operating cost
- Increase marketability and value

## Impediments to LID

Impediments to LID include:

- Emergency and waste management services that insist on wider and wider access roads to accommodate larger and larger equipment.
- Local ordinances with requirements for parking, curb and gutter, street widths and lengths, cul-de-sac requirements, side walk and drive ways, setback and frontage, etc.
- NCDOT standards
- Parking “needs” are often mandated, often through lease agreements, by commercial and retail businesses.
- Uncertainty in performance and cost. There is a general lack of education for home builders, realtors, lenders, regulators, legislators, home owners, and developers. Many do not understand LID. Questions that impede LID include, “Can you get a state permit for LID? What is LID? What does it cost? Is it going to take longer to get a permit and complete the construction? Does it provide equal or better water quality controls? Will it control the larger storm events? Is it only for projects with good soils and where the SHWT allows infiltration? Is LID is merely an alternative to traditional stormwater control measures?”
- The cost to set up an HOA
- Resistance to change. Developers know what will work. They aren’t so sure about LID
- Flood control mandates by local governments. Ponds designed to detain large storm events is seen as an impediment to LID. Without large ponds developers fear they will be held accountable for flooding if LID doesn’t work. Note: Several local governments will allow a variance if the developer can show there will be not be an impact on flooding, i.e, discharges directly to the Cape Fear River.
- Consumers do not demand LID nor is LID is not required. There are no state or local mandates to utilize LID practices. For the most part LID is voluntary.
- Responsibilities for implementing stormwater requirements are fragmented. In addition to state and Federal requirements, each local government has unique 1) ordinances, 2) flood control requirements, 3) project review and permitting processes, etc. Further the various elements of design and build are fragmented, i.e. developers, designers and engineers, those responsible for stormwater, landscape companies, builders, local and state regulators, etc.
- Guidance and technical questions. Can soils with low infiltration rates reliable infiltrate, over time, the design storms? Do tight soils seal up? What effect does compaction have on infiltration? Is the required two feet separation from the water table necessary?
- Design standards, i.e., the requirement for two feet above the seasonal high water table may impede LID and the requirement have a minimum hydraulic conductivity of 0.52 inches per hour may impede LID.
- Lack of design standards, i.e., disconnected surfaces, overland flow, and innovative systems.
- Design requirements, i.e., demonstrating equal or better stormwater controls., provide equivalent protection , overland flow, ensure water quality standards and uses are not threatened.
- Access to private property to inspect and maintain stormwater control measures, i.e., code enforcement would be a nightmare, deed restrictions, and operation and maintenance concerns, higher perpetual inspection requirements.
- Traditional/Conventional approaches can be cost effective and provide equivalent protection

## **False Perceptions**

1. “LID is merely an alternative to traditional Stormwater Control Measures (SCM).”

Rather than looking to LID as the alternative to traditional Stormwater Control Measures (SCM), LID should be the standard for all commercial, industrial, and residential development and redevelopment throughout the State. Traditional SCM should be the alternative and only allowed if the applicant has demonstrated that it is not practical to use LID SCM and techniques. There are three principles that distinguish LID from traditional approaches to stormwater management.

2. “LID will not work in certain soils or may be limited by the SHWT.”

While utilizing certain traditional SCM may be limited by the soils or the SHWT, LID should not be discounted. If specific SCM will not work based on the soils and SHWT, they won't work regardless of the approach the developer takes.

3. “LID doesn't address large storm events. Ponds designed to detain large storm events is seen as an impediment to LID.”

Again LID considers the site's best attributes. Either way, both the traditional approach and the alternative LID approach must be designed for the same storm events.

4. “The developer will be held accountable for flooding if LID doesn't work.”

Again LID considers the site's best attributes. The developer will not be held any more accountable for using an LID approach in lieu of using a traditional approach. Indeed, one might argue that the contractor has demonstrated due diligence by incorporating traditional SCM as part of the initial site planning rather than designing SCM around a predetermined site plan.

5. Only the local government can provide the necessary documentation that the project has met the local LID criteria – DWQ has not established the minimum LID criteria.

DWQ has had minimum LID criteria for some time. LID practices and techniques are described in detail in DWQ's BMP Manual and DWQ's LID Guidebook. What's important is that applicants demonstrate that they are employing the fundamental principles of LID, i.e., 1) preserving natural landscape features such as open space and tree cover, preserving soils with good infiltration rates, and minimizing effective imperviousness, 2) treating stormwater runoff in smaller SCM placed throughout the site, and 3) reducing runoff.

DWQ allows local governments with approved LID programs to determine whether or not a project is LID. Further, DWQ will allow a certified NC LID Professional to determine whether or not a project is indeed LID. The purpose of DWQ “approval” is to ensure a certain level of consistency state wide with respect to LID. Until those local programs are approved, DWQ will still have to make the call as to whether or not the project is LID.

