The Hydro International Plan

Hydro International®

Making Smarter Water Management Decisions: How to design for limited space in a runoff reduction project

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Contents

A TOTAL THAT IS LIKELY TO GROW OVER THE COMING YEARS.

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Foreword

Runoff reduction is becoming a bigger priority for stormwater designers. Rapid climate change and urbanization are creating challenges for new projects, existing developments, and the environment in general.

The Intergovernmental Panel on Climate Change's recent report has warned that climate change could lead to disastrous consequences by 2040. This United States, along with Bangladesh, China and the Philippines, are home to 50 million people who will be exposed to the effects of increased coastal flooding by 2040, if 2.7 degrees of warming occur. Even in instances where flooding isn't life threatening, it can have damaging and costly results. The cumulative cost of flooding disasters in America exceeded $300 billion in 2017, a total that is likely to grow over the coming years.

North America is one of the most urbanized of the five continents, with 82% of people respectively living in cities, towns and other urban settlements. Urbanization continues to grow and with it, permeable surfaces are being reduced. Residential developments, parking lots, and commercial buildings are just some of the challenges that today's stormwater designers face.

This eGuide will help designers to make smarter water management decisions and minimize water runoff, even in locations that have little space.

Introduction

Runoff reduction is key to managing the increasing risks and events caused by climate change and urbanization.

However, projects themselves can be complex. This is a time of transition for stormwater designers. Best Management Practice (BMP) manuals often make infiltration the primary objective but it's not always feasible.

Local ordinances might be contradictory to infiltration. These include:

- Parking
- Hydrology
- Pollution control
- Total Maximum Daily Loads (TMDL)
- What can or cannot be done with runoff water

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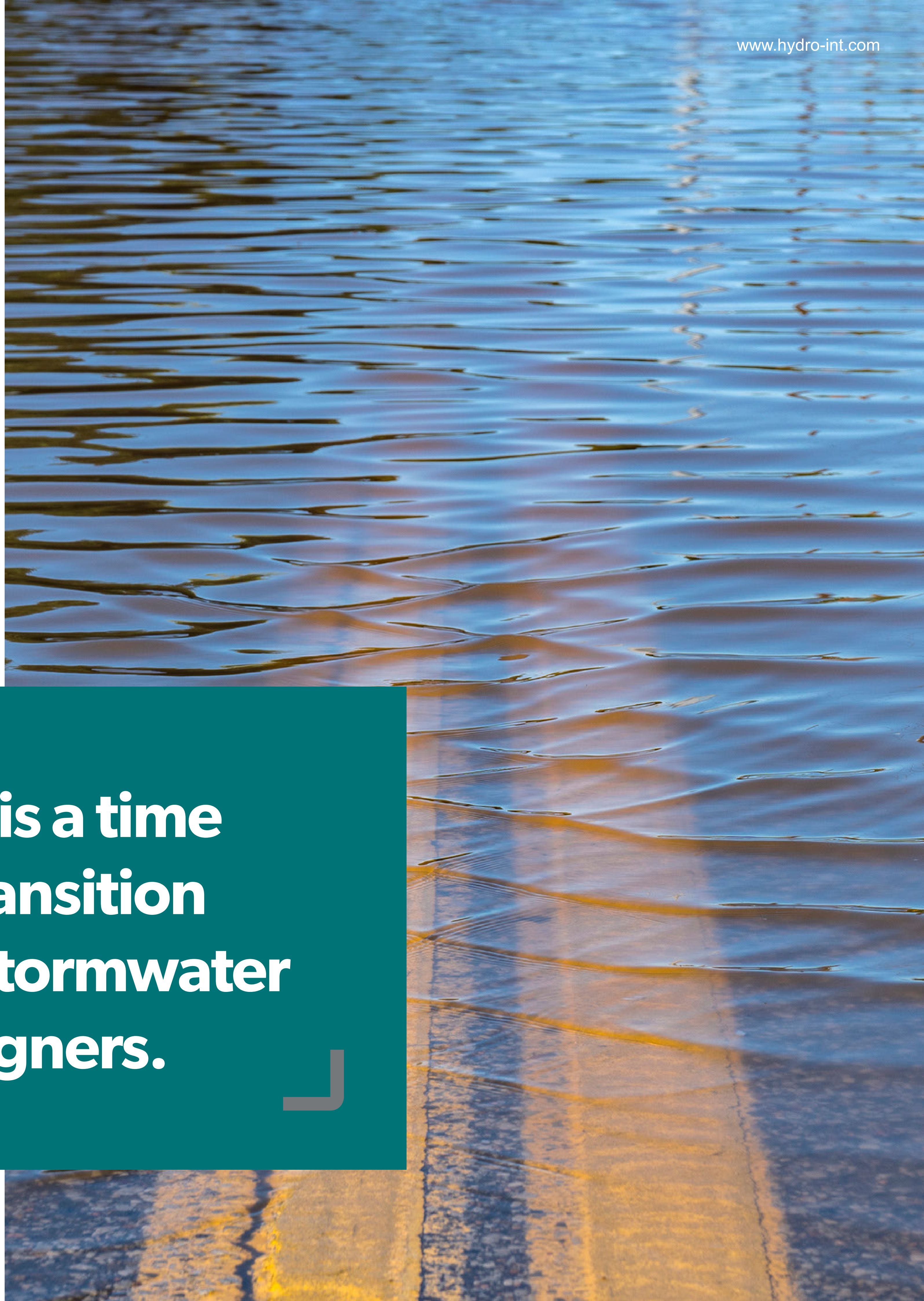

