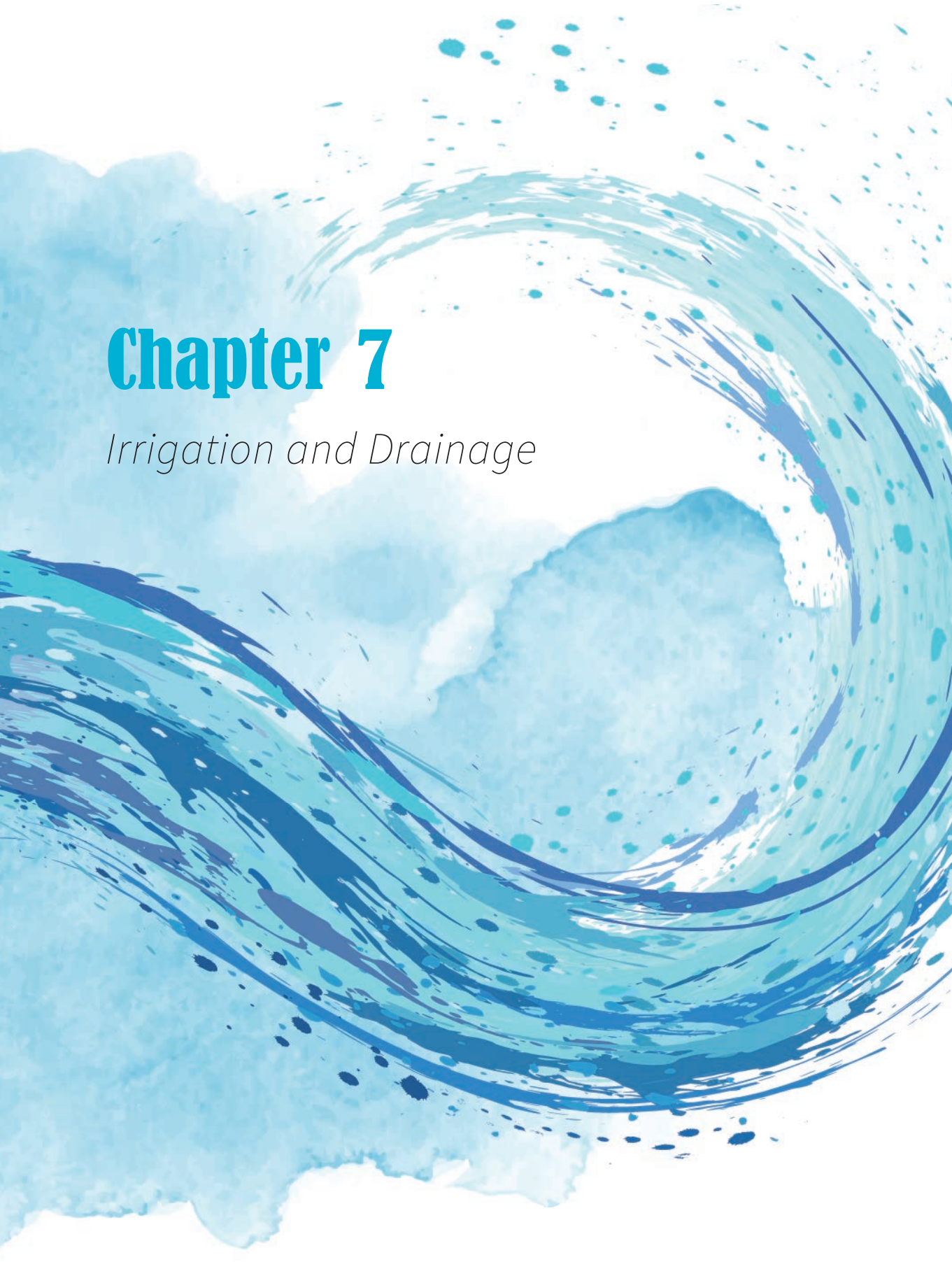


Chapter 7

Irrigation and Drainage

A Wheat Harvest in the Irrigated Area of the Lower Reach of the Yellow River

1 Overview

China is a country with the largest area of irrigated land. Farmland irrigation and drainage has a history of more than 5,000 years. It plays a decisive role in agricultural production, food security as well as economic and social development. From Dayu Controlling the Waters until now, a large number of well-known ancient irrigation and drainage projects have

Karez Well in Xinjiang

been finished by hardworking Chinese people,such as the world-famous Zhengguo Canal, Dujiang Weir and Lingqu Canal, which are still effective to this day, providing economic, social and ecological benefits.

