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Sponge City Strategies and Practices in Weihai, China

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Abstract

The "sponge city" strategy is China's version of what is called "Low Impact Development" (LID) as called in the West. It considers a city as an ecosystem to enhance local safety and overall developments. However, its principle is more systematic compared to the 2D concepts of "development" or "infrastructure" in the LID model. Such a systematic philosophy is rooted in China's ideological background. Weihai, a city on the eastern coastline of Shandong Province, has made innovative contributions to sponge city strategy, such as cultural tourism and region merging to compete for governmental funding. We examine Weihai's local resources and its outline for sponge city construction, especially its specific contributions to the sponge city strategy in policy and practice.

Keywords: sponge city, Low Impact Development, Weihai, Procedures, measures

1. LID versus Sponge City Strategy

Low Impact Development (LID) is a popular Western term that was first coined in reference to controlling storm water. Its main meaning

came to be minimizing the negative impact of urbanization by infiltrating, evaporating, or reusing rain fall. These practices include constructed wetlands, permeable pavements, "green roofs" (roof rainwater harvesting system), and so on[1]. LID was first adopted in Maryland[2], and soon became popularized across the U.S.A. and Europe. In Europe it is usually called "green infrastructure," while sharing similar core practices[3]. Later, when it was imported into China, it was transformed into the sponge city strategy. In contrast to LID's 2D concepts—"development" and "infrastructure"--sponge city's 3D conception is more systematic, which is partly due to China's Marxist dialectics and methodology. For example, an earlier Chinese ecological proposal was to build a "four-type society," meaning one that integrated resource saving, environmentally friendliness, population balance, and ecological and environmental health and safety[4]. Such integration demonstrates the systematic characteristics of China's ideology, research, and scholarship, such as the "Four Comprehensives" of Xi Jinping. This is the cultural background of China's sponge city strategy.

A sponge city is one that possesses solid "resilience" in adapting to environmental changes and coping with natural disasters caused by rain. Fig.1 above is an outline of a sponge city. The four sections on the right side—green roofs, a bioretention facility, and transparent ground surface and rainwater recycling—are typical elements in previous LID projects.

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[1] Dietz, Michael E. "Low Impact Development Practices: A Review of Current Research and Recommendations for Future Directions." *Water Air & Soil Pollution* 186.1-4, (2007): 351-363.

[2] See Coffman LS. "Low-impact Development: An Alternative Stormwater Management Technology." *Handbook of Water Sensitive Planning and Design*. (Maryland: France RL), (2002): 97-123.

[3] See Tzoulas, Konstantinos, et al. "Promoting Ecosystem and human health in urban areas using Green Infrastructure: A literature review." *Landscape & Urban Planning* 81.3, (2007): 167-178.

[4] Hongjin Liu. A review of Fang Shinan's thoughts on ecological civilization. *Journal of Poyang Lake*, (2017) (4),71-77.

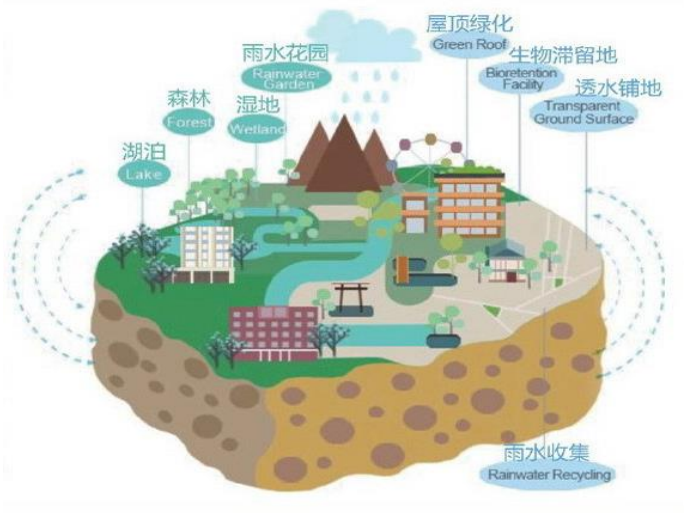

Fig.1 General Diagram of a Sponge City (www.chinacitywater.org)

