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MANAGEMENT

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# Confronting stormwater challenges

In the inaugural edition of *WORLD WATER: Stormwater Management*, **Conor Denehy** of BlueTech® Research presents an overview of the global market for stormwater treatment and management systems and technologies.

# Stormwater management market set for growth

Over the past five years, the topic of stormwater has gained high priority in the water industry. Historically, technologies for water and wastewater treatment were preeminent in water technology publications and conferences; however, climatic, demographic, and regulatory changes have shifted the focus. Increased urbanization, more frequent and increasingly intense rainfall events, continued deterioration of old combined collection systems, and moves by regulators to address the significant negative environmental effects of higher precipitation, has catapulted stormwater to the top of the agenda.

Stormwater control measures are now a standard requirement in urban planning and building guidelines in virtually all developed countries. The primary aim of these regulations is to minimize the volume and speed of runoff over the impervious surfaces created by urban developments. Therefore, in areas with such regulations, commercial, industrial, and residential developments require stormwater management systems of some type.

The management system can include a variety of hard engineering methods such as porous pavements, infiltration basins, retention ponds, and stormwater treatment equipment. The system can also include a range of “green” engineering solutions known as low impact developments (LIDs) in the United States, sustainable drainage systems (SuDS) in the United Kingdom, and water sensitive urban design (WSUD) in Australia. These types of solutions can involve rainwater harvesting, groundwater discharge, and a variety of rain garden/bioretenention techniques (e.g., living roofs).

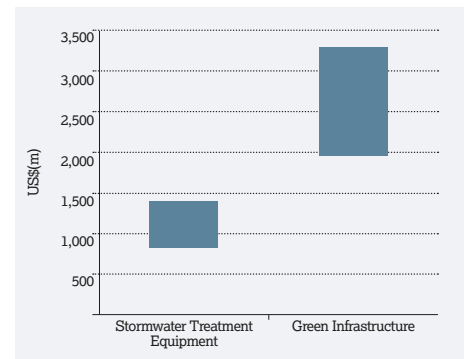
LID and other green engineering type treatment systems, such as bioretention rates, constructed wetlands, and retention ponds, are increasingly popular due to their typically lower cost installation (albeit with higher footprint) and amenity and ecosystem service value. It is important to note, however, that the level of treatment achieved by these systems is dependent on site-specific criteria. Their effectiveness and lifespan can be significantly diminished without pretreatment and proper maintenance.

Many structural stormwater treatment systems are subsurface measures and have a smaller footprint than green engineering solutions. These systems can be coupled with green engineering solutions to form a stormwater treatment train, which can improve effluent quality and reduce the cost of remediating green areas (e.g., silting etc.) However, most technology-based structural systems on their own do not provide all of the additional benefits associated with green engineering treatment systems.

## US investment demand

Investment in stormwater management infrastructure is sorely lacking in the United States. Old municipal systems have been underfunded for years, while rising regulatory standards affect private residential, commercial, and industrial sites.

In the next 20 years, the need for stormwater technology and infrastructure in the USA municipal sector is set to surpass US\$105 billion. Measures to correct combined sewer overflows (CSOs) comprise the majority of the need in the municipal stormwater



Estimated annual US Market for stormwater treatment equipment and green infrastructure

THE REPAIR OF AGEING STORMWATER INFRASTRUCTURE AND EXPANSION OF CSO CONTROL MEASURES WILL BE GROWTH AREAS IN EUROPE IN THE SHORT TO MEDIUM TERM.

market, although there is growing pressure to increase the implementation of controls on separated systems. In addition, the integrated planning framework introduced by the US Environmental Protection Agency (EPA) may



## THE ANNUAL US STORMWATER TREATMENT AND MANAGEMENT MARKET IS VALUED AT US\$3 BILLION TO US\$6 BILLION AND WILL CONTINUE TO GROW.

allow communities to defer required controls for combined systems in exchange for controlled discharges from separated systems. This will only be allowed when communities can demonstrate that the benefit to the environment is greater overall.

Combined sewer collection systems are generally older and account for approximately 37 percent of the total collection sewer systems. Separate sewers often connect into combined sewers at the lower end of the catchment. When there is limited storage in the system, it is therefore not surprising that this is the area with the greatest need.

Green infrastructure is comprised of measures such as bioretention, constructed wetlands, permeable pavement, green roofs, rain gardens, cisterns used for harvest, and other low impact developments. It accounts for a larger portion of the market need than stormwater treatment systems in these areas because of the ability for green infrastructure to reduce volumes and rates of runoff into the combined system.

Outside the US municipal market, BlueTech Research forecasts significant growth in stormwater investment in commercial, industrial and residential markets. Industrial sites, in particular, may be a growth area for proprietary stormwater treatment equipment. These sites can generate highly contaminated stormwater, which is not amenable to green engineering solutions. In addition, the environmental footprint of green engineering can often be an issue at these types of sites. There is a supply gap for stormwater equipment that can remove an array of contaminants while minimizing footprint.

