

The background of the page is an abstract, artistic representation of water. It features dynamic, swirling brushstrokes in various shades of blue, from light turquoise to deep navy. These strokes are interspersed with numerous small, dark blue and white splatters, creating a sense of movement and energy. The overall composition is fluid and organic, with the water elements appearing to flow around the central text.

Chapter 4

*Construction and Operation
Management of Water
Conservancy Projects*

1 Overview

Since 1949, the Chinese government has placed water resources administration and utilization in a strategic position of national development and carried out massive water conservancy projects. President Xi Jinping stated the guiding principles of water resources administration— “prioritizing water saving, spatial balance, systematic governance, and giving full play to the role of government and market” . During the 19th National People’s Congress of the CPC, water conservation ranks first out of the nine major infrastructure construction missions. Since then, more efforts have been exerted to better accelerate the construction of water conservancy infrastructure.

With consistent efforts made in the past 70 years, a comprehensive water project system has roughly got into shape, playing a key role in river flood control, farmland irrigation, and urban and rural water supply. China’s water conservancy projects outrank other countries both in scale and number. The management of project construction is ever-modernizing, accompanied with a significant improvement in construction quality and a safer working-environment at construction sites. Furthermore, the water project system has seen great progress in flood control and drought defense, witnessing a sharp rise of comprehensive benefits for economic and social development.

2 Major Achievements

2.1 Water Conservancy Project Construction

Nowadays, the total amount of reservoirs in China has increased to nearly 100,000, up from 1,200 in 1949. The aggregated water storage capacity has increased from about 20 billion m³ to over 900 billion m³. River levees that are Level 5 or above for flood prevention cover a combined length of over 300,000 km, enabling China to potentially defend against the greatest



Taocha Canal Headwork of the Central Route of South-to-North Water Diversion Project

flood that has ever occurred in the nation's major rivers or streams since 1949. China has established over 100,000 sluices above designated size, over 95,000 pumping stations, supplying water to 22,000 irrigated zones that covers an area of over 133.33 hm². These facilities enable China to guarantee food security for 21% of the world's population, with about 6% of the world's water resources and 9% of the world's arable land. China's water-resource allocation system is also on track, characterized with the "South-to-North Transfer, East-West Complementary Transfer Strategy" . As an example, the South-to-North Water Transfer Project has subsequently brought about the availability of 860 billion m³ of water supply. The water conservancy projects have played a significant role in effective water supply for urban and rural areas, even in medium drought years. Consistent efforts have brought preliminary improvement in 1.2 million km² of the land area suffering from soil and water erosion, together with the establishment of 20 million hm² of terrace fields and over 60,000 soil-retaining dams. These soil and water conservation measures can reduce soil erosion by 1.8 billion metric tons annually and enlarge water-retention capacity by 30 billion-plus m³. In rural areas, over



World Bank Loan Project Xiaolangdi Multi-Purpose Hydro Project of the Yellow River

47,000 hydropower stations have been built, with an installed capacity of 79 million kW, generating a total of 250 billion kW·h of electricity per year. China's water conservancy projects have been ranking among the top of the world both in scale and number. These projects are safe, stable and generating economic and social benefits as planned.

2.1.1 Historic Technological Advances from Imitation to Independent Innovation

Up to date, China has established a relatively comprehensive technological system in water conservancy projects. It is home to the world's highest concrete arch dam, roller compacted concrete dam (RCCD), and concrete face rock-fill dam. It also boasts of the most dams that are 200 meters high or above, the world's top in installed hydropower capacity and scale of flood discharge structures. China has developed a series of internationally leading technologies, including super-high dam construction, heavy-flow flood discharge, the super-large chamber, the treatment of complicated ecological foundations and super-high slopes.

2.1.2 Modernization of Construction Management for Water Conservancy Projects

Investment in water conservancy construction has gradually shifted from a single channel of budgetary appropriation to multi-channel. This



integrates fiscal appropriation, water conservancy funding, policy loans, public financing and foreign investment. China has initially established a diverse, multi-level, multi-channel landscape of water conservancy development led by government investment and complimented with public investment. Management of water conservancy projects are getting more professional, followed with the full implementation of regulations such as the legal project person accountability system, tendering and bidding system, construction supervising system and contract management system. With these measures, the market entry and supervision systems are more effective. The credit system is well under construction and various construction methods are in pilot, like agent construction and the general contracting of “design-to-build” .

2.1.3 Significant Improvement of Construction Quality

China boasts the lowest rate of dam-break accidents around the world. For decades, it has enjoyed a steady progress in construction quality of water conservancy projects. 13 hydro-projects, including the *Three Gorge Project* and the *Yellow River Xiaolangdi Project*, have won the Milestone Award from the International Commission on Large Dams (ICOLD). Besides, several projects have been awarded with the China Luban Construction Engineering Prize (National Prime Quality Project), including Pump Station at Guazhou, Yangzhou, First Phase of Reclamation



Dongjiang-Shenzhen Water Supply Project

Project (North) at Oufei, Wenzhou, and Niulan-River-to-Dianchi-Lake Water Replenishing Project in Yunan Province; projects with the Tien-yow Jeme Civil Engineering Prize include Xiajiang Water Conservancy Project in Jiangxi Province, and Youjiang River Water Conservancy Project at Baise ; and 150-plus projects have been awarded the China Dayu Quality Water Conservancy Project Prize.