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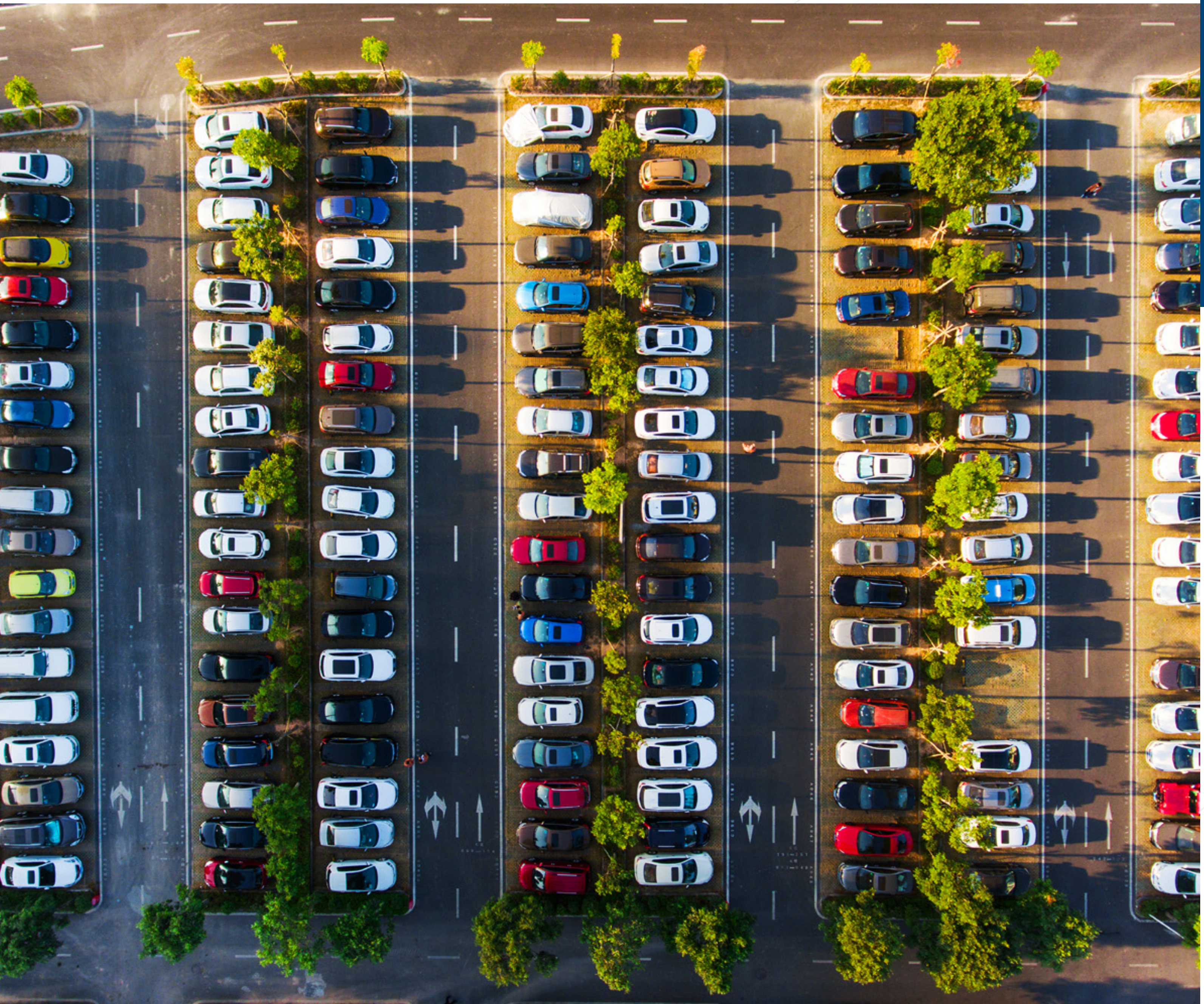
Some key requirements may include balancing the need to improve infiltration against the challenges of the landscape itself, such as soils with low infiltration rates and topography that channels water where it is not wanted. There are also inevitable conflicts between those trying to achieve infiltration and those wishing to develop.