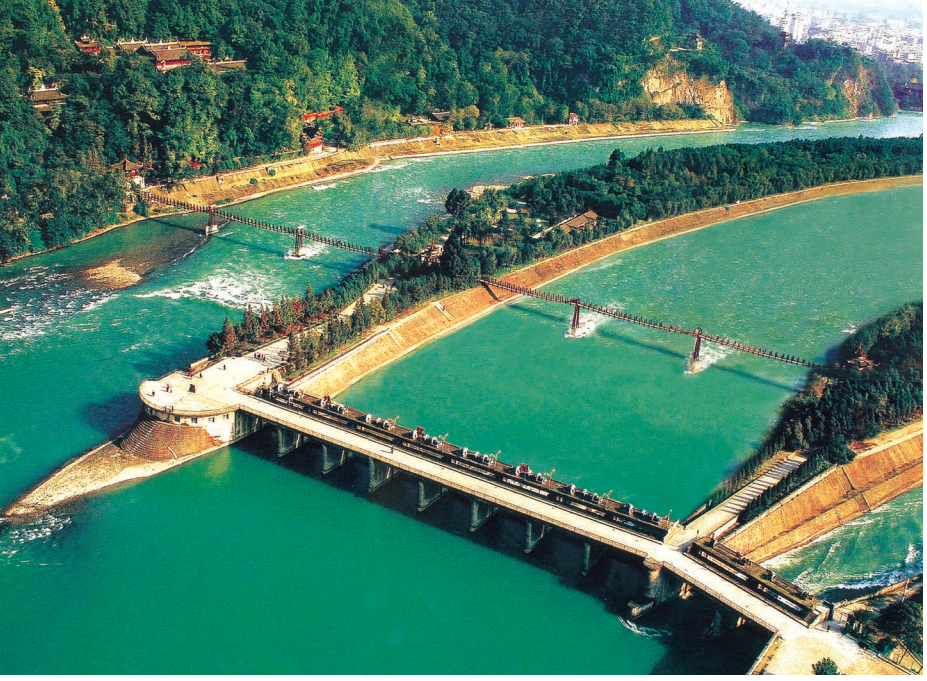
Since the 1950s, the Chinese government has focused on the requirements of economic and social development. It has organized people of all ethnic groups across the country to carry out large-scale water conservancy construction. This has helped with flood control and drought relief, guaranteeing water supply and food security, and helped with ecological improvement. The irrigated area has been continuously expanded increasing its support capacity. As the basic conditions for agricultural production constantly improved, new breakthroughs in grain output continue to be made.

2 Main Achievements & Challenges

2.1 Main Achievements

2.1.1 Farmland Irrigation and Drainage System is Gradually Improved

Through the construction and reinforcement of reservoirs and other water storage projects and the implementation of inter-basin and cross-regional water diversion projects, the water resources safeguard system



Headworks of Dujiangyan

has been initially formed. The system combines storage, diversion and transfer and effectively alleviates the problem of an uneven distribution of water resources. Thus farmland irrigation and drainage facilities are upgraded and the capacity for agricultural production is greatly improved. At present, 7,326 reservoirs in various types have been built, and each has an irrigation capacity of 667 hm^2; 4.6 million small dams and 6.9 million water cellars have been completed, which are supplemented by 4.9 million electromechanical farmland wells with an installed capacity of 49.5 million kW; 4.34 million fixed irrigation drainage pumping stations have been constructed, with an installed capacity of 27.16 million kW; The size of irrigated arable land has grown from 16 million hm^2 in 1949 to over 69 million hm^2 at present, ranking first in the world. The total grain output has gone up from 113.2 billion kg in 1949 to over 650 billion kg. More than 75% of grain is produced in irrigated areas.

