

Gutters and Pipes Make Room For Bioswales and Built Wetlands

The emerging watchwords are low-impact development, as many of today's engineers seek to create living, breathing, absorbant systems — ones that turn stormwater into a resource and developments into complementary parts of local ecosystems

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Urban stormwater in Alberta's towns and cities has traditionally been treated as a nuisance — something that posed a considerable risk for flooding and property damage. The engineered solution was a gutter-and-pipes strategy that sought to discharge rainwater as efficiently as possible into downstream rivers.

It was an understandable approach when urban populations were small and downstream water quality issues few. But today, as Alberta's cities continue to grow, our relatively small prairie rivers are receiving heavy loads of stormwater sediments and pollutants, and tributary streambeds are being eroded. While the levels of some river contaminants may be lower than they were 50 years ago, they are many cases of failure to meet ever-tougher quality standards for surface water set by Alberta Environment.

These standards have helped drive infrastructure investment in the wastewater plants of Calgary and Edmonton, resulting in facilities with cutting-edge technologies such as tertiary treatment and ultraviolet disinfection. Stormwater systems, however, have not kept pace, despite some efforts to reduce their impacts in recent decades such as the use of constructed wetlands in new urban neighbourhood design.

About 87 per cent of the suspended solids load in the North Saskatchewan River immediately downstream of Edmonton comes from the stormwater system. The remaining 13 per cent is about evenly split between three different sources. These are wet weather-related flows from combined sewer system and primary/secondary bypasses from EPCOR's Gold Bar Wastewater Treatment Plant, and continuous discharges from the final effluent channel at the plant.

Rapid urban development is the primary culprit. Consider that about half of Edmonton's 70,000-hectare municipal area has been developed and 40 per cent of that development is hard surfaced — buildings, roads, parking lots and the like. When rainwater hits these hard surfaces, it is quickly flushed into the stormwater system, carrying with it whatever vehicle oils, fertilizers, pesticides and other pollutants had been deposited there.

The runoff into rivers is at least five to 10 times the annual volume of what was before development. Similarly, the runoff in Calgary's Nose Creek watershed is many times higher today

than the two to three per cent runoff before development.

"By the late 1970s and early '80s, we were starting to see that the out-of-sight, out-of-mind approach didn't always work," says Bert van Duin, P.Eng., a stormwater specialist with Wardrop Engineering in Calgary and an adjunct assistant professor at the University of Calgary's Schulich School of Engineering. "Some areas were being flooded on a pretty regular basis."

To mitigate these problems, stormwater engineers have over the past couple of decades introduced dry ponds, and later wet ponds typically two-hectares in size. More recently, they've introduced constructed wetlands using vegetation to filter some of the stormwater.

Wet ponds and wetlands are designed to detain stormwater surges for one to three days, thus allowing sediments and their adsorbed pollutants to settle and river discharges to slow. For fully developed basins, end-of-pipe treatment systems can be built to treat stormwater, which the Kennedale wetland under construction in northeast Edmonton will use.

But these facilities do not address the very large increase in the volume of stormwater that comes with development, resulting in tributary stream erosion. In addition, contaminants deposited during the summer months may be remobilized during the winter when the water chemistry changes under prolonged ice cover.

Thus, stormwater engineers in Edmonton and Calgary are now looking at a new and more integrated way of handling stormwater — one that takes into account water quality as much as it does the 100-year storm.

Called low-impact development, this approach seeks to mimic the natural hydrology of these areas before development came along. It attempts to use the natural landscape as a sponge to retain rainwater longer, preferably close to where it falls.

Simply put: build the environment as part of the ecosystem instead of something separate.

"We're starting to go beyond 'engineered' solutions focused on managing the peak flow rate," says Lyndon Gyurek, P.Eng., supervisor of environmental planning with City of Edmonton Environmental Monitoring and Drainage Services. "In the last few years, we've embarked on a path that lends itself to solving real-world problems in a more sustainable way by encouraging the use of green infrastructure where appropriate."

Adds Mr. van Duin: "We're trying to look at not just the extreme storm

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event but also at the whole spectrum of precipitation and runoff from a water quality and erosion perspective. It's those small storms that occur a couple of times per summer that contribute more to water quality issues and erosion on a cumulative basis.

"You still have to deal with extreme events. But low-impact development concepts allow you to control these day-to-day events better, plus make the whole system much more resilient for when the big one comes along."

Mr. van Duin and Dr. Gyurek, whose PhD is in environmental engineering, are part of a veritable movement. The two are secretary and treasurer, respectively, of the Alberta Low Impact Development Partnership. Stormwater engineers, planners, landscape architects and biologists formed ALIDP in 2004 to seek ways to balance the growth of our communities with improved watershed health in Alberta.

Low-impact development, or LID, employs a range of site design tools to retain rainwater locally. On residential lots, it can mean introducing vegetated, or green, roofs, or simply increasing the amount of topsoil to eight inches from the typical three, then ensuring there's enough organic matter in the mix to help absorb rainwater. Where there are downspouts from hard roofs, their flow can be redirected to rain barrels or to small tanks — underground and pervious — that are surrounded by shrubs or flowers.

"In our past approaches to stormwater, we haven't been using rainwater as a resource. We've essentially been wasting it," says Dr. Gyurek.

Beyond residential lots, techniques to slow the runoff of stormwater include establishing local rain gardens — ponded, vegetated storage areas, away from buildings, where water filters into the soil — and bioswales, which are vegetated ditches alongside roadways. Hard-surface runoff can also be reduced by narrowing residential streets and surfacing parking lots with pervious pavement, allowing some stormwater to be absorbed by underlying soils.

"Any feature that can infiltrate or absorb water is an LID tool," says Dr. Gyurek.

LID concepts are being planned for a growing number of new housing and

industrial developments in Edmonton and Calgary. In northwest Edmonton, for example, a proposed subdivision will include a network of bioswales and natural stormwater ponds to help filter water runoff bound for nearby Big Lake. Further east in the Griesbach area, developers of a housing project are looking at such tools as porous pavement, clustered green spaces and narrower streets.

At the new Walden development in south Calgary, rainwater will be captured in medians and park systems and allowed to seep into the landscape, with much of the remaining runoff diverted to a stormwater pond used by a golf course. In the nearby Cranston development, roadside vegetated ditches and bioswales at the back of residential lots and in open spaces are being used to reduce and cleanse stormwater flows. The redeveloped Currie Barracks residential project in south-central Calgary also features bioretention cells and bioswales.

Low-impact development concepts are not restricted to Alberta's big cities. A new residential project in Cochrane, for example, includes a rain barrel for every lot and front-yard depressions to collect rainwater. Other fast-growing communities near Calgary — including Okotoks and Canmore — are taking an interest in LID, too.

The input of enlightened stormwater specialists, however, is not enough for LID to succeed. They must work with municipal planners and housing developers to integrate LID concepts into the early stages of planning new developments.

Measures such as pervious pavement and bioswales must also be carefully planned, installed, and maintained and monitored over the long term to ensure they work properly and to avoid such things as flooding and property damage — the very thing stormwater management has always sought to control.

That is where ALIDP comes in. Mr. van Duin concludes: "It is our mandate to provide information and tools that will help municipalities, consultants, developers and contractors make informed decisions to arrive at practical, cost-effective, socially acceptable and environmentally sound approaches to watershed management. Approaches, incidentally, that fit perfectly with Alberta's Water for Life and new land-use frameworks."

MORE INFO

The Alberta Low-Impact Development Partnership

www.alidp.org

Public Event

LID Criteria Launch

May 13, Red Deer

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