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# OPPORTUNITY AND CHALLENGE, CHINA'S SPONGE CITY PLAN

BY HAIFENG JIA, ZHENG WANG & SHAW L. YU

Over the past decade China's urban population has grown to 52.4 percent in 2015 from 42.5 percent in 2005, and the build-up areas have increased by 17,252 km<sup>2</sup>. This roughly equates to an addition of 165 million people dwelling in urban areas in a decade, which is extraordinary! This rapid urbanization process, sometimes lacking adequate planning and design, has led to a worsening "city syndrome" situation such as urban flooding, water pollution, heat-island effects and ecologic deterioration, etc.

The National New Urbanization Plan (2014-2020), released in 2014 by Chinese Central government, sets a target for China's urban population to rise by 1% per year to reach 60% by Year 2020. Such an ambitious plan presents great challenges to leaders of all levels of government in terms of avoiding city syndromes and achieving a sustainable urban development process.

## The Ambitious "Sponge City" Initiative

In order to promote a sustainable urbanization strategy, the Chinese government announced a new urban drainage infrastructure building paradigm, branding it "Sponge City" (SC) initiative, in 2013. Deviating from the traditional "rapid-draining" approach, the new paradigm calls for the use of natural systems such as soil and vegetation as part of the urban runoff control strategy. The "six-word" principle, which includes "infiltrate, detain, store, cleanse, use and drain", forms basis of the guidelines for urban stormwater management.

In October 2014 the China Ministry of Housing and Urban-Rural Construction (MHURC) issued a draft technical manual on Sponge City construction. In October 2015 the State Council of China announced a major expansion of the SC Initiative, which is being implemented nationwide. Recognizing the limitation of Low Impact Development (LID) / Green Infrastructure (GI) facilities in controlling large or less frequent storm events, the government mandates the integration of green and gray infrastructure. The expanded SC Plan includes as its goals not only effective urban flood control, but also rainwater harvest, water quality improvement and ecological restoration. The use of LID/GI

practices will be required for all new development and retrofit sites, science and commercial parks, green spaces, non-mechanical vehicle roads, pedestrian walkways, etc.

During 2015 and 2016, the China Ministry of Finance (MOF), with support from MHURC and the Ministry of Water Resources (MWR), selected 30 cities (see figure 1 for the locations of these pilot cities), among more than five hundred applicants, as pilot sites under the Sponge City Plan. Each city is to receive 400 to 600 million RMB (1 RMB ~ 0.15 \$US) annually from the central government for three years, with the total investment estimated to be about 42.3 billion RMB. Local matching is required and public-private partnerships (PPP) are encouraged. Cities will receive a 10% bonus

from the central government if the PPP contribution exceeds a certain percentage of the overall budget. According to preliminary estimates, the total investment on the Sponge City Plan is roughly 100 to 150 million RMB average per square kilometer or 10 Trillion RMB for 657 cities nationwide.

China's SC Initiative has attracted the attention of experts, officers and publics all over the world. This was made clear by the success of the "2016 International Low Impact Development Conference" at the end of June in Beijing, which attracted more than 1200 delegates from over 20 countries. During the conference, a declaration, "The Beijing Consensus: Low Impact Development for Urban Stormwater Management", was issued.

