CENTRAL TEXAS LAND/WATER SUSTAINABILITY FORUM

Low Impact Development—A Central Texas Perspective

Low Impact Development (LID) is a comprehensive approach to site planning, design, and pollution prevention strategies that attempts to minimize downstream impacts of land development by matching the pre-development runoff condition and creating a more sustainable and ecologically functional landscape. The LID approach provides the central Texas area with many benefits to water resources and overall quality of life when implemented properly.

The purpose of this short document is to more clearly define the specific impacts of land development (define the problem) and describe how the LID approach can address or minimize the impacts (provide a solution). It concludes with brief discussions of LID benefits and challenges.

1. Problem Definition

It is well understood that land development produces impacts in the receiving water. Conventional urban land development increases the intensity of stormwater runoff flows from a site. Buildings, roads, and other impervious surfaces shed rain more rapidly than areas covered by vegetation, so the volume of runoff increases. Also, urban land uses frequently incorporate rapid drainage of stormwater, and this efficient drainage can contribute to a higher peak flow. The problems produced by the higher peak flow are increased flood risks downstream, stream channel scour, and aquatic habitat damage. Attempts to address the flooding problem (higher peak flows) by providing flood detention basins reduce peak flows but not the volume of runoff. Consequently, erosive flows occur for longer durations resulting in channel degradation.

In addition to the physical damage to streams and aquatic habitat from more frequent and extended periods of high flow and scour of stream beds and banks, there can be changes in the type and amounts of constituents contained in runoff. City of Austin monitoring data indicates that urbanization of a watershed increases the concentration of many constituents including bacteria, heavy metals (copper, lead, zinc, and cadmium), nutrients (nitrogen and phosphorus), oxygen-demanding substances (biochemical and chemical oxygen demand), and PAHs. Currently approved herbicides and insecticides would also be expected to be detected more frequently in urban watersheds. These increased concentrations can result in adverse impacts in the receiving water.

The central Texas response to the concern over urban runoff has been to address water quality concerns by removing particulate matter and associated pollutants, using sedimentation/filtration basins. In addition, flood detention basins are implemented to

address higher flow rates and act to remove particulate matter by settling. These measures are only partially effective at addressing the full range of adverse impacts associated with urbanization.

To summarize, land development produces two kinds of problems—increases in the quantity and rate of runoff flow resulting in accelerated soil erosion and stream degradation, and increases in the concentration of many potentially harmful constituents.

2. LID Solution

LID is a comprehensive approach to land development or re-development to manage **both** problems. The LID approach:

- Works to maintain and enhance the predevelopment hydrologic regime of urban and developing watersheds;
- Treats pollutants in the stormwater by infiltration and biodegradation in soil and vegetation;
- Works with nature to manage stormwater as close to its source as possible, treating stormwater as a resource rather than a waste product;
- Emphasizes conservation and the use of on-site features to protect water quality;
- Tries to create functional and appealing site drainage; and
- Can reduce construction, maintenance and inspection costs.

LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness, and employing processes of infiltration to soil, evapotranspiration, and retention of stormwater runoff to closely match predevelopment runoff conditions. There are many methods used to achieve the objective of maintaining predevelopment hydrology, including bioretention facilities, rain gardens, vegetated rooftops, rainwater harvesting, and permeable pavements. LID principles can be summarized with four actions that begin with the letter "**S**": **S**low it down, **S**pread it out, **S**oak it up, and use them as **S**ource controls (i.e. distributed throughout the watershed and not as "end of pipe" controls).

By implementing LID principles and practices, water can be managed in a way that reduces the impact of development and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can help maintain a watershed's hydrologic and ecological functions by maintaining predevelopment runoff conditions.

3. Benefits Provided by LID

The LID approach can alleviate many of the problems posed by development. The following section provides a brief discussion of the actual or quantifiable benefits, as well as the more qualitative benefits of LID practices.

Benefits that Can Be Quantified

Reducing Pollutants Introduced by Development

LID practices can reduce the concentrations of many pollutants to background levels through settling, adsorption and decay in the soil, and biological uptake. And by reducing the volume and flow rates of runoff to near pre-development levels, the load of potential pollutants is further reduced.

Protection of Downstream Water Resources

LID practices can prevent or reduce hydrologic impacts on receiving waters, reduce stream channel degradation from erosion, improve water quality, and enhance the recreational and aesthetic value of our natural resources.

