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Nutrient reduction

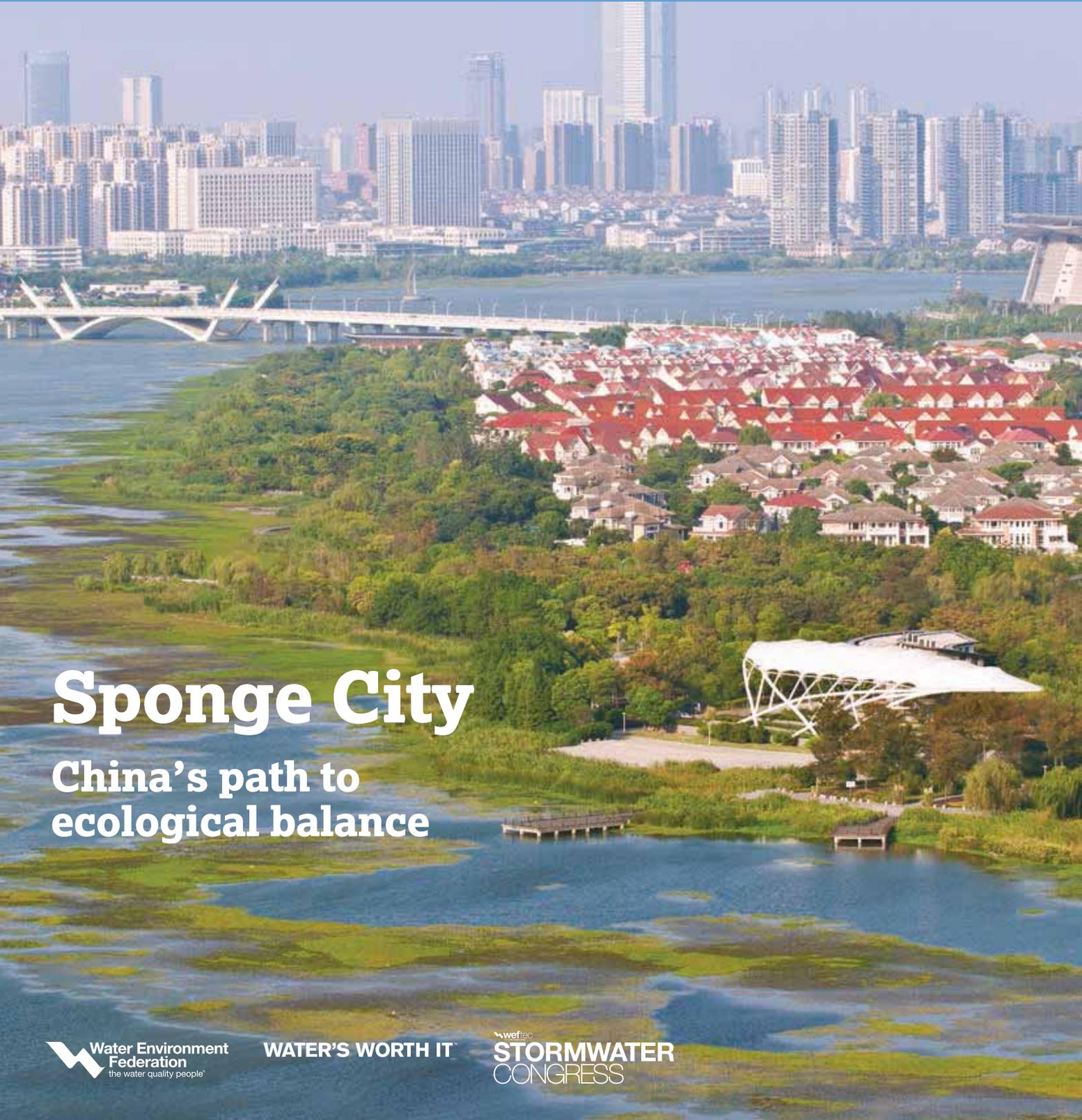
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Sponge City

China's path to ecological balance

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Cover image Wetland city landscape in China.
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The Baltic Sea watershed is comprised of a host of countries with differing policies and practices, yet a myriad of cross-boundary collaborations are helping to improve water quality by addressing excess nutrients and algal blooms, **Ginny Snead**, department manager of Hydraulics, Hydrology, and Drainage with Louis Berger, reports.