2.1.4 Progress of Water Conservancy Projects Related to Hong Kong, Macao and Taiwan

The Donjiang-Shenzhen Water Supply Project has supplied water to Hong Kong for 50-plus consecutive years and the Fujian-Jinmen Water Supply Project has started to function. The Datengxia Gorge Water Conservancy Project is well under construction, and currently working at normal water level. The project will play a significant role in reducing the upstream saltwater tide, and consequently guaranteeing the security of the water supply in Macao and the Pearl River Delta areas.

2.2 Operation Management

2.2.1 Improving Water Conservancy Project Management

China has witnessed much progress in institutional reform of State-owned large and medium-sized water conservancy project management enterprises, resulting in a better separation of project management and



Danjiangkou Water Control Project

maintenance. Institutional reform in small water conservancy project management has also advanced smoothly. This has led to a better clarification of project ownership, improved designation of management and maintenance units and obligations, an increase of funding. At present, China has realized a full coverage of professional management and maintenance of small dams.

2.2.2 Solidified Basis for Water Conservancy Project Management

2.2.2.1 Digitalized Management of Water Conservancy Projects

With the principles of demand-and-application orientation, digital empowerment and full-fledged service, the MWR has been advancing in digitalized management of water conservancy projects by developing National Reservoirs and Dams Database Management Information System, coupled with a information management system that involves water-resources administrative departments and water-conservation administrative departments at various levels of government. Besides, the MWR has established the Basic Information Database for Embankment Sluice, with an overall review rate of 96% for embankment sluice. With this Database, the MWR has achieved normalization of embankments and sluices registration, integrating water conservancy projects into a national network. This integration lays a solid foundation for a smart water conservancy system that could serve safety forecasting, precaution, rehearsal and contingency purposes. In addition, the First Phase of

National Large Reservoirs and Dams Safety Monitoring and Supervising Platform is advancing as scheduled.

2.2.2.2 Reservoir and Dam Safety

Put into effect accountability system for reservoir and dam safety. China strictly implements an accountability system for reservoir and dam safety, and a system of “Three-person Accountability Rule” where there is an administrator, a technician, and an on-duty inspector for flood control. Every year before the predicted flood season, the media will publicize officials who are responsible for reservoir and dam safety, so as to increase public scrutiny and therefore ensure comprehensive management and accountability system of reservoir and dam safety.

2.2.2.3 Steady Improvement in Setting up Administration and Protection Areas for State-owned Water Conservancy Projects

With the River-and-Lake Chief policy, the MWR, together with the local governments, has promoted to delimit the areas of rivers, lakes, as well as water conservancy projects. Subsequently, the Ministry has motivated and coordinated the local governments to conduct a comprehensive examination of the delimitation issue of conservancy projects, sluices and embankments, and then compiles a list of projects that are yet to be delimited. On the basis of previous work, the Ministry has further guided the delimitation work by issuing the *General Plan for Delimiting Administration and Protection Areas of Water Conservancy Projects During the 14th Five-Year Plan Period*, which defines annual objects and tasks in this regard.

2.2.2.4 Better Maintenance of Small Water Conservancy Projects

With the policy of comprehensively promoting construction of infrastructure, adopted by the Central Committee of CPC and central government, the State Council has approved the *Work Plan for Security and Maintenance of Water Conservancy Projects During the 14th Five-Year Plan Period*. To better implement this work plan, the Ministry ensures tasks and obligations of local governments to better achieve precision management and control. Besides, the Ministry introduces various measures to enhance project quality and safety management during maintenance of small water conservancy projects.

2.2.3 Updated Knowledge of Safety Conditions of Water Conservancy Projects

2.2.3.1 Actively Engaging Reservoir and Sluice Safety Condition Assessment Work

China put into place a reservoir and dam safety assessment warning system, which promptly re-examines the safety issues of those defective reservoirs that need reinforcement or maintenance, and carry out diagnostic investigations on risky issues of the small reservoirs. The WMR has set up evaluation standards for dangerous sections and projects and hereafter compiled a list of dangerous sections and projects. With these standards, the Ministry conducts pilot safety evaluation programs of those dangerous sections and projects to command updated information. On the other hand, the Ministry carries out a census of faulty and dangerous large and medium-sized sluices and complies the *General Plan for Safety Evaluation of Large and Medium-sized Sluices During the 14th Five-Year Plan Period*. Under the guidance of the General Plan, the WMR accelerates the evaluation work and consequently determines the issues of maintenance, demotion and retirement.

2.2.3.2 Accelerating Demotion and Retirement Evaluation of Water Conservancy Projects

The WMR has initially set up a normalized work mechanism of safety evaluation for water conservancy projects. With the establishment of a digitalized database, the Ministry has fully promoted the safety evaluation program by means of comprehensive research and studies, scientific treatment of demotion and retirement, and an optimized mechanism of exit for water conservancy projects. With these measures in place, the past few years have witnessed significant improvements in safety conditions of numerous small water conservancy projects, which play a key role in flood control, drought defense and irrigation.