Minimizing or Avoiding Downstream Flooding Impacts

LID practices can be effective in preventing increases in peak flow and flooding impacts associated with conventional development, reducing and possibly eliminating recourse to detention ponds.

Groundwater Recharge

LID practices act to infiltrate runoff to recharge groundwater, ideally matching the predevelopment condition. Infiltration practices that replenish groundwater can maintain or even increase stream baseflow. Adequate baseflow to streams during dry weather is important because low groundwater levels can lead to greater fluctuations in stream depth, flows, and temperatures, all of which can be detrimental to aquatic life.

Habitat Conservation

LID can be incorporated into preservation or enhancement of natural resources and wildlife habitat, in some cases avoiding expensive mitigation costs. Aquatic habitat improvements can also be seen from LID practices as the quality, volume, rate, and temperature entering receiving waterbodies is more closely associated with predevelopment conditions.

Water Conservation

LID practices can infiltrate runoff to recharge groundwater, or store runoff for later use. Both can reduce irrigation demands on the potable water system and aid water conservation.

Real Estate Value/Property Tax Revenue

Homeowners and property owners are willing to pay a premium to be located next to or near aesthetically pleasing amenities like water features, open space, and trails. Some stormwater treatment systems can be beneficial to developers, because they can serve as a "water" feature or other visual or recreational amenity that can be used to market the property. These designs should be visually attractive and safe for the residents and should be considered an integral part of planning the development. Various LID projects and smart growth studies have shown that people are willing to pay more for clustered homes than conventionally designed subdivisions. Further, many studies have shown examples where developers and subsequent homeowners have received premiums for proximity to attractive LID practices.

Lot Yield/Development Cost

LID practices typically do not require the large, contiguous areas of land that are usually necessary for traditional stormwater controls. In cases where LID practices are incorporated on individual house lots and along roadsides as part of the landscaping, land that would normally be dedicated for a stormwater pond or other large structural control can be developed with additional housing lots. This can reduce the cost of development. For more information on the cost-benefits of LID, visit www.texaslid.org for a bibliography of cost-benefit resources and case studies.

Qualitative Benefits-Aesthetics and Quality of Life

Many of the direct and indirect benefits of LID are derived from improved land value—through improved aesthetics, additional lot yield, or property protection—and quality of life benefits. These latter benefits are some of the most difficult to quantify, yet are also some of the most important for a community as LID techniques can help brand a community, provide multiple amenities, and provide for an improved landscape and sense of place.

Aesthetic Value

LID techniques are usually attractive features because landscaping is an integral part of the designs. Designs that enhance a property's aesthetics using trees, shrubs, and

flowering plants that complement other landscaping features can be selected. The use of these designs may increase property values or result in faster sale of the property due to the perceived value of the "extra" landscaping.

Public Spaces/Quality of Life/Public Participation

Placing water quality practices on individual lots provides opportunities to involve homeowners in stormwater management and enhances public awareness of water quality issues. An American Lives, Inc., real estate study found that almost 80 percent of potential homeowners rated natural open space as "essential" or "very important" in planned communities.

Native Species Preservation

While LID is primarily identified with minimizing changes downstream, it can also include preservation of habitat for native insects, reptiles, amphibians, birds, mammals, and plants among the tools to be employed in the efforts to minimize the impact of development.

4. Challenges Faced by LID

While LID offers many benefits and has been applied with substantial success in other parts of the country, the central Texas area has seen very limited application for a number of reasons. Some of the challenges facing a broad application of LID measures in central Texas include:

Regulatory Conflicts

In the last decades, land development codes and design criteria have focused largely on flooding and traffic issues. Even where water quality goals are incorporated in the criteria, they create several unnecessary barriers to meeting those criteria more effectively using LID. For example, conventional criteria mandating rapid release of the water collected in stormwater control features may need to be modified to optimize the potential blend of flood control, stormwater treatment, and water conservation functions offered by LID designs.

Concerns over Enforcement, Maintenance, and Long-Term Performance

With the intensive development experienced in central Texas, there have been many examples of problems in the area of enforcement and maintenance of conventional development measures, and there is a justifiable concern that there will be problems with distributed systems that may be more difficult to administer. It is recognized that it

will be a substantial effort to change a long-established system, and that lessons will have to be learned as to how best to achieve a system that minimizes impacts of development.