Overcoming cross-boundary water quality issues

In 2010, *National Geographic* magazine declared the Baltic Sea dead zone the largest in the world. Dead zones are a concerning issue plaguing many water bodies across the globe, where nutrient pollution leads to eutrophication and algal blooms.

Algal blooms in the Baltic Sea are sometimes the size of Germany. This increase in algal growth is fed through a cycle of excess nutrients in the water column. After the algae bloom, then die and sink to the bottom of the sea, organisms consuming the decaying algae use up oxygen in the water, creating hypoxic conditions. These low-oxygen areas are called dead zones because they cannot support aquatic life.

In the Baltic Sea, nitrogen, phosphorus, and sediment inputs occur in levels potent enough to cause eutrophication that has resulted in the large dead zone. There are numerous factors contributing to eutrophic conditions in the Baltic Sea. Sewage treatment plants have long been recognized as large nutrient contributors, and much has and continues to be accomplished by installing treatment technologies to reduce nutrient discharges. This, however, has not been enough to curb the growth of the Baltic Sea dead zone. Stormwater runoff from agriculture and urban areas is still a large source of nutrient discharges, and as in other parts of the world, it has become apparent that these diffuse discharges also need to be addressed.

While some Baltic countries require

or incentivize agricultural and urban stormwater controls, these policies and requirements are not in place throughout the watershed. Yet, there is an increasing focus on stormwater controls in the region through a combination of public outreach, incentive policies, and increased regulation.

Fostering collaboration

Success in combating the region's water quality issues hinges on the ability of countries and organizations to work collaboratively to collectively reduce pollutant inputs. Not only are the Baltic Rim states separate countries, but to complicate matters, only some of them are part of the European Union (EU). Recognizing this, the European Union and the nine Baltic watershed countries – which include Finland, Sweden, Germany, Russia, Estonia, Latvia, Lithuania, Poland, and Denmark – formed the Baltic Marine Environment Protection Commission (HELCOM). The commission seeks member-country collaboration and aims to protect the marine environment of the Baltic Sea from all sources of pollution.

In addition to HELCOM, several other collaborative efforts are underway by groups within the Baltic Sea watershed at a more grassroots level. The EU program Baltic Flows, for instance, is laying a foundation for the development of stormwater monitoring and management capacities and policies in the watershed. With the goal of





A view of Tallinn's Old Town, which may date as early as 1154 and is listed as a United Nations Educational, Scientific and Cultural Organization World Heritage Site. All images by Ginny Snead



Left: A view of rooftops in Tallinn, Estonia and the Baltic Sea beyond that. Right: A storm drain system in the cobblestones of the historic Eira District of Helsinki, Finland

reducing pollutant inputs to the Baltic Sea, the organization is focused on streams, rivers, and cities within the watershed.

The Baltic Flows group recognizes that, encircled by a mix of Nordic as well as Central and Eastern European countries, the Baltic Sea and its water quality are subject to a diversity of national practices and policies. Therefore, the program supports the development of research-driven clusters, or groups of stakeholders, with cross-country collaboration. Additionally, innovative solutions and enhanced capacities in diffuse-load monitoring and urban stormwater management resulting from the program should translate outside of the Baltic watershed and play a role in the emerging global stormwater market.

In December 2014, Baltic Flows held a workshop for stakeholders in Tallinn, Estonia to foster collaboration among groups and countries. Organizations from Estonia, Latvia, Lithuania, Finland, Germany, and Sweden, as well as international partners from China and the United States, attended the workshop. The Estonian Minister of the Environment spoke about the emerging stormwater issues in Estonia and recognized the need for better planning and management. The workshop provided participants with opportunities to find joint activities. For instance, one group with partners from Sweden, Latvia, Estonia, Germany, and Finland is focusing on methods and incentives for sustainable city planning. The workshop also helped participants identify potential funding sources with discussions on stormwater utilities, taxes, monitoring of stormwater controls, and long-term maintenance.

Partnerships result in nutrient reductions

Groups aiming to improve stormwater management around the Baltic Sea can look to a collaborative model established by the Clean Baltic Sea project, led by the Finland-based John Nurminen Foundation. Working with the St. Petersburg water utility, Vodokanal, a US\$5.67 million project involved upgrading the three largest wastewater treatment plants in St. Petersburg, Russia – the largest city on the Baltic Sea coast – to provide enhanced phosphorus removal. Co-funded evenly by the foundation and Vodokanal, the project reduced annual phosphorus loads to the sea by 1,000 metric tonnes, an estimated 20 percent of the total phosphorus load discharged into the Gulf

ENCIRCLED BY A MIX OF NORDIC AS WELL AS CENTRAL AND EASTERN EUROPEAN COUNTRIES, THE BALTIC SEA AND ITS WATER QUALITY ARE SUBJECT TO A DIVERSITY OF NATIONAL PRACTICES AND POLICIES.

of Finland, which flows to the Baltic Sea.