However, the four natural sections on the left are particular to the sponge city strategy. For example, whereas LID proposes artificial wetlands to harvest, filtrate, and reuse rainwater, a sponge city builds aqueducts to link city tunnels with natural wetlands and rainwater gardens. The whole system has a bidirectional regulation function. That is, during a rainstorm, the excessive rainfall will flow via the connecting aqueducts to the rainwater gardens, wetlands, and finally to the forest and lakes (from right to the left part as the Fig.1 indicates); in dry seasons, the water will flow from the left to the right side. One noteworthy fact is that, most of the time except for extreme weather conditions, the flow of water between the city tunnels and the natural wetlands and lakes needs no energy[5]. Therefore, the sponge city strategy, by considering the whole city as an ecological system, not only reaches the low-impact

[5] For example, in drought, there may need drawing and delivering service outside the natural flow.

requirements in urban construction as proposed by LID, but also effectively reduces energy consumption and enhances the natural connection between a city and its surrounding wild regions. In sum, based on LID techniques but with a more systematic insight into the greater ecosystem, the sponge city strategy is more energy-efficient environment-friendly to the human society and the whole Earth.

The idea to build a sponge city was initially proposed at the 2012 Low-Carbon City and Regional Development Technology Forum, held in Shenzhen. This idea steadily attracted academic [6] and governmental attention over the next few years. On 12 December, 2013, Xi Jinping stated at the CPC Central Committee Conference on Urbanization that, "to promote urban drainage systems, we should use more natural forces in keeping and draining rainwater. A sponge city should retain, infiltrate, and purify rainwater more naturally" (i.e., with less human intervention). This is the core of the sponge city strategy, distinguishing it from the Western LID concept. One year later, on 31 December, 2014, according to the spirit of Xi's talk, the PRC Ministry of Finance, Ministry of Housing and Urban-Rural Development and Ministry of Water Resources co-launched a central fiscal support program for sponge city construction on a trial basis. The selected cities would receive earmarked subsidy funds on three levels: 400, 500, and 600 million CNY according to their scales. As one of the cities competing for the funds, Weihai's natural features and recent implementations of the strategy are introduced below. Its innovative practices in sponge city construction are discussed.

[6] According to the searching results via Baidu Scholar, the publications on sponge city strategy numbered 1260 items in 2012, 1500 items in 2013, 2017 items in 2014, 5435 items in 2015 and 4543 items in 2016— the fewer publications in 2016 may be due to the time cost in converting the paper publications before they can be searched online.

2. The City of Weihai in Shandong Province

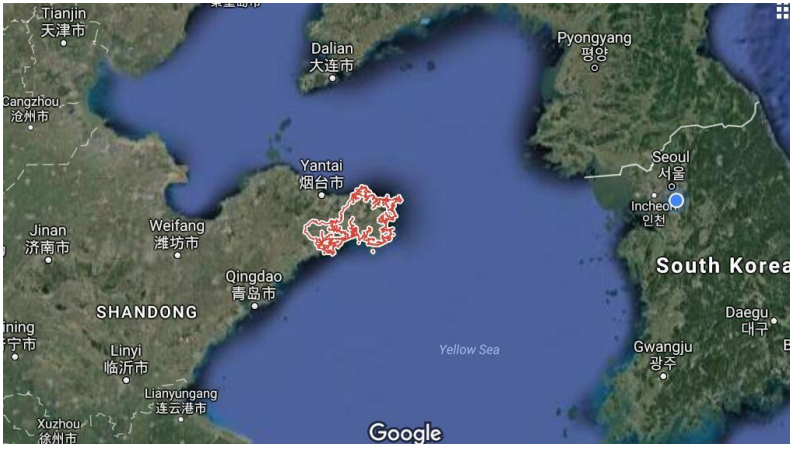

Fig. 2 The location and scale of Weihai in Shandong Province, China (Google map, "Rongcheng City")