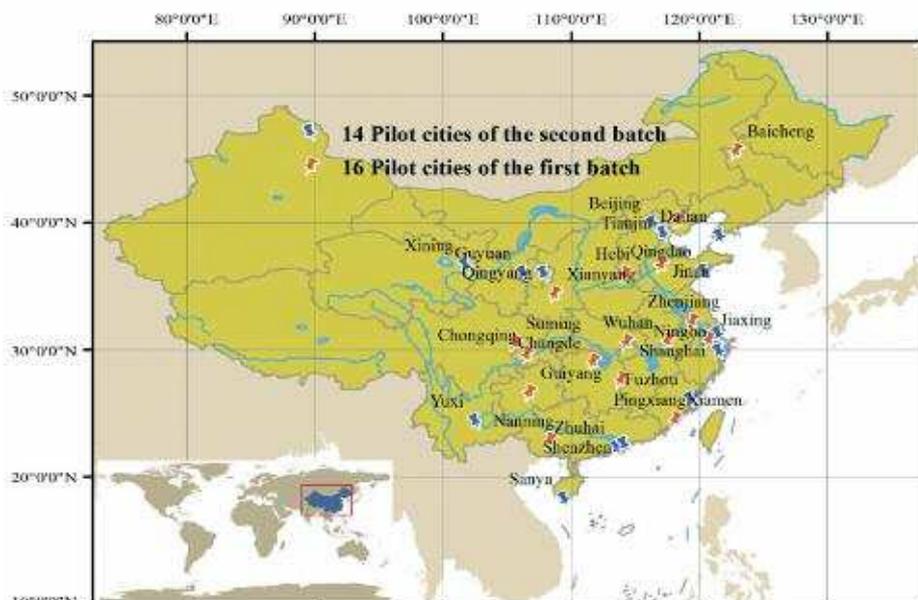


Figure 1. Location of the Pilot Sponge Cities

China's SC Initiative represents an enormous and unprecedented undertaking by the government for achieving urban sustainability. MHURC officials recognize that the success of the SC will require a combined and coordinated effort by many government agencies in areas such as landscape/architectural planning, construction, municipal, water, transportation, finance, environmental protection and input from other stakeholders. To finance all the sponge city projects is a real challenge. The government has listed some innovative strategies for fund-raising, which includes, in addition to government grants and subsidies, local matching and public-private partnerships. The government is also encouraging participation by financial institutions, and will allow qualified entities to issue construction bonds to finance the sponge city projects.

### Challenges for the SC Plan Implementation

Significant challenges lie ahead for the SC Plan implementation. A few important ones are discussed below:

#### **Inertia of Traditional Approaches and Measure of Success for Local Officials**

First, in contrast to the traditional urban construction philosophy in China, i.e., the age-old notion of man can conquer nature, the basic concept of the SC approach is living with nature and making use of nature's abilities. Although the Central Government has mandated the SC construction and has issued technical guidelines, some provincial and local government officials are slow to act due to inertia of tradi-

tions. So far, the financial assistance does provide incentives for action. Also, the current criteria for local officials' performance evaluation does not include SC implementation. If the promotional evaluation process could be modified to include results of SC implementation, local officials would be much more committed to its success.

#### **Inter-agency Coordination at Local Levels**

Currently, there is close coordination among the key agencies responsible for implementing the SC Initiative at the ministry level, i.e., MHURC, MOF and MWR. However, at the local, or sponge city level, often many agencies are involved, such as the urban planning, construction, water conservancy, and environment protection bureaus, etc. A smooth and efficient SC implementation requires a great effort and time for inter-agency coordination. To facilitate such efforts, some SC pilot cities have created the "Sponge City Offices", which include representation from all bureaus related to urban water.

#### **Inadequate Investment and Return Estimates**

China's sponge city initiative represents an enormous and unprecedented undertaking by the government for achieving urban sustainability. In the era of budgetary constraints and competing needs, how to finance all the sponge city projects is a real challenge. The government has listed some innovative strategies for fund-raising, which includes, in addition to government grants and subsidies, local matching and public-private partnerships.



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**Shaw L. Yu**, after graduating from Cornell University in 1968 Dr. Yu taught for thirty-five years at several universities including Rutgers, Tulane and the University of Virginia. Dr. Yu is recognized internationally as an expert in stormwater management, nonpoint source pollution control technology and watershed management. Dr. Yu is currently a Life Member and an Honorary Diplomat of the American Academy of Water Resources Engineers of the American Society of Civil Engineers (ASCE).



Figure 2. The 2016 International Low Impact Development Conference

A major current issue is how to develop a reliable, and tangible, estimate of returns on investments in the SC projects. For example, how to quantify and appraise the benefit of SC implementation is still an important question. Also, after the completion of an SC project, maintenance of the LID/GI facilities will become a crucial factor affecting project sustainability. The lack of information on maintenance

requirements and costs would contribute to uncertainties in SC budget estimates.

