SECTOR ASSESSMENT (SUMMARY): MULTISECTOR (WATER SUPPLY AND SANITATION, WATER-BASED NATURAL RESOURCES MANAGEMENT, AND WASTE MANAGEMENT)

Sector Road Map

1. Sector Performance, Problems, and Opportunities

1. Despite high levels of economic growth in the People's Republic of China (PRC), there are vast regional disparities in both economic development and physical infrastructure provision. The income gap between urban and rural households has widened considerably since the early 1980s. The PRC is undergoing rapid urbanization—the urban population more than tripled from 190 million in 1980 to 691 million in 2011, rising from 19.4% to 51.3% of the total population.[1] The fast-growing urban population requires major investments in water infrastructure and services to ensure an inclusive and balanced development.

2. The PRC's water resources are under threat from inefficient use, weak institutional management, and inadequate protection. For years, water demand has been outstripping available water supply in the PRC due to rapid economic development, increasing urbanization, and large growth in population. The total annual water resources of the PRC are about 2,841 billion cubic meters (m^3), the sixth largest in the world. However, the annual per capita freshwater resources of the PRC were only 2,156 m^3 in 2007, among the lowest for a major country.[2] The scarcity of water in the PRC is aggravated by extensive pollution from industrial, domestic, and agricultural sources. Climate change, which results in more extreme weather events, requires better water resources management and disaster management strategies to lessen the constraints that water scarcity puts on economic and urban development.

3. Water scarcity and water pollution have important social impacts. The most important one relates to the health risks resulting from polluted sources of drinking water. Drinking water in many rural areas is unsafe, with unhealthy levels of hazardous materials such as high concentration of fluoride. The PRC government has made significant strides in improving water supply and sanitation in rural areas since 2000s; however, vast investment is still needed. Environmental degradation and pollution exacerbate poverty in rural areas while also threatening the health of vulnerable rural groups, particularly children. Safe drinking water and adequate sanitation are central to people's lives. The impacts of poor water supply and sanitation services are causing serious health problems. Inadequate water supply facilities in many areas of the PRC contribute to lower water supply coverage, poor drinking water quality, and high nonrevenue water.[3] Improved water supply and sanitation are closely linked to progress in health, education, gender equality, and environmental sustainability. In densely populated urban and peri-urban areas, poor sanitation translates into squalid living conditions and high vulnerability to environmental hazards (flooding, landslides, and drain overflows). Better wastewater disposal and drainage, and nonpoint source pollution[4] control would improve health outcomes and human productivity by reducing the prevalence of water-related infections and diseases.

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[1] National Bureau of Statistics. 2011. *Statistical Communiqué of the People's Republic of China on the 2011 National Economic and Social Development*. Beijing.
[2] World Bank. 2009. *Addressing China's Water Scarcity*. Washington, DC.
[3] Nonrevenue water refers to water that has been produced and is "lost" before it reaches the customer.
[4] Nonpoint source pollution refers to diffuse pollution caused by sediment, nutrients, organic and toxic substances originating from land-use activities, which are carried to lakes and streams by surface runoff.

4. **Water security in Chaonan.** Chaonan District is a county-level administrative division of Shantou Municipality in Guangdong Province. About 30 kilometers away from the Shantou City center, Chaonan District has a population of about 1.33 million spreading over about 600 square kilometers, of which 1.13 million or about 85% are rural residents. Chaonan District has been experiencing rapid economic growth since its establishment in 2003. However, due to its large rural population and less-developed industry and services, the district's economy and fiscal revenue fell far behind the developed regions in Guangdong Province and even below the national average. Its per capita gross domestic product in 2011 was only CNY16,379, which was about 32% of the provincial average of CNY50,807 or about 46% of the national average of CNY35,198. The per capita annual net income of rural households in 2011 was CNY5,076, about half the provincial average of CNY9,372 or 72% of the national average of CNY6,977. The total annual water resources of the district are about 580 million m^3, equivalent to only about 450 m^3 per capita per year, which is internationally considered as absolute water scarcity.[5] There are about 70 small and medium-sized reservoirs in the district with a total storage capacity of about 224 million m^3, of which eight reservoirs along the three river systems (Jinxi, Longxi, and Qiufeng) are the district's dominant water sources, contributing about 180 million m^3.