As Fig. 2 above shows, Weihai (the red region) is located on the eastern tip of Shandong province, near Yantai, Qingdao and Dalian (across the Bohai Strait). Its coastline measures 985.9 kilometres. Weihai is also the nearest Chinese port city to Korea and Japan, with regular shipping and flights to Seoul and other cities. By the end of 2016, it had a population of 2.82 million, and GDP of 321.22 billion CNY. It has a temperate monsoon climate, with four distinct seasons. Compared to the inland areas of the same latitude, it has rich rainfall, moderate annual temperature, and a mild climate. Weihai's average annual temperature is 11.9 ℃, its average precipitation is 730.2 millimetres/year, and its average sunshine hours number 2538.2. Weihai is famous for its beautiful seaside sceneries and good environment, becoming the first coastal open city in China in 1984. In 1990, it was honored as one of first of China's National Health Cities. In 1996, the Ministry of Construction offered it the prize of National Garden City. On 7th May, 2009, it was

ranked as the National Forest City. Due to its close proximity to South Korea, Weihai has attracted a large number of Korean travellers, business visitors and investment. In 2015, it became the leading pilot city of the China-Korea Free Trade Zone.

On 7th December 2016, Weihai was listed by the State Council as the first comprehensive pilot area for the New Type of Urbanization Plan. Following that is Weihai's current Sponge City Construction Outline (hereafter referred to as the Outline), launched by the People's Government of Weihai Municipality. It provides a schedule for Weihai's sponge city construction: by the end of 2020, more than 25% of the urban built-up area will meet the requirements listed in the Outline; then by the end of 2030, more than 80% of the urban built-up area should meet it. The Outline is based on The General Office of the State Council on Promoting the Sponge City Construction Guidance (China's Council [2015] No. 75), as well as the provincial government's General Office of the People's Government of Shandong Province about Implementing Opinions of China's Council [2015] No.75 File on Sponge City Construction (Gov. Lu [2016] No.5). A summary of the Outline follows.

3. Weihai's Outline for Sponge City Construction

3.1 Overview

In order to promote sponge city construction in Weihai, the Outline stresses the restoration of urban water ecology, the conservation of water resources, and, to enhance the prevention of waterlogging, to strengthen the harmonious development between humanity and nature. Comprehensive measures should be adopted to permeate, stagnate, store, decontaminate, drain, and consume the rainwater. The city should at least reuse 75% of the rainfall for local consumption, and gradually achieve

the target conditions that there are no hydrops in small rain, no floods in heavy rain, no smelly and black water, and alleviation of the heat island effect. By 2030, more than 80% of the urban built-up area should meet the above requirements.

Scientific planning. According to the Outline and The Provisional Regulations on the Compilation of Special Planning of Sponge Cities (Construction Policy No. 50, 2016), a detailed and scientific plan should be set up for the construction of a sponge city. The city should decide on a timetable for the revision of municipal rivers, urban drainage system, green space and roads, and so on, to meet the urban construction targets and requirements. The plan should be specified in certain blocks. In this process, we should care about the protection of the whole ecological system, such as the mountains, rivers, forests, and farmlands.

Strict control of the process. Sponge city construction requires implementing the whole project in several steps: programme inspection and review; preliminary design review; construction design review; construction permission; construction completion; and approval of completion. Long-term censorship should be established to ensure the effective management of the whole process from planning and design to the acceptance of construction. The control levels and indexes should meet the same requirements as in previous LID projects for rainwater systems.

Accelerating the planning and implementation processes. According to the Outline and the more specific plans in towns' and blocks' sponge city construction, a database should be built to record and support the implementation and annual construction plans. The present city is divided into the newly developed areas and the old city districts. All the new areas, including Industrial Zones, Economic and Technological Development zones, and all kinds of parks, should fully implement the requirements of the Outline. Meanwhile, the old city districts should have a deadline for the implementation of the Outline. Besides that, the

projects in the old city areas should consider the modifications of shantytowns, old residential areas and urban infrastructure as the places for breakthroughs, in order to end urban waterlogging, enforce the utilization of rainwater and the management of black smelly water, and finally to promote the regional governance as a whole.