6. DWQ requires a separate O&M plan and separate supplement forms for each BMP.

DWQ is developing a DWQ LID supplement form and several local governments do use a state accepted LID-EZ supplement form to facilitate the permit process and to provide the necessary documentation to DWQ that the project is indeed LID. Use of the LID EZ spreadsheet allows the designer of an LID project to forego all the various supplement forms. In the absence of the LID EZ spreadsheet, each proposed BMP under LID would be placed onto a supplement form.

Under 15A NCAC 02H .1008 (i), prior to approval of the development by the Division an operation and maintenance plan or manual shall be provided by the developer for stormwater systems, indicating the operation and maintenance actions that shall be taken, specific quantitative criteria used for determining when those actions shall be taken, and who is responsible for those actions. The plan must clearly indicate the steps that shall be taken and who shall be responsible for restoring a stormwater system to design specifications if a failure occurs and must include an acknowledgment by the responsible party. Development must be maintained consistent with the requirements in these plans and the original plans and any modifications to these plans must be approved by the Division.

A sustainable stormwater program must have a viable mechanism to ensure practices are installed and maintained over time. Unlike developments with one or two BMPs, a low impact development relies on a stormwater management system. The required maintenance plan or manual for that *system* must include an educational component and indicate:

- What inspections and maintenance actions that shall be taken,
- When those inspection and maintenance actions shall be taken, and
- Who is responsible for those actions.

7. Smaller SCM placed throughout the site may not be capable of treating the entire drainage area.

Under LID, each BMP may not necessarily be designed to meet the minimum volumes or surface areas for that drainage area. For example, if a roofed area drains to a rain garden that is capable of holding 400 cf of volume, but the amount of roof area generates a 500 cf. DWQ can approve of it as long as that additional 100 cf is made up for downstream or in another proposed BMP.

Also, if the Project is determined to be LID, DWQ allows the curve method to be used for LID projects to calculate the water quality volume that must be managed. (Reference NCDENR Stormwater BMP Manual, Chapter 3, Section 3.3.1 and Section 3.3.2).

8. LID won't work in low sites or fill areas or sites with bad soils.

Compacting soils and/or using fill can reduce infiltration by as much as 98%. While, LID won't be as effective in low sites, where fill or compacted soils has altered the infiltration of the soils, or with bad soils as it might otherwise be on Type A & Type B soils but LID might still reduce the overall volume to be treated in conventional end of pipe system. Low sites or fill areas, with bad soils might be a good reason to allow conventional end of pipe BMPs.

9. LID is required to meet the MEP standard.

The performance standard is MEP. The entity can use either LID or traditional end of pipe treatment to meet those performance standards. There are three principles that distinguish LID from traditional or conventional approaches. First, instead of designing SCM around a predetermined site plan, as often is the case, LID is a holistic approach that incorporates LID SCM and techniques as part of the site planning and site screening. LID works with the site's attributes to manage stormwater, employing principles such as preserving natural landscape features such as open space and tree cover, preserving soils with good infiltration rates, and minimizing effective imperviousness. Second, LID decentralizes SCM. In lieu of traditional end of pipe SCM, LID treats stormwater runoff in smaller SCM placed throughout the site. And third, LID reduces runoff by:

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- Utilizing SCM that use and reuse stormwater runoff, i.e., cisterns, rain barrels, irrigating landscaping, etc.

There are three principles that distinguish a traditional or conventional approach from LID. First, with traditional or conventional approaches, SCM are typically added to the design rather than incorporated into the design. Second, SCM are generally placed in one or two low spots rather than multiple spots throughout the site. And third, stormwater runoff is generally conveyed to a central SCM.

Traditional SCM can be an alternative to LID if traditional SCM provide equivalent protection or it is just not practical to use LID.

### **What is Green Infrastructure (GI)?**

GI is often associated with LID. Like LID, many of the barriers to green infrastructure arise from unfamiliarity with GI. Where LID uses a holistic approach to site development, GI concepts, policies, regulations, and incentives facilitates LID by:

- Encouraging and incentivizing redevelopment,
- Protecting natural resource areas and critical habitat,
- Establishing buffer zones to protect wetlands, riparian areas, lakes, rivers, estuaries and floodplains,
- Requiring dedicated open space,
- Preserving, protecting and maintaining trees on public and private property and rights-of-way
- Planting trees to enhance the urban tree canopy,
- Providing incentives to direct development to previously developed areas,
- Directing growth to areas with existing infrastructure, such as sewer, water, and roads,
- Encouraging and incentivizing mixed use and transit-oriented developments,
- Allowing street design standards that encourage streets to be no wider than is necessary,
- Allowing shared driveways, reduced driveway widths, two-track driveways, and rear garages and alleys Allowing alternative forms and decreased dimensions of residential driveways and parking areas,

- Encouraging and incentivizing green infrastructure practices as a standard part of construction, maintenance, and improvement plans
- Allowing or encouraging pervious or permeable pavement,
- Allowing alternative parking requirements that allow flexible arrangements to meet parking standards
- Allowing alternative measures to reduce required parking in exchange for specific actions that reduce parking demands on site,
- Allowing landscaping to reduce runoff,
- Ensuring stormwater management plan reviews take place early in the development review process