There are inevitable conflicts between those trying to achieve infiltration and those wishing to develop.

There are also frequently longer-term issues such as failed plantings – when the shrubs, trees and other vegetation installed as a fundamental part of the bioretention cell die off. This is usually caused by the limitations of the cell itself, as most are self-contained boxes that do not allow roots to develop properly.

In areas with erratic rainfall, unless great care is taken with maintenance by a team with a full understanding of the needs of the plants, this will inevitably result in die-back. This is unsightly and defeats the key purpose of the bioretention cell. Other problems can include erosion of media – a successful runoff retention solution has to control this, as discussed below.

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Overcoming design issues

A problematic relationship can exist between those who are trying to develop a site and the designers who are tasked with infiltrating water from it.

Urban land is extremely valuable-sites are crowded, and this creates inevitable conflict when attempting to design in room for infiltration.

It's important to have a clear focus on resolving runoff reduction.

The majority of designers regard crowded sites as the main issue they face when attempting to reconcile infiltration with the multitude of other project requirements, though physical site constraints also feature prominently in their perceived challenges. These challenges underline the importance of having a clear focus on resolving runoff reduction.

There are, fortunately, a range of methods available to work around these challenges, enabling the maximum development potential to be achieved while meeting infiltration goals. Some of the solutions are natural, such as swales and detention ponds, and others involve engineering to a greater or lesser degree, such as green roofs, bioretention cells, and vortex flow control systems.

Below, we look at a number of tools that can be used to make the most of the available urban land and minimize the amount of storage required. The key is to use targeted, low-impact engineering.

GREEN ROOFS

BIORETENTION CELLS

VORTEX FLOW

How to design for limited space

There are several tools and tricks that can be used to get the most out of the available space and still meet infiltration goals.

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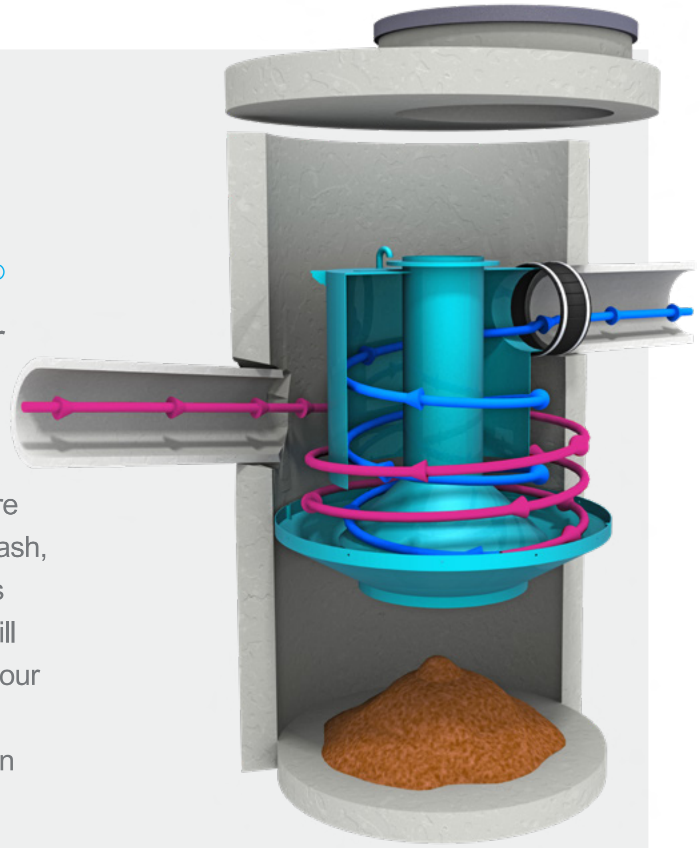
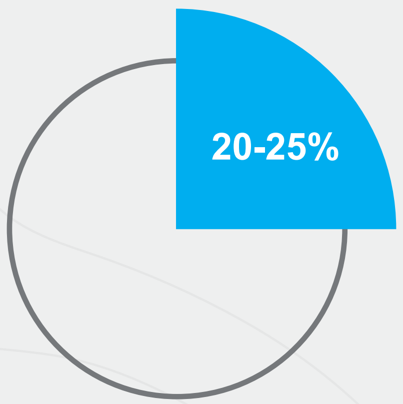
Save Site Space:
Pretreat with an MTD
Product: Downstream Defender®
Type: Advanced vortex separator



Manufactured Treatment Systems (MTDs) are installed below ground where they capture trash, sediment and other pollutants. If site space is a challenge, using (MTDs for pretreatment will not only allow you to reduce the footprint of your receiving bioretention area by 20-25%, it will also free up space above ground that you can use for parking spaces or other site needs.