Setting standards. According to The Guidelines on Sponge Urban Construction Technology, LID for Rainwater Systems (City File [2014] No. 275) as well as the Outline, technical standards should be decided by comprehensively considering the geographic and climactic characteristics of Weihai. These standards should suit those physical features, and meet the safety requirements as the guide for the construction of a sponge city.

3.2 Procedures and measures

Promoting the construction of sponge parks and green spaces. The construction of city parks and green spaces should be organically combined with green networks, water networks, and road networks. The co-construction of rainwater gardens, sunken green spaces, artificial wetlands and grass ditches has abundant benefits. Apart from their traditional functions, e.g., ecological, landscape, and leisure, future parks and green spaces will be characteristic of sponge city facilities, so as to effectively capture rainwater and store excessive water from surrounding areas.

Promoting the construction of sponge-type roads and squares. The traditional means to drain away water fast and directly should be changed to the consumption function of the green belts along the roads. Meanwhile, the newly built green belts should utilize the modes of concave green land and grassing ditches to retard and reduce rainwater runoff. Permeable pavements should be laid in city squares. On one hand, road construction should consider the capture, storage, purification, and

reuse of the rainfall. On the other hand, we should also narrow the pressure on the municipal drainage system.

Promoting the construction of sponge-type architecture and residential quarters. The newly built residential communities should be strictly coordinated with LID requirements to reduce local impact. The collection and utilization of rainwater should be designed before construction. The non-motor vehicle roads, squares, and car parks in residential communities should better be constructed with permeable pavements. Additionally, the landscape facilities inside the residential communities should have better water storage and reuse functions. Government-funded projects should be pioneers in the requirements of sponge city construction, including the Affordable Housing projects, and renewal projects of shantytowns and older residential areas. Government investment should go to the improvement and construction of LID rainwater facilities, including rainwater drainage systems and excessive rainfall control facilities. Those big public projects, such as governmental agencies, schools and institutions, hospitals, cultural and sports venues, traffic stations and commercial complexes, should strictly implement the requirements of the sponge city construction Outline. Industrial and mining enterprises are also encouraged to build concave green spaces, transparent pavements and rainwater gardens; if local conditions permit, there can also be some rainwater collection, storage, and reuse facilities. The main purpose of the whole urban construction is to improve the abilities of consumption, storage, and reuse of rainwater.

Promoting the construction of urban drainage and waterlogging facilities. We should build urban drainage pipe networks, storage ponds, drainage pump stations, line discharge channels, and so on. The modification of frequently flooded areas should be boosted to eliminate urban inundation points. Rainwater and sewage should be separately directed to reduce initial pollution to the rainfall. The rainwater that has been discharged into natural water should first be purified through the

shorelines. We should boost the construction and modification of coastal trunk pipes to effectively control the leakage and confluence of the pollution from sewage overflow. Above all, the layout of the construction of rainwater facilities should be scientifically designed by considering the combination of rainwater utility, plus the drainage and waterlogging facilities.

3.3 Implementation steps

Step 1. The launch of the Outline. The outline provides the overview, measures, and requirements above on the reconstruction of Weihai as a sponge city. In 2017, projects of more than 4.76 square kilometres should be started.

Step 2. Comprehensive promotion (2017- 2020). Guided by the Outline, all districts (including the National Development Zone and Nanhai District) should establish project databases to manage the construction in an orderly manner. With the construction's continuance, relevant standards, norms, and policies can be further formulated in detail.

Step 3. Summary and popularization (2021- 2030). Experiences gained in the construction of Weihai sponge city during the 13th Five-Year Plan (2016-2020) can be conscientiously summarised and popularized in future implementation.

