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Mixed-Use Developments

Zoning

Avoid Surprises

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[home](#) > [information center](#) > [land development](#) : Low Impact Development

Low Impact Development

'Green' Approaches to Storm Water Management Preserve Natural Systems and Improve Water Quality

While the green building movement is having a significant impact on many high profile projects, only a limited number of residential, retail and commercial developments have gone green-but that could soon change. Environmental awareness around the United States is increasing and consumers are starting to seek out green products. The hybrid car market, for example, while still a small percentage of overall new car sales, is expected to grow from 40,000 cars a year in 2003 to 350,000 in 2008, according to J.D. Powers and Associates.

However, one of the most powerful reasons for developers to build environmentally conscious projects is that they can actually save money both in development and in long-term maintenance. In particular, Low Impact Development strategies and green site planning can lessen the environmental impact of new developments by reducing storm water runoff and improving water quality. These approaches can also meet new regulations regarding storm water, save money and set the project apart in the marketplace. These strategies, therefore, are not just good for the planet—they're good for developer's, too.



What is low-impact development?

Traditional development practices take a straightforward approach to water: grab it and get it off the site. Paved surfaces slope to the drainage system, which shuttles water to river and lakes. The problem is that the water picks up junk along the way: oil, pesticides and sediment.

Awareness of these problems first grew out of the environmental movement of the 1960s and early 1970s. In 1972, the National Pollutant Discharge Elimination System (NPDES) was created under the Clean Water Act to regulate the discharge of pollutants into the nation's waters.

If we want to maintain our quality of life, we need to make the best use of our water. New development

"Once the major water quality problem in the United States was point-source pollution,

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such as factories dumping toxic substances into rivers," said Steve Veal, a Carter & Burgess Public Works Unit Manager.

strategies are a good place to start.

Heather Kinkade-Levario
 Carter & Burgess

"Today, the problem is more likely to be non-point source pollution-the pollution that comes from everywhere and nowhere."

The Clean Water Act specifically regulates storm water management during construction: projects greater than one acre in size must carefully control runoff. Federal law is less specific concerning post-construction, and many completed projects largely ignore storm water quality issues. The exception is found in cities like Austin and Seattle where permanent pollution prevention practices are proscribed by strict storm water ordinances.

Meanwhile, in the 1990s, the green building movement began to pick up steam. Landscape architects and engineers involved in these projects, as well as those wrestling with traditional approaches to site planning, realized that significant savings in water usage could be achieved by approaching storm water in a new way.

"Why stop with the building itself?" said Heather Kinkade-Levario, a Planning Studio Leader in Carter & Burgess' Urban Design & Planning Unit. "Why not make the site as environmentally friendly as possible? These big basins and pipes are expensive. There is a better way!"

The result was a collection of new strategies and techniques grouped under the category Low Impact Development. They can generally be divided into two categories: active and passive.



Passive storm water management

Passive approaches use natural, gravity-driven processes to slow and filter water. "As water flows through the site, it should meander along so it has time to sink in. Compare that to sheet flow across a parking lot, where all sorts of oils and particles are picked up," Kinkade-Levario said.



Passive strategies start by considering each site as its own watershed. Designers get a sense of natural drainage basins and existing vegetation so the site can be designed to take advantage of as many of these features as possible. Low Impact developers will also work to preserve open space, sometimes choosing to "cluster" homes.

"When you cluster a development, rather than spreading homes throughout the entire site, you group them together, perhaps with smaller lot

sizes," said Kinkade-Levario. "Now you don't have to add infrastructure to the remaining open land. You've preserved trees, wetlands, meadows and other natural amenities that the residents can enjoy, and you've enabled that portion of your site to continue to filter storm water in a natural way."

A further approach is to reduce the width of streets within residential developments. Many projects today have streets of up to 32 feet wide. Streets account for 40 to 50 percent of the impervious cover in residential areas and generate the largest amount of storm water pollution, according to researchers at the University of Connecticut. However, streets can be narrowed to between 26 and 20 feet and still provide enough room for traffic, reducing overall impervious area by 5 to 20 percent. Emergency responders, particularly fire departments, however need to be involved in the design of these streets; often driveways need to be widened and on-street parking limited to allow easy access for fire trucks.