REDUCE THE FOOTPRINT OF YOUR RECEIVING BIORETENTION AREA BY 20-25%

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Controlling flow when you can't infiltrate

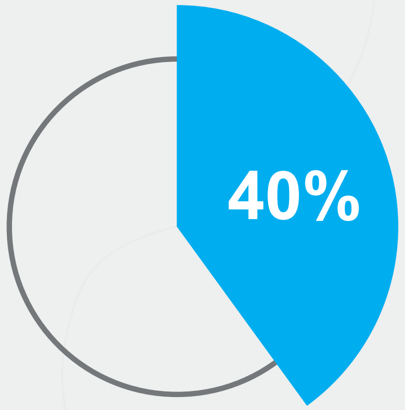
Product: Hydro-Brake® Optimum

Type: Vortex flow control systems

If area soils do not percolate fast enough to enable use of infiltration systems, engineers either have to direct excess water to a drainage line or use underground storage. The latter option is preferable so as to avoid having large amounts of untreated water rush downstream carrying large pollutant loads but underground storage can be expensive. Storage systems usually have a large underground footprint which does free up space above ground but the costs of storage chambers and the excavation greatly increase project costs.

Flow control valves like the Hydro-Brake are used in just these situations to maximize savings on new construction projects by minimizing detention and storage volumes by up to 40%.

MINIMIZING DETENTION AND STORAGE VOLUMES BY UP TO 40%



Prevent failed plantings and imposter plants

Product: Hydro StormScape™

Type: Bioretention

Green Infrastructure is strongly preferred by stormwater regulators and engineers because it's believed to best mimic a site's pre-development hydrology. Further, if designers intend to use plants or other greenery for aesthetic purposes.

The first generation of bioretention and tree-in-a-box systems began to take hold in the mid-2000s but the industry is only now beginning to understand the ways in which these systems must evolve to ensure long-term performance and efficacy. For example, standard bioretention systems can easily become overgrown if they're not maintained and it doesn't take long for them to be mistaken for a clump of shrubs instead of a treatment system.

Additionally, tree-in-a-box systems have historically been planted inside of concrete boxes which we now know are essentially "tree coffins" that will strangle the root ball and eventually kill any tree or plant system that gets big enough.

Hydro StormScape™ was designed with an open base so as to maximizes the amount of contact with the native soils, enable as much infiltration as possible and provide room for roots to migrate out to maintain healthy, attractive plantings to prevent plant death. The system can also be used with trees and shrubs but also with a variety of street furniture such as bicycle racks, flag poles or even message boards. The latter is a popular option which can be used to educate end users and the public about what the treatment system is doing, how it works and why the system needs occasional maintenance.

> **It is also critical to ensure good ongoing maintenance, which will depend heavily on whether the owner is willing to remain involved.**

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Conclusion: how to achieve project success for runoff reduction

While it is often necessary to work with whatever site conditions are available, pretreatment provides a quick way to reduce the footprint of the solution required, which immediately helps to resolve one of the major issues where land is both crowded and valuable for other purposes.

Putting pretreatment under parking spaces, using MTDs, immediately saves 20-25% of the footprint of the infiltration system. Optimizing storage volumes with vortex flow controls, particularly where orifices of 2-4in are required, is a useful rule of thumb as to where these operate at their best. It also allows full use to be made of the storage chambers on site, ensuring storage volumes can be reduced, depending on the design storm, by between 10% and 50%.

It is also critical to ensure good ongoing maintenance, which will depend heavily on whether the owner is willing to remain involved. The welfare of the media will crucially depend on whether the contractor installing it has relevant expertise and understands the need to protect it during construction.

Designers have more control over some of these factors than others, so it is critical that all parties work together and have a full understanding of how their decisions will impact the site and the surrounding environment.

Engineers designing runoff reduction need a broad toolkit that can meet many different conditions. Careful application of engineered devices can make low-impact development much more effective and reduce its impact on valuable land.

Want some further advice or expertise on how to design for limited space?

Request one of our lunch and learn sessions.

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