Measured in terms of reduced phosphorus load, the Clean Baltic Sea project is regarded as the single most significant project combating eutrophication of the Baltic Sea. The project owes its success to more than five years of cross-country collaboration.

Donations from private companies and individuals as well as contributions from the Finnish Ministry of the Environment and the Swedish International Development Cooperation Agency funded the foundation's share of the project costs. Groups outside of Russia supported these upgrades because it was determined to be the most effective and quickest way of cost-effectively improving water quality in the Gulf of Finland.

Building on the success of Clean Baltic Sea, the Finland city of Helsinki has started project Horizon, working with the John Nurminen Foundation and other groups. Horizon is both a fundraiser and a public outreach campaign to increase awareness of Baltic Sea water quality issues. Profit will come from donations to an art project featuring plates with donors' names. The art project will be featured on the Jätkäsaari pier in Helsinki, and at completion its full length will measure 54 meters, corresponding to the average depth of the Baltic Sea.

Campaign profits will be directed to additional Clean Baltic Sea projects aimed at reducing phosphorus inputs. The goal of the campaign is to finance enhanced phosphorus removal equipment for Gatchina in southwestern Russia. Gatchina is the second



largest city in the Russian Baltic Sea drainage basin, after St. Petersburg, and generates significant phosphorus discharges to the Gulf of Finland and Baltic Sea. As part of the collaborative effort, the necessary equipment will be delivered free of customs and taxes.

Tackling nutrients in stormwater

In addition to these wastewater-focused programs, CityWater is a stormwater project that is a collaborative effort between the Finland cities of Helsinki and Turku, as well as Tallinn City and Tallinn University in Estonia. CityWater works in close cooperation with the Baltic Sea Challenge Network, a group with the objective of promoting and facilitating water protection projects and spreading positive, sustainable examples in the Baltic Sea region. The challenge is an international network for saving the Baltic Sea, with a focus on concrete action at the local level.

Specifically, the CityWater project is implementing three engineered stormwater

controls in Helsinki, Turku, and Tallinn to demonstrate their effectiveness for treating stormwater. Design and construction of the three controls will mimic natural hydrology, treating urban stormwater runoff before it discharges to a water body. The project includes the retrofit of existing developed land, a cost-benefit analysis of water protection measures, and the project results as a tool for supporting continuous water protection work. Tallinn University will handle project communications and results with outreach in Finland, Estonia, Latvia, and Lithuania.

Finally, the Race for the Baltic is a program financed by Zennstrom Philanthropies, and the group's most recent initiative is the Baltic Sea Business Plan. The plan will assess best practices for addressing eutrophication and is expected to be released in early 2015.

There are a myriad of efforts to address the increasingly recognized issue of nutrient pollution, and more specifically stormwater inputs, to the Baltic Sea. With so many efforts,



SUCCESS IN COMBATING THE REGION'S WATER QUALITY ISSUES HINGES ON THE ABILITY OF COUNTRIES AND ORGANIZATIONS TO WORK COLLABORATIVELY TO COLLECTIVELY REDUCE POLLUTANT INPUTS.

Left: Envisat captured satellite image of algae blooms in the Baltic Sea that reached 1600-km-long, 190-km-wide in 2010. Photo by ESA
Right: Rainwater drips from a downspout onto the stone sidewalk in Tallinn's Old Town. Photo by Ginny Snead

the region's ability to succeed in improving water quality lies in the ability of countries and groups within this large watershed to communicate and collaborate. While this is a formidable challenge, several successes have already been achieved. Fortunately, the Baltic Sea's future is ultimately dependent on not one, but a number of organizations – taking leadership and cooperating to reduce nutrient inputs through a variety of approaches.

Author's Note

Ginny Snead is a water resources engineer with Louis Berger and currently leads the company's Richmond, Virginia office in the United States. Prior to joining Louis Berger, she ran the Commonwealth of Virginia's non-point regulatory programs, including the stormwater programs. Snead holds a bachelor's degree in Environmental Science from the University of Virginia and a master's degree in Environmental Engineering and Policy from Johns Hopkins University.