5. Chaonan District faces a great challenge of ensuring water security for its social and economic development due to (i) lack of adequate water treatment and supply facilities, (ii) weak institutional capacity for water resources management and provision of water services, and (iii) water pollution in rivers and other water bodies around the towns and villages in the plain area. Current water supply capacity, including the three major water supply systems of Jinxi, Longxi, and Qiufeng, is about 135,000 m^3 per day, which is far from meeting both the current and future demand for domestic and industrial uses in the district. Water demand is estimated to reach 288,800 m^3 per day by 2020 and 331,423 m^3 per day by 2025. The current water supply systems serve about 70% of the district population, but cannot guarantee 7-day, 24-hour services. The three water supply systems are independent from each other and cannot supplement each other if one system faces water shortage. Due to low technical standards, aging of the pipes, and lack of maintenance, nonrevenue water of the current district supply systems are as high as 50% (40% leakage, 10% nonpayment), resulting in serious water and energy losses, high water tariffs, and limited service coverage.[6]

6. Moreover, about 429,600 residents (32% of the population) do not have access to tap water. Some are still using wells as direct source for cooking and drinking without appropriate treatment, which has caused serious health problems due to the high fluoride content in the groundwater. Such unreliable and inequitable water supply has affected economic development and people's living standards in Chaonan District.

7. The water quality in the reservoirs is generally good (class II);[7] but soil erosion occurs in some catchment areas and eutrophication[8] risk is increasing, especially in the Qiufeng reservoir, due to nonpoint source pollution from agricultural practices in the watershed. Lian River, which originates from Puning Municipality and flows through Chaonan District, is seriously polluted.

[5] Hydrologists typically assess scarcity by looking at the population–water equation. An area is experiencing water stress when annual water availability drops below 1,700 m^3 per person. When annual water availability drops below 1,000 m^3 per person, the population faces water scarcity; and below 500 m^3 absolute water scarcity.

[6] Nonrevenue water refers to water that has been produced and is "lost" before it reaches the customer.

[7] The PRC's National Standard defines five water quality classes: Class I for headwaters and natural reserves; Class II for first-class drinking water sources and habitats of rare species; Class III for second-class drinking water sources, aquaculture, and swimming; Class IV for water sources for industrial use, and recreational use that does not involve direct human contact with water; and Class V for water sources for agricultural use and landscaping.

[8] Eutrophication refers to excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen.

The water quality of most Lian River sections is below class V, and cannot be used for irrigation or landscaping. In 2011, total domestic wastewater discharge amounted to 22.6 million m^3 and total industrial discharge reached 19.2 million m^3, primarily from textile and dyeing factories in the district. Inadequate wastewater treatment capacity and rural sanitation networks are also concerns. Currently, less than 50% of the district's wastewater is treated and only about 20% of rural wastewater is connected to the district's sewerage system.

8. The district lacks adequate institutional capacity and a water supply master plan for integrated water resources management. The district government established the Chaonan Water Supply Company (CWSC) in 2012 to operate and maintain the district's several independently operated water supply plants (WSPs) and the pipe networks. However, CWSC has limited control over water distribution to and tariffs for end users because ownership of the distribution pipes belongs to individual towns or villages. CWSC supplies water through these towns and/or villages to end users, and charges the towns or villages rather than charging the end users directly. Such an arrangement has resulted in higher overall cost, low efficiency, inadequate maintenance, and unfair and high tariffs. CWSC needs to be entrusted with overall responsibility over the water supply system, and empowered with qualified professionals to provide better services to its clients. There is also a need to strengthen the district's overall water resources management capacity, and to increase public awareness on water resources protection and environmental improvement. This is to ensure the sustainability of the water supply and thus the economic development of the district.

