

IRRIGATION AND DRAINAGE

# IRRIGATION AND DRAINAGE IN CHINA

MINISTRY OF WATER RESOURCES, PEOPLE'S REPUBLIC OF CHINA



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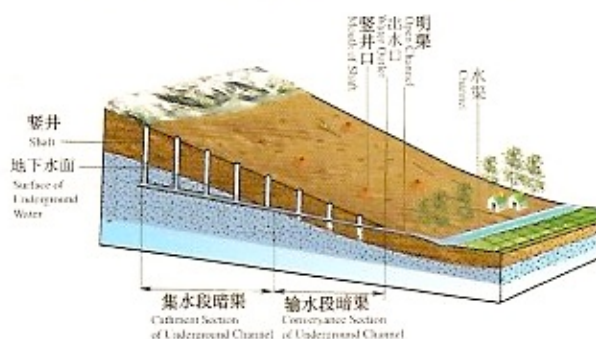
## 1. Overview

Irrigation and drainage plays a very important role in agricultural production, socioeconomic development, and eco-environment protection in China, a country with a long history in developing irrigation and drainage systems. Over 2,000 years ago, LI Bing and his son built Dujiang Weir, a gravity irrigation project on the Min River in Sichuan Province. Still in service today, the weir irrigates an area of 693,300 ha. Since the 1950s, tens of millions of irrigation works in all types including water storage irrigation, water diversion irrigation and water pumping irrigation have been built in China. The increase in irrigated area over the past few decades exceeds the combined irrigated area developed over thousands of years.

In parallel with extensive development of irrigation, China has also paid equal attention to control of surface and sub-surface water logging and salinization.

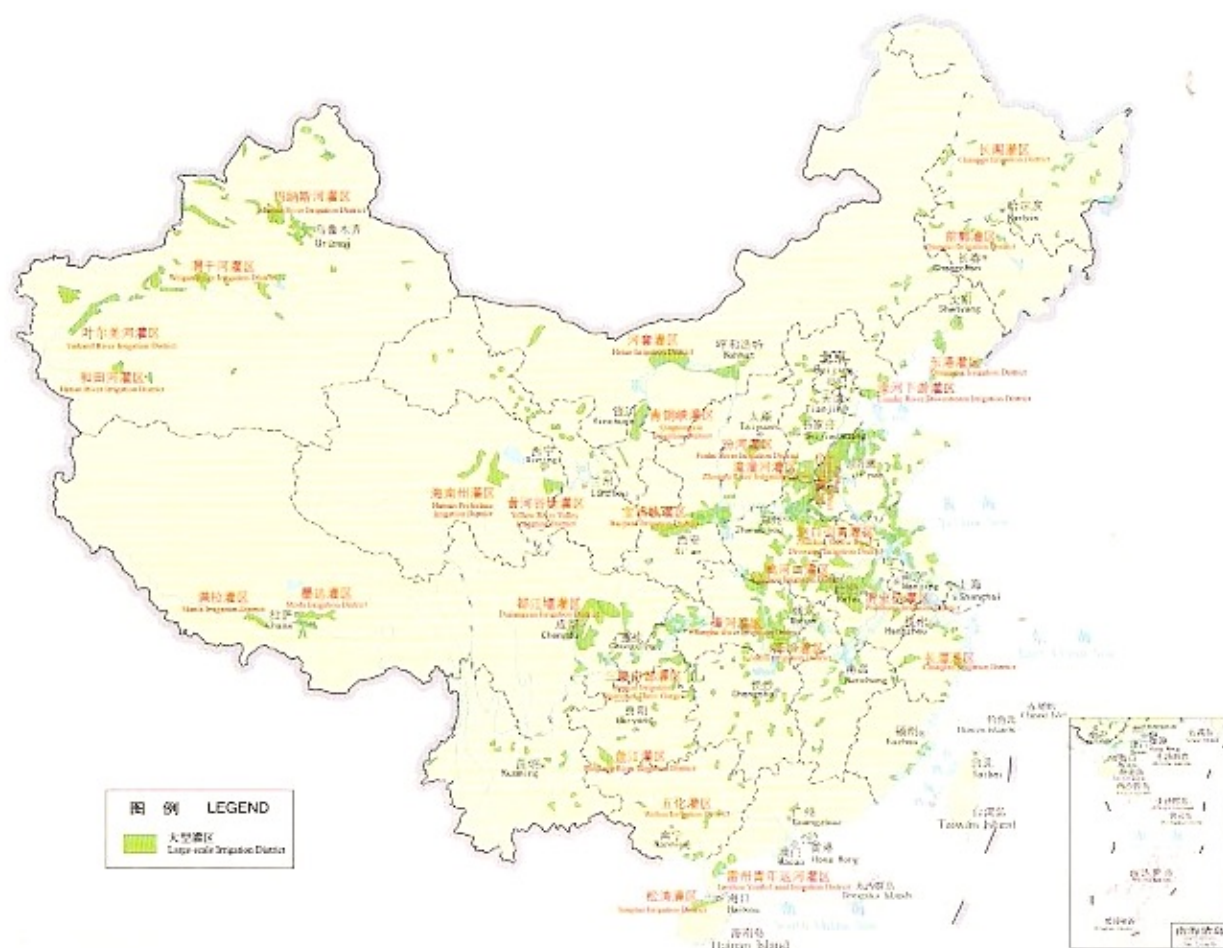


*Karez Well in Xinjiang Uygur Autonomous Region*



*Diagram of Karez Well*





*Layout of large-scale irrigation districts*

Meanwhile, main drainage river channels have been dredged and expanded; a great number of farmland drainage systems have been put in place; drainage sluices and pumping stations are built; alkaline land gets irrigated, and open ditch drainage applied. Flood water has been diverted for desilting purpose. Irrigation and drainage by way of well is applied; and vegetation is planted in line with specific soil conditions.



*Remains of the inlet of Lingqu Canal*