Construction sites are another major market in the treatment of stormwater. In particular, they face new regulatory hurdles under the latest EPA proposals. New regulations will force all construction sites greater than one acre to design and implement a Stormwater Pollution Prevention Plan (SPPP). According to the EPA, the incumbent legislation could impose an extra billion US dollars per year in treatment costs on the construction industry alone. This cost will be in the deployment of erosion, run-off, and sedimentation management techniques that typically involve green engineering techniques such as riparian buffers, seeding, and gradient terraces. In some cases, they also include stormwater control and treatment equipment such as geotextiles, storm drain protectors, and active controls (e.g., chitosan-enhanced sand filtration and electrocoagulation).

Overall, the annual US stormwater treatment and management market is valued at US\$3 billion to US\$6 billion and will continue to grow.

### Eastern Europe set for growth

In the area of stormwater treatment, the European market is underdeveloped in comparison to the United States. The Water Framework Directive (WFD) is the overarching European legislation that governs all water quality control issues, including stormwater. As such, it is the main European-wide driver for improved stormwater quality. The effect of this driver will vary from country to country and depend on a range of factors, such as the prevailing stormwater collection system, current approaches of national environmental regulators, and whether improving stormwater discharge quality will significantly aid a

member state in achieving its WFD obligations.

While stormwater treatment has not received as much attention in Europe, stormwater management is tackled proactively in many EU countries. Catchment management plans and the regulatory planning push for a sustainable urban drainage system (SuDS) resulted in an expansion of the market for green engineering solutions.

In Europe, combined sewers are the most common system of treatment, accounting for more than half of the collection systems in Europe. Up to 80 percent of built-up areas in some countries are served by combined sewers. In comparison, only 37 percent of US collection systems use the combined sewer approach.

The repair of ageing stormwater infrastructure and expansion of CSO control measures will be growth areas in Europe in the short to medium term. An example of this growth is in Poland, which joined the EU in 2004. It spent US\$53.5 million (€40 million) on stormwater and wastewater infrastructure on one single administrative area.

### Floods prompt action in China

China has been investing heavily in water and wastewater infrastructure with high spending rates on some stormwater projects. In recent years, the Wuhan City Asian Development Bank financed a US\$260-million project for the expansion of a stormwater drainage, conveyance, and treatment system.

The Asian Development Bank (ADB) also has made urban stormwater management a top priority given that recent extreme flooding events have cost hundreds of millions of dollars in losses. The ADB also recognizes the routine traffic problems and property damage that major cities experience due to poor drainage.

In terms of the Chinese stormwater market opportunities, there may be a market for improving the sub-standard collection and drainage systems. This has been a major factor in the under-utilization of the hydraulic capacity of wastewater treatment plants that has caused the release of untreated wastewater into surface waters.

China is beginning to deal with its stormwater and its water quality issues in general, setting up what is projected to be a major market. Whether Western equipment and service providers can penetrate this market remains to be seen because Chinese projects traditionally favor Chinese suppliers and contractors. As stormwater management and treatment systems work off relatively basic principals, it is likely that Chinese equipment and service providers will fill this potential need.

### Australia remains a leading market

Oceania is a strong, sizeable market for stormwater technology. In particular, Australia and New Zealand have well-developed regulations and policies on stormwater management, including the Australian Local Government (Stormwater) Act that resulted in the formation of a Stormwater Management Authority. Further implementation of

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## Events 2013-14

2013

### October

**5-9 Chicago, Illinois, USA**  
Stormwater Congress, Held during WEFTEC 2013, 86th Annual Technical Exhibition & Conference  
[www.weftec.org](http://www.weftec.org)

**14-17 Nairobi, Kenya**  
3rd IWA Development Congress & Exhibition, Organized by International Water Association  
[www.iwa2012nairobi.org](http://www.iwa2012nairobi.org)

**14-15 Manchester, England, UK**  
7th European Wastewater Management Conference & Exhibition, Organized by Aqua Enviro Technology Transfer  
[www.aquaenviro.co.uk](http://www.aquaenviro.co.uk)

**22-24 Wiesbaden, Germany**  
FILTECH 2013  
[www.filtech.de](http://www.filtech.de)

**21-24 Tel Aviv, Israel**  
Watec Israel – Water Technology and Environment Control Exhibition & Conference/Cleanvest Summit 2013  
[www.watec-israel.com](http://www.watec-israel.com)

**23-26 San Francisco, California, USA**  
CitiesAlive, 11th Annual Green Roof & Wall Conference  
[www.citiesalive.org](http://www.citiesalive.org)