9. The provincial, municipal, and district governments have been increasing their investments in the district's water resources management and water supply and wastewater treatment facilities. They established conservation zones around the district's three major reservoirs to protect water from pollution. They rehabilitated the reservoirs to their designed function and full-storage capacity. The governments are also restoring the severely polluted Lian River. Two wastewater treatment plants, with a total treatment capacity of 60,000 m^3 per day, have been in operation since December 2010. In 2013, the Chaonan district government approved its wastewater treatment master plan (2013–2020), which aims to expand the two wastewater treatment plants to their design capacity of 130,000 m^3 per day and to construct three additional wastewater treatment plants and associated sewerage and sanitation networks by 2020 to cope with increasing wastewater volume. To implement and coordinate these activities, the district urgently needs an integrated approach to water resources management and construction of water supply infrastructure inclusive of urban and rural residents. It needs external support to help (i) promote equitable supply of water and thus equitable urban and rural development, (ii) improve the district's water resources management and CWSC's performance, and (iii) promote water conservation and step up water security for both urban and rural residents. During project preparation, opportunities for private sector participation in the project were explored but found limited due to the fragmented ownership of the water supply pipe networks in the district.

2. Government's Sector Strategy

10. **Water resources management.** The PRC's Twelfth Five-Year Plan (2011–2015) aims to build a harmonious and moderately prosperous society through livelihood improvement, equitable urbanization and coordinated urban–rural development, and balanced regional and environmentally sustainable growth.[9] Water resources management has gained increasing

[9] Government of the People's Republic of China, National People's Congress. 2011. *Outline of the Twelfth Five-Year Plan of the People's Republic of China, 2011–2015.* Beijing.

priority. The decree on the Reform Measures for Accelerating Development of Water Conservation was the first document issued by the State Council in 2011 to advance the lagging water conservation development in the next 5 to 10 years by completing the disaster management network against floods and droughts, water resource allocation system with higher use efficiency, water resource protection system, and water management reform. Looking ahead, the PRC's new programs for water resources management will focus on (i) flood control on numerous small and medium-sized rivers; (ii) safe drinking water; (iii) reforestation for carbon sequestration; (iv) wetlands conservation and watershed development; (v) pollution control, including minimizing agricultural waste; and (vi) water and soil conservation.

11. **Urbanization.** The PRC government projects a 4% increase in urbanization during the current five-year plan period, or a net increase of the urban population by about 10 million each year. About $1 trillion in investment in urban infrastructure (such as water supply, wastewater treatment, flood management, solid waste management, and transport facilities) is expected during the period. Infrastructure and services will be developed particularly in small and medium-sized cities, and urban management will be improved at all levels. The government is prioritizing a process of urbanization and urban development that provides the greatest economic and social benefits across the country while safeguarding the environment. Priority is also accorded to making all cities livable by improving the urban environment, which includes efforts to improve municipal and social services, reduce pollution, and improve land use. The plan also targets an increase in basic environmental public service capacity by improving the country's urban wastewater treatment and reuse facilities.

12. The twelfth five-year plans for Guangdong Province and Shantou Municipality also focus on building a resource-oriented and environment-friendly society to increase water use efficiency, improve the environment, reduce regional social development gaps, and improve people's living environment. In line with the national and provincial strategies, the Shantou Municipality Economic and Social Development Plan aims to strengthen water resources development and protection; facilitate investments in major water resources programs, including rural drinking water schemes; upgrade capacities for disaster prevention and management; and improve the environment.[10] Chaonan District, one of four satellite city clusters proposed under the Shantou Municipality plan, will be upgraded and accelerated for urbanization, serving as an important manufacturing base for light industry and a commodity distribution center.