### **Lack of Site-specific Technical Guidance and Product Certification**

Stormwater management by nature is highly site-specific due to spatial rainfall variability and other pertinent local environmental, social-economic factors. For example, the Guiding Opinions on Advancing the Construction of Sponge Cities issued by the China State Council sets a control goal of 70% annual runoff volume for 20% of the built-up areas by 2020. In order to achieve such goals, cities in different climate regions will need different design criteria for their control practices. Also, some of the control practices, such as an underground stormwater treatment system, are manufactured by private companies. An evaluation and certification process would be highly desirable before such products are used for public projects. Furthermore, the design, construction and maintenance of LID/GI systems require professionals with appropriate background and training. Therefore, a concerted effort and time is needed for Research and Development (R/D) in SC technology in order to achieve successes for the SC projects.

### **The Way Forward**

#### **The SC Implementation Strategy**

The current SC plan scope has been expanded to include not only dealing with the urban water runoff problem, but also with the broader management of urban water. For example, the integration of green and grey infrastructures is required for flood control, water quality improvement and ecological protection and restoration. Local governments will need to adjust their land use planning and stormwater infrastructure construction strategies to satisfy SC requirements. To effectively improve water quality, the government could consider establishing regulations similar to the National Pollution Discharge Elimination System (NPDES) and the Total Maximum Daily Load (TMDL) programs used successfully in the United States. Also, to provide a strong incentive for local government officials, the success of SC implementation could be used as a performance evaluation factor for promotion considerations.

#### **Improving Investment and Financing Options**

The SC construction represents an urbanization process of an enormous scale that requires a major financial commitment from the

## **The Beijing Consensus on Low Impact Development for Urban Stormwater Management Prepared during the 2016 International LID Conference**

- Our ultimate goal is to manage urban stormwater in such a way to create a living environment in which humanity and nature co-exist harmoniously and a sustainable condition is maintained.
- We consider stormwater runoff as a water resource and its beneficial use should be maximized, especially in relatively dry areas. We recognize water quantity and quality are both limiting factors to water usage. Consequently, managing stormwater should emphasize both the quantity and the quality aspects.
- To mitigate the negative impact of urbanization, efforts should be made to conserve/restore the natural hydrologic processes as much as possible.
- In controlling urban runoff quantity and quality, we should consider the combined use of both natural (such as infiltration, evapotranspiration, etc.) and engineered (such as low impact development (LID) or green infrastructure (GI) practices) processes and systems.
- We realize under certain situations (e.g. extreme rainfall events), the integration of green and gray infrastructures might be necessary.
- We recognize the need to link land uses with urban water management plans. An effective and sustainable urban stormwater management requires a solid regulatory framework.
- We understand there may be consequences of urban runoff management planning and design, e.g., upstream impacting downstream (connectivity). A watershed-wide consideration is encouraged and tools for such analysis, e.g., watershed hydrologic models, are needed.
- More often than not, the urban stormwater management may involve multiple jurisdictions and agencies. Therefore it is highly desirable that a strong collaboration exists among various relevant agencies, institutions, groups, etc. (stakeholders) on a continuing basis. Moreover, setting up goals and selecting appropriate techniques for achieving them should consider local and/or regional conditions.
- We realize that urban runoff management requires a significant and long-term commitment and investment. Public-private partnerships and other cost-effective strategies should be considered. Also, life-cycle operation and management of practices, such as planning, design, construction, inspection/acceptance, etc. are needed.
- We need to make constant innovation and improvement. We will make great efforts to promote the sharing the knowledge and experiences on a continuous basis.

government. Innovative financial options, such as appropriate PPP project portfolio, credit support, loan guarantees, special construction funds and bond issuing should be considered and promoted. The government should also simplify the administrative approval process for reducing the upfront costs of PPP projects. Decentralization of administrative authority properly to local governments can help them build a tailored and flexible policy approach appropriate for local social, environmental, economic and cultural situations.

#### **Developing Sponge City Industries**

The sustainable development of SC requires a robust industrial base. The central government should consider assisting related industries and

establishing a viable sponge city industry chain. Under the current economic climate of "over-capacity reduction", the SC projects can offer good business opportunities for manufacturers producing pervious concrete, permeable bricks, infiltration pipes, etc. A stable supply system will help ensure the successes of the sponge city projects. ■

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