Narrower streets have other advantages as well: they are cheaper to build and maintain, and traffic naturally travels more slowly and safely.

The next step is to divide the site into micro-watersheds that can be managed individually. Specific strategies include the following:

- Micro-basins, French drains and swales
- Sidewalks, driveways and parking lots sloped towards open space
- Depressed islands (rather than raised planters) in and along parking lots
- Pervious paving surfaces such as pavers, gravel-crete, porous concrete and porous asphalt
- Rain gardens, where specifically selected vegetation is planted in low areas so water will naturally flow at the end of a downspout

"Consider a tree in a raised island in a parking lot," Kinkade-Levario said. "The tree's roots can't extend beyond the edge of the island, not only because they can't get water but also because the surrounding pavement gets too hot. The tree never grows very big and its weak roots make it vulnerable in wind."

However, if a tree is planted in a depressed island surrounded by lightcolored, porous pavers, the tree's roots can extend under the paved surface so it can grow taller and stronger.

"Natural irrigation will keep it healthy, and the tree will contribute toward shading the paved surface and filtering runoff," said Kinkade-Levario. "Now you've contributed to both the aesthetics and the function of your site."



Active storm water management

Active Low Impact Development techniques generally involve systems of pumps, pipes and storage tanks to capture, store and reuse rainwater. Rainwater harvesting involves gathering relatively clean water from rooftops, while storm water reuse captures water at ground level where it can pick up pollutants. This water can then be stored (either underground or in above grade cisterns) and used for any purpose for which nonpotable water is appropriate, including the following:

- Landscape irrigation
- Fountains or water features
- Car washes
- Cooling towers
- Firework pre-wetting

- Sewer cleaning
- Dust control
- Snow making
- Restrooms (Innovative systems pump water to toilets through separate piping systems. Rainwater can be supplemented with treated water when necessary.)

"There are thousands of innovative examples out there where communities are reusing water," said Carter & Burgess Senior Project Manager Bart Hines, a member of the board of directors for the Water Reuse Association. "Many golf courses have extensive water reuse strategies. So do power plants. The entire state of Florida reuses 52 percent of their wastewater effluent for non-potable purposes, which saves the potable water resources for the highest and best uses. Reuse of all waters is a great cost-saving strategy, regardless of the size of the community."



How is low-impact development good for developers?

The stakes are high in development projects, and few developers are willing to gamble their projects on new techniques solely for environmental reasons-particularly if they fear those techniques will cost more. However, Low Impact Development can provide significant benefits to developers and doesn't have to cost more. Three benefits-in addition to preserving water quality-can be obtained:

Meet legal requirements. Today, the primary enforcement mechanism for storm water pollution prevention is the EPA's National Pollutant Discharge Elimination Systems (NPDES) program. A storm water pollution prevention plan is required for all construction projects of more than one acre in size. However, most developers need to do little to reduce pollution after their project is complete.

That could change, however, as storm water pollution prevention becomes a priority for more local communities. This is driven by increased environmental concerns as well as by the municipal provisions of the Clean Water Act. Under Phase I of the NPDES program, cities with populations greater than 100,000 were required to develop storm water management plans and implement Best Management Practices (BMPs); Phase II, effective since March 2003, extended the same requirements to most smaller communities.

Cities are likely to turn to new developments to find improvements in storm water control. The Dallas/Fort Worth metroplex, for example, is developing a new Integrated Storm Water Management program that will regulate storm water pollution prevention across the region and encourage low-impact strategies. Communities across the United States, wrestling with poor water quality, eroded streams and creeks and increased flooding, as well as NPDES requirements, are likely to follow North Texas' lead.

Save Money. Low Impact Development strategies don't necessarily cost more-indeed, they often cost less. Passive Low Impact Development techniques such as swales, French drains and rain gardens cost less than the retention ponds and below ground storm water tanks used in typical storm water management and do a better job filtering water.

"And developers get back land on their site," said Kinkade-Levario. "Low Impact Development techniques take up less space than big retention ponds. They're spread out across and are integral to the entire site. The developer then has more property available for their project."