13. The Guangdong Provincial Water Resources Development and Protection Master Plan, approved in 2011, emphasizes that water resources will be developed, used, and managed in a coordinated and sustainable way.[11] The short-term objectives of the plan are to (i) improve, by 2020, the urban and rural water supply safeguard system; (ii) achieve ecologically and socially safer, harmonious water resources modernization; and (iii) realize sustainable water resources use. The long-term objectives by 2030 are to establish a water-conserving society and accomplish various water resource indexes for promotion of a stable and sustainable development of Guangdong Province. The Shantou Municipality Water Resources Master Plan further defines objectives and tasks in implementing the provincial master plan.

[10] Shantou Municipality Government. 2011. *Twelfth Five-Year Plan for Shantou Economic and Social Development*. Shantou.

[11] Guangdong Provincial Water Resources Department. 2011. *Guangdong Water Resources Development and Protection Master Plan*. Guangzhou.

3. ADB Sector Experience and Assistance Program

14. The Asian Development Bank (ADB) has fostered a diverse and active portfolio in natural resources management and sustainable water resource use, including wetland preservation, water resources management, and biodiversity and ecosystem management. ADB's assistance to the PRC's water resources sector has been effective in addressing a range of water resources protection problems, with a positive impact on water resources, pollution control, and public health. Since 1998, about 15 ADB loan projects to the PRC's water resources sector have financed water resources management, water supply, wastewater treatment, flood control, and solid waste management. Lending in the agriculture and natural resources sector has increased in 2006–2012 over 2000–2005. ADB-financed water resources development projects in the PRC have generally performed well.

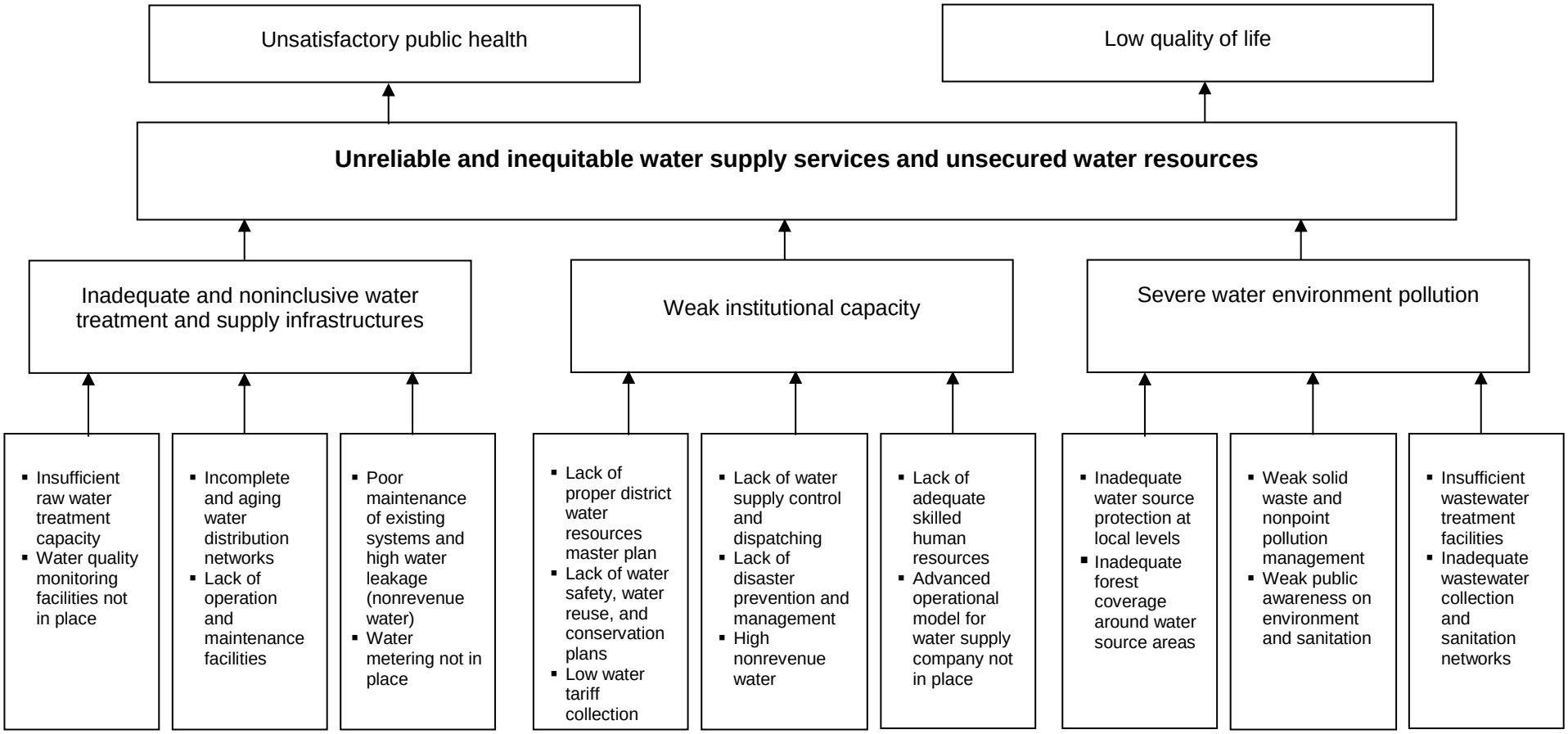
15. Up to 2012, ADB had approved 39 urban development and environmental improvement projects in the PRC with a total loan amount of about $4.5 billion. The loans have financed water supply, wastewater treatment, urban transport, flood control, solid waste management, and central heating. ADB has been supporting the PRC's development initiatives, focusing on the provision of infrastructure and creation of an enabling environment to lay a foundation for sustainable socioeconomic development. ADB assistance to the urban sector has been effective in redressing various urban development challenges and environmental problems.