### October

**24-26 Mumbai, India**  
IFAT India 2013, International Trade Fair for Water, Sewage, Refuse, Recycling, and Energy Conversation  
Organized by Messe München and MMI India  
[www.munich-tradefairs.com](http://www.munich-tradefairs.com)

**28-30 New Delhi, India**  
India Water Forum on Water Use Efficiency  
Organized by Energy and Resources Institute (TERI), Ministry of Drinking Water and Sanitation and Ministry of Urban Development in India.  
[www.teriin.org](http://www.teriin.org)

**29-31 Bangkok, Thailand**  
Flood Control Asia 2013 – Flood Protection Management & Technology Exhibition, co-located with Asia Flood Conference 2013.  
[www.flood-expo.com](http://www.flood-expo.com)

### November

**5-8 Amsterdam, The Netherlands**  
Aquatech, Trade Exhibition for Process, Drinking, and Wastewater  
[www.aquatechtrade.com](http://www.aquatechtrade.com)

2014

### January

**14-16 Tampa, Florida**  
Green Infrastructure and Water Management in Growing Metropolitan Areas  
Organized by Patel College of Global Sustainability, University of South Florida, US Forest Service  
[www.patel.usf.edu/patel-center](http://www.patel.usf.edu/patel-center)

### February

**25-28 Savannah, Georgia, USA**  
The Utility Management Conference™, Organized by Water Environment Federation  
[www.wef.org](http://www.wef.org)

### March

**11-14 Baltimore, Maryland**  
Collection Systems 2014: Collection on the Chesapeake, Organized by Water Environment Federation  
[www.wef.org](http://www.wef.org)

**30 – April 2 Denver, Colorado, USA**  
Conference on Sustainable Water Management, Organized by American Water Works Association  
[www.awwa.org](http://www.awwa.org)

### September

**7-11 Kuching, Sarawak, Malaysia**  
13 International Conference on Urban Drainage 2014  
[www.13icud2014.com](http://www.13icud2014.com)

### October

**5-10 Pacific Grove, California, USA**  
Ninth International Symposium on Subsurface Microbiology Organized by the International Society for Subsurface Microbiology, National Water Research Institute  
[www.2014issm.com](http://www.2014issm.com)

### Upcoming WEF Webcasts: Complimentary

Chemical Grouting: Control Infiltration and Sustain Existing Sewer Collection System Assets  
**September 18**

Collection Systems: Optimize System Operations  
**November 9**

Integrated Planning Framework in Action: Baltimore's New Integrated Plan to Address Water Quality Impacts  
**December 4**

**For more information, email [webcasts@wef.org](mailto:webcasts@wef.org)**

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regulations by such bodies will result in opportunities for equipment and service providers.

Singapore and Australia are leading the way in terms of the collection and use of stormwater. Each regards stormwater as a resource in the wrong place rather than just a problem to be managed. This harvesting is typically achieved by the capture and retention of stormwater in retention basins and reservoirs. Incentives to promote local, residential stormwater harvesting are in use in these countries.

A recent investment of US\$77.8 million (\$86 million AUD) was made into developing Australian stormwater harvesting and use infrastructure. The Australian Department for Water stated in a recent report, "Stormwater harvesting and reuse is a crucial component of stormwater

management and planning." In terms of market opportunity, there will be market expansion in the area of collection and conveyance systems for municipal level stormwater reuse (e.g., rainfall harvesters, collection ponds and retention basins) at a local, decentralized level. Solutions for stormwater resource recovery are generally more sophisticated with higher value than mere mitigation.

A more detailed analysis of the stormwater market and technology opportunities can be found in BlueTech® Research's Insight Report Stormwater Treatment and Management Market.

### Author's Note

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researchers and others have found that bioretention media can also export pollutants, in particular copper and nutrients. As a result, WSC is testing the components of bioretention mixes, rather than just water coming into and out of the systems. Sand, for example, has been shown to contain copper, nitrates, and phosphorous.

In western Washington, protecting the water quality and unique aquatic life of Puget Sound is a major driver for stormwater management, and bioretention media has a role to play in that goal. WSU researcher Jenifer McIntyre is studying the effects of runoff on aquatic animals. In experiments, salmon directly exposed to highway runoff died within 12 hours. However, runoff filtered through certain bioretention media was no longer acutely lethal.

From training to research to application, the WSC brings its contributions to Washington's stormwater sector full circle by helping bring innovative products to market. The center reviews treatment technologies and systems for Ecology through the Technology Assessment Protocol – Ecology (TAPE) program. Technologies certified through TAPE must meet state-required standards for total suspended solids, dissolved copper and zinc, phosphorus, and oil removal. Once verified, technologies can be used for stormwater treatment on development and redevelopment projects as required by Ecology's Stormwater Management Manuals.

"The final approval lies with Ecology, but we shepherd the product through the testing protocol," Rozmyn said. "The manufacturer then has solid data to show that what they say is true."