Infrastructure costs can be lower, particularly when considered over the long term. For example, a parking lot paved with asphalt may cost only \$2 per square foot to install;

however, basins, storm drains, curbs and gutters must be built alongside the lot. Striping must be updated regularly, and the pavement itself must be sealed or even replaced every 10 years. On the other hand, pervious pavers cost \$5 per square foot, but parking lots with pavers don't need the same curbs, gutters, basins, etc. Pavers last 25 years and require very little maintenance.

More active strategies such as rainwater harvesting have more extensive upfront costs but long-term water bills go down significantly. For sites requiring extensive irrigation, rainwater reuse can either eliminate or dramatically reduce water utility costs.

"Green site planning also doesn't necessarily add time to project schedules," said Kinkade-Levario. "If considered up front by knowledgeable landscape architects and engineers, low-impact strategies can be implemented without any time lost."

Differentiates the project. As environmental awareness becomes widespread, consumers are becoming more attracted to ecologically friendly developments. Savvy developers can use low impact development strategies as a selling point.

Furthermore, green site planning dovetails with several other development trends, including Smart Growth and New Urbanism. Narrower, more efficient street layouts, for example, encourage pedestrian activity, promote connectivity and reduce impervious cover. These projects can foster a "sense of community" in part on environmental responsibility and stewardship.

"Home buyers who are looking for a certain type of lifestyle are drawn to these projects," said Kinkade-Levario. Even if the developer doesn't choose to promote a project as green, low-impact techniques bring benefits to the look and feel of a project.

"Open space is highly prized in developments, particularly high-end residential projects," said Veal. "Low Impact Development provides a way to offer an amenity while promoting water quality and makes storm water pollution prevention a priority." Ultimately, the greatest benefit of low-impact development is to the entire community. Environmentally sensitive design reduces the consumption of potable water, decreases pollution to rivers and lakes, and increases ground water infiltration and aquifer replenishment.

"If we want to maintain our quality of life, we need to make the best use of our water," Kinkade-Levario said. "New development strategies are a good place to start."



North Central Texas Develops

Regional Storm Water Pollution Prevention Policies

The North Central Texas Council of Governments (NCTCOG) is working on a new Integrated Storm Water Management (ISWM) program that would provide a single set of guidelines for all municipalities in the D/FW Metroplex. "We're being driven by several purposes," said NCTCOG Director of Environment and Development John Promise. "We need to do a better job of managing flood risks, preventing pollution and controlling the erosion and degradation of streams and drainageways."

ISWM emphasizes analysis, evaluation and site-specific planning early in the development process. Developers will draw up plans that identify preservation areas, buffers and BMPs to prevent pollution as well as identify continuing operation, maintenance and inspection strategies.

The draft guidelines do not strictly dictate Low Impact Development techniques, but they do encourage reducing impervious cover. Developers would get credits for designing with the land, retaining natural drainageways and preserving open space. If developers choose to bulldoze their site, grade the land and design using conventional techniques, they would be required to build extensive (and expensive) structural BMPs to mitigate storm water pollution impact.

The iSWM program is still under development. "In our first phase, we asked, can we really come up with a design approach that addresses flooding, water quality and stream-bank erosion? The answer was yes," said Promise. "In the second phase, where we are now, we're asking, do we understand costs and benefits? Are we prepared to implement this plan? In the third phase, we'll develop a tool box of materials, training programs and implementation mechanisms."

To evaluate costs and benefits, NCTCOG selected seven recent projects in the area developed using conventional means. A consulting team is redesigning these projects using the draft design manual and estimating the costs of building the redesigns. NCTCOG deliberately selected a wide range of development and redevelopment projects, including single-family, multi-family, retail, office, etc., with a range of design challenges for the study.

"What we're trying to learn is how these strategies work with different types of development examples—what works and what doesn't," said Promise.

The results of this study will be released in the fall of 2004. Then the design guidelines and study results will go out for public review and comment.

"The timing is right for this project," said Promise. "We've got communities across the region involved—more than 55 local governments are actively supporting us with 100 percent cost-sharing. Storm water doesn't respect city limits. We're going to do this together."



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