3.4 Supporting measures

A. Strengthening organization and leadership. To achieve the goals and steps above, a leader team for Weihai sponge city construction should be established with the mayor as the director, and a vice mayor as the vice director. The team members should be composed of the principal managers in each responsible department, town, and district, including

the deputy heads of the municipal government, district governments, and relevant departments and units. The team should strengthen the organizational leadership and work of the coordination, supervision, and inspection of Weihai sponge city construction. Problems encountered in the construction should be studied and solved in time. The team office will be located at the Municipal Bureau of Urban and Rural Construction. The office should establish a coordinative mechanism of supervision, and regularly schedule the work with progressive reports. District governments are advised to establish and improve the relevant work mechanisms, and strengthen the measures for the promotion of sponge city construction in this area.

B. Scientific division and assignment of responsibilities. The Municipal Development and Reform Commission (MDRC) is responsible for allocating funds to the sponge city construction projects under annual construction and investment plans. The MDRC should be active in seeking policy and financial support from national and provincial governments. The Municipal Finance Bureau is also responsible for enhancing the financial security of the sponge city construction. The Bureau of Land Resources (BLR) shall supply land for each project, and ensure the requirements of the construction. The Urban and Rural Construction Bureau (URCB) is the leading body to formulate supportive policies, standards, and norms in the construction and acceptance of the projects, and to cooperate with the other bodies to promote the implementing process. When deciding on planning certificates, the Planning Bureau (PB) shall strictly obey the requirements of the sponge city construction Outline. The Environmental Protection Bureau (EPB) shall provide environmental monitoring data to support the preliminary examination and approval of the projects. The Municipal Water Conservancy Bureau (MWCB) shall organize the construction of water projects, e.g., the reservoirs, rivers, and internal river basins in the sponge city construction. The Municipal

Meteorological Bureau (MMB) shall provide timely relevant meteorological information and historical data. The Water Service Company (WSC) is responsible for waterway regulation, ecological construction, and sewage treatment.

C. Increasing investment. For this objective, the departments and units at all levels should raise funds from multiple channels. The investment can be increased by enlarging and broadening the channels to guarantee the process of sponge city construction. There should be a clear boundary between the operating and non-operating properties of the sponge city construction projects. Governmental and social capitals should cooperate to invest under the spirit of sharing both the risks and the revenues. Franchising, governmental purchase services, and financial subsidies can be applied to encourage the participation of social capital in the construction and running of the sponge city projects. If the local conditions allow, all the projects in one area can be contracted as a whole package to attract those conglomerates and enterprise unions that have sufficient funds and comprehensive business capabilities. The organization of the projects can work systematically under this one-package contract, in order to optimize the holistic efficiency of the sponge city construction

D. Conducting performance appraisals. Based on The Performance Evaluation of the Sponge City Construction (Trail) (City Letter [2015] No. 635), concrete criteria and effective methods should be established to assess the performance of the sponge city construction. These methods include the index system of performance evaluation and appraisal regime. The performance of the projects' construction and social capital investment should be scientifically reflected and evaluated in them. Payments and service fees should be made according to the performance appraisal results, in order to promote further investments from social capital.

E. Strengthening propaganda and public opinion guidance. Mass

media plays a significant role in educating and popularizing the meaning and significance of the sponge city construction, as well as the governmental policies, procedures, measures and expected results. Therefore, we should widely popularize the concept and successful experiences of the sponge city construction to embody social consensus and create a harmonious atmosphere so that the whole society can understand, care about, and support the construction of the sponge city.

Bibliography

COFFMAN, L.S. "Low-impact Development: An Alternative Stormwater Management Technology." *Handbook of Water Sensitive Planning and Design*. Maryland: France RL, (2002): 97-123.

DIETZ, MICHAEL E. "Low Impact Development Practices: A Review of Current Research and Recommendations for Future Directions." *Water Air & Soil Pollution* 186.1-4 (2007): 351-363.

HONGJIN LIU. A review of Fang Shinan's thoughts on ecological civilization. *Journal of Poyang Lake*, (2017) (4), 71-77.

TZOULAS, KONSTANTINOS, et al. "Promoting ecosystem and human health in urban areas using Green Infrastructure: A literature review." *Landscape & Urban Planning* 81.3 (2007):167-178.

WEIHAI GOVERNMENT, *Opinion of Weihai People's Government on Promoting the Implementation of Sponge City Construction* (2016).