2.1.2 Water-saving Irrigation is a Key Water Conservancy Task for Sustainable Utilization of Water Resources

Water for agricultural use accounts for about 60% of the national economic and social water consumption. The Chinese government put forward that "water-saving irrigation should be carried out as a revolutionary measure". The local governments at all levels and all sectors of society, especially the farmers who had benefited from this measure, have actively participated in the construction and management

of water-saving irrigation projects. Through the continued construction of irrigation facilities and implementation of water-saving measures in irrigated areas, China's water-saving irrigation has been developed. The coverage of water-saving irrigation projects has increased to 37.80 million hm^2, including 23.19 million hm^2 of efficient water-saving irrigation through low-pressure pipe irrigation, sprinkler irrigation, micro irrigation and so on. The effective utilization coefficient of irrigation water in farmland, which is regarded as an indicator of efficient water use in irrigation, increased from 0.43 in 2000 to 0.568. In the past 30 years, the area of effectively irrigated farmland in China has increased by 20.07 million hm^2 .Water consumption for agricultural irrigation has basically remained at about 340 billion m^3, but the proportion of water used for irrigation has decreased from more than 79% to the current 55% or so. At present, China's water-saving irrigation measures have developed from irrigation in small areas to concentrated contiguous irrigation in large areas, from field water saving to comprehensive water saving, from plain well irrigation to gravity irrigation and arid hills irrigation, and from efficient cash crops irrigation to field crop irrigation.

2.1.3 The Supporting System for Irrigation and Drainage is Gradually Improved

The *Water Law of the People's Republic of China*, *Regulations for Irrigation and Drainage* and *Opinions on Promoting a Comprehensive Reform of*

Sprinkler Irrigation

Water Price for Agriculture requires the government to take irrigation and drainage construction seriously. The Chinese government has formulated the *Rural Revitalization Strategic Plan* and the *National Economic and Social Development Plan*, which clearly define the objectives and tasks of the construction and reconstruction of farmland irrigation and drainage facilities and put forward developmental requirements, which are the focus of the national infrastructure. We have established an investment and financing system for irrigation and water conservancy where public finance is the leading factor, with social supplements and farmers' participation. We have also improved supporting policies, either civilian-run or state-subsidized, such as replacing subsidies with awards, providing subsidies for the purchase of agricultural machinery and tools, and preferential financial loans. The Chinese government has issued and implemented the strictest water resource management system, the *National Water Saving Action Plan*. It has formulated a system for farmland water conservancy technology, product and equipment standards and various other project construction management standards. As China's scientific and technological capacity has significantly improved, a water-saving technology system suitable for the national conditions has emerged. The aim to integrate an industrial system for equipment and materials production with a water-saving system combined with scientific research and application is well on the way.

2.2 Challenges

2.2.1 Ensure Food Security and Comprehensively Build a Well-off Society

With a huge population of 1.4 billion, it is always a top priority for China to solve the problem of feeding the population while relying only on domestic resources. Therefore, we must speed up the construction of farmland water conservancy facilities and strive to improve the total agricultural production capacity and output efficiency. Then we can realize the aim of "storing grain in land and technology".

2.2.2 Relieve the Contradiction between Supply and Demand of Water Resources and Promote Ecological Civilization

At present, the average annual water shortage of China's agriculture is about 30 billion m^3. In some agricultural areas, the following problems are obvious: extensive management, inefficient water consumption, over-exploitation of groundwater and transfer of water originally supplied for ecological purpose. We must vigorously develop water-saving irrigation, adjust the agricultural layout and planting structure, change the traditional way of agricultural development, promote water-saving technologies and scientific irrigation methods, and enhance the efficiency and economic returns of agricultural water consumption.

Pishihang Irrigation District, Located in Anhui Province

2.2.3 Adapt to Rural Reform and the Development of Agricultural Modernization

At present, China's rural economic and social structure is undergoing profound changes. The rural labor force has shifted to the cities and is ageing. The "Empty-nest" phenomenon is becoming more prevalent. The benefit-cost ratio of agriculture is comparatively low. We must vigorously accelerate the modernization of irrigation and drainage, through information technology and scientific endeavour, with the aim to effectively reduce labor intensity while improving productivity.

2.2.4 Cope with Global Climate Change and Improve the Capacity to Reduce the Losses Resulted from Drought and Other Natural Disasters

Affected by climate change, the impact of extreme floods and droughts on agricultural production is increasing. It is necessary to reinforce the reconstruction of irrigation and drainage facilities, improve the reliability of agricultural water supply and drainage, then lay a solid foundation for water conservancy to enhance the agricultural sector's ability to effectively cope with climate change and to combat the effects of floods and droughts.

3 Strategies and Key Measures for Future Development

3.1 Developmental Goals of Irrigation and Drainage by 2030

3.1.1 Extend irrigated area to 76.3 million hm^2 nationwide, which will include 71.3 million hm^2 of effectively irrigated farmland; and basically restore and rehabilitate farmlands and arable land throughout the country that is vulnerable to being waterlogged or salinization.