2.2.3.3 Steady Growth of Project Monitoring System

China has made great efforts in establishing infrastructure for precipitation measure and forecast, and safety monitoring of small water conservancy projects. It carries out pilot programs, adopting new technology and methods, to promote high-level, high-standards, high-quality monitoring infrastructure, which could eventually improve the monitoring capabilities of small conservancy projects. Also, China is

progressing in constructing ministry and provincial level monitoring platforms of water conservancy projects.

2.2.4 Establishing Operation and Management System of Water Conservancy Projects

China has been making great progress in modifying operation and management systems, establishing a set of laws and regulations, taking the following legal document as core: *Law on Water*, *Law on Flood Control*, *Regulations on Safety Management of Water Conservancy Projects*, *Regulations on River Management*. The WMR pays equal importance to comprehensive control and key projects, pays high heed to application and efficiency. Meanwhile, the Ministry has revised many documents and regulations, to ensure mandatory management of operation and improve management system of water conservancy projects.

2.2.5 Further Reinforcement of Supervising and Examining Project Operation Management

2.2.5.1 Precision Measures Adopted for Specific Supervision and Inspection Purposes

With an optimized work plan, the WMR has supervised and inspected water conservancy projects, sluices and dangerous embankments and sections from six aspects of operation, including operation management of small water conservancy projects, operation management of large and medium-sized water conservancy projects, operation management of small water conservancy projects, operation management of sluices, dangerous embankments and sections, safety and maintenance of small water conservancy projects, and monitoring infrastructure construction of small water conservancy projects. On the basis of supervision and inspection, the WMR enforces accountability of local governments and urges problem solving after the inspection, in an effort to improve operation management of water conservancy projects, optimizing supervision and inspection and facilitating standardization and professionalization of supervision and inspection work.

2.2.5.2 Gaining Momentum in Standardized Management of Water Conservancy Projects

In 2003, the MWR stipulated Evaluation Methods of Water Conservancy Projects and specific evaluation criteria, which was followed with an evaluation of management of MWR. By the end of 2021, over 165 pipeline companies have stood from the evaluation. Further, in 2022, the MWR strengthened the legal documents of water conservancy projects by stipulating *Guidance of Standardized Management of Water Conservancy Projects*, revising *Management Evaluation Methods Water Conservancy Projects* to *Evaluation Method for Standardized Management of Water Conservancy Projects*, makes a standardized management program across China. By the end of 2022, 3,821 water conservancy projects have passed the evaluation of standardized management carried out by the local governments. 21 water conservancy projects have fulfilled the standards of management set by the MWR.

3 Work Goals

Following the guidingline of goal-oriented and problem-oriented work, we will steadily advance development of major water conservancy projects with effective management and supervision of construction quality. In the meantime, it is our priority to ensure construction safety, prevent and eliminate risks and potential dangers, and generally improve the quality of projects. This is conducive to the healthy development of the water conservancy construction market. It is our prime goal to ensure reservoir construction safety, especially of small ones. Our short-term goal is to conduct a project census and strengthen our foundation of project management. Our medium- and long-term goals include the establishment of a standardized, digitalized and modernized project management system, which lays a solid foundation for the comprehensive development of water conservancy project management.

4 International Cooperation and Exchanges

Water resources and hydropower has been one of the first industries in China to “go abroad”. Chinese hydroelectric enterprises actively engage in international cooperation. With decades of overseas business and development, these enterprises have gained international reputation in overseas contracting, investment, business and trade in the area of water resources and hydropower. These enterprises are also in command of leading technologies in water resources and hydropower development, operation management, financial services and capital funding. This allows the enterprises to be capable of integrating the whole industrial chain that includes the design, construction and manufacture of major machinery. We have forged diverse cooperation with 100-plus countries and regions in terms of hydropower development, undertaking hydropower projects and



The Sino-Kazakhstan Horgos River Friendship Water Diversion Project



river planning in over 60 countries. Doing businesses in over 140 countries internationally, Chinese hydroelectric enterprises own more than 10 million kW of installed capacity rights¹, with a total contract amount of US\$150 billion, ranking top among all the “go abroad” industries. In recent years, international cooperation on trans-boundary rivers have been developing smoothly. The *Horgos River Friendship Water Diversion Project* and the *Sumbe River Water Diversion Project* between China and Kazakhstan are already in use and generating economic benefits. The *Sino-Kazakhstan Horgos River Alamali (Chukulbrack) Joint Mudslide Blocking Dam* that has begun construction will, once completed, effectively protect major infrastructure in the lower stream, and ensure the safety of life and property along the river.

1 Installed capacity rights refers to the installed capacity according to the proportion of rights. For example, if two companies invest in a power plant with the installed capacity of 1 million kW, and one of them accounts for 60% of shareholder rights, or 60% of all shares, then its installed capacity rights are 600,000 kW ($1,000,000 \times 60\% = 600,000$).