16. The project builds on ADB's experiences and lessons from previous projects and knowledge generated from policy-oriented studies on integrated water resources management, water supply, wastewater treatment, urban and rural development, and flood and wetland management in the PRC and other countries. Experience suggests that project investments are effective when they are part of well-conceived and broader water resources management plans and approaches, and when such support is accompanied by capacity building to strengthen water resources management and public awareness on environment and sanitation. The project is intended to demonstrate inclusive urban and rural water resources development and protection while incorporating environmental and social considerations in planning and development. Major lessons from those earlier projects incorporated in the current project design are (i) an integrated approach of structural and nonstructural measures to water resources management; (ii) wide community participation and increased public awareness for environmental improvement; (iii) adequate operation and maintenance with sustainable financial sources based on a realistic and enforceable tariff structure and reforms; (iv) capacity development of the executing, implementing, and relevant agencies; (v) effective cross-sector coordination between relevant agencies at various levels; and (vi) establishment of an effective project monitoring and evaluation system.

17. The project is in line with ADB's strategic priorities in support of urban and rural infrastructure and environmental improvement. It supports ADB's Water Operational Plan, 2011–2020 for increasing water use efficiency and rural water supply coverage, and promoting integrated water resources management.[12] The project is also in line with ADB's country partnership strategy, 2011–2015 for the PRC, which supports the government's goal of building a harmonious society by (i) combating the rising income inequality and the widening regional disparities, and (ii) promoting environmentally sustainable development.[13]

[12] ADB. 2011. *Water Operational Plan, 2011–2020.* Manila.
[13] ADB. 2012. *Country Partnership Strategy: People's Republic of China, 2011–2015.* Manila.

Problem Tree
Multisector: Water Supply and Sanitation, Water-Based Natural Resources Management, and Waste Management



Source: Asian Development Bank.