3.1.2 Extend the coverage of the national farmland water-saving irrigation project to more than 56.70 million hm^2, which will include 34 million hm^2 by sprinkler irrigation, micro-irrigation, or pipeline irrigation.

Dujiangyan Irrigation District

3.1.3 Increase the farmland irrigation water use coefficient to 0.6; and cap nationwide water consumption for irrigation purposes at 373 billion m^3.

3.1.4 Tighten irrigation water use management; establish a system that features "total quantity control and quota management" of irrigation water consumption; and set up a sound incentive and constraint mechanism.

3.2 Priority Tasks

3.2.1 Speed up the Transformation and Construction of Major Irrigation and Drainage Engineering Facilities

Complete the construction of supporting facilities and modernization renovation in large and medium-sized irrigation districts nationwide. Speed up the renovation of irrigation and drainage pumping stations, strengthen the management of key waterlogged areas, and improve the irrigation and drainage system. A number of new large and medium-sized irrigation districts will appear in areas where water and soil resources permit.

3.2.2 Develop Water-saving Irrigation Vigorously

Speed up the implementation of efficient water-saving irrigation on a gigantic scale in the main grain producing areas, water shortage areas and ecologically vulnerable areas; vigorously promote pipeline irrigation, sprinkler irrigation, micro-irrigation and other efficient water-saving irrigation technology; enhance water-saving in agriculture through a combination of engineering measures, advanced agronomic techniques and improved management.

3.2.3 Comprehensively Push Forward the Construction of Small Irrigation and Drainage Projects

Construct field work in irrigation areas and small-scale projects in mountainous areas, such as the "Five Kinds of Small Water Conservancy Projects", including small dams, small pumping stations, small channels, small pools and small water cellars; and speed up the construction of drought-resistant emergency water projects in the flood-prone areas so as to improve the support capacity of anti-drought projects.

3.2.4 Quicken Reform in the Field of Irrigation and Drainage

Continue to reform the management of pumping stations and other key irrigation and drainage projects in irrigation areas; reform the property rights system of small-scale farmland irrigation infrastructures; facilitate the development of the "water users association" among farmers; and

Small Waterworks in Guizhou Province

actively cultivate specialized and marketed service teams. By 2020, the irrigation area where farmers participate in the management of irrigation water will reach more than half of the effective irrigation area. Actively carry out the total control and quota management of irrigation water; construct water metering and informatization facilities; and reform agricultural water price.

4 International Cooperation and Exchanges

Since the 1980s, we have engaged in both multilateral technical exchanges and cooperation with international organizations including UNFAO, UNICEF, the EU, the World Bank, Asia Development Bank, the International Water Management Institute, and the International Commission on Irrigation and Drainage, as well as bilateral exchanges and cooperation with countries such as Japan, the UK, Australia, the Netherlands, and so on. For instance, we cooperated with the Japanese

Nigerian Engineers Visited Water Tank in Dingxi City, Gansu Province

ICID Heritage Irrigation Structures in China

government in execution of the "Development and Training Center for Irrigation and Drainage Technology" program and the "Demonstration Project on Water-saving Renovation of Large Irrigation Areas in China". In cooperation with the UK, we carried out the World Bank managed project "Reforming Rural Water Conservancy in China for the Poor". Economic or technical cooperation between China and other developing countries in Asia and Africa also goes on in areas such as the construction of irrigation and drainage projects, rural water supply facilities and personnel training. This plays a positive role in helping those countries improve their rural and agricultural infrastructure, increase grain output, and raise living standards of the local population.

As a member of the International Commission on Irrigation and Drainage (ICID), China has conducted all-round exchanges with the ICID, organized several international irrigation and drainage conferences, participated

Sprinkler Irrigation in Guangxi Zhuang Autonomous Region

in the work related to the ICID, and carried out bilateral cooperation and exchanges with ICID member countries. There was one Chinese expert elected ICID Chairman, five elected vice chairman, and 15 granted ICID water-saving technology awards. Water-saving Nigerian youth-engineers visited the water tank in Dingxi City, Gansu Province. China also won the ICID Heritage Irrigation Structures in China Headworks of Yintang Irrigation District in Heilongjiang Province award and water management award. As of 2022, China has 30 ancient irrigation projects listed in the ICID Register of Heritage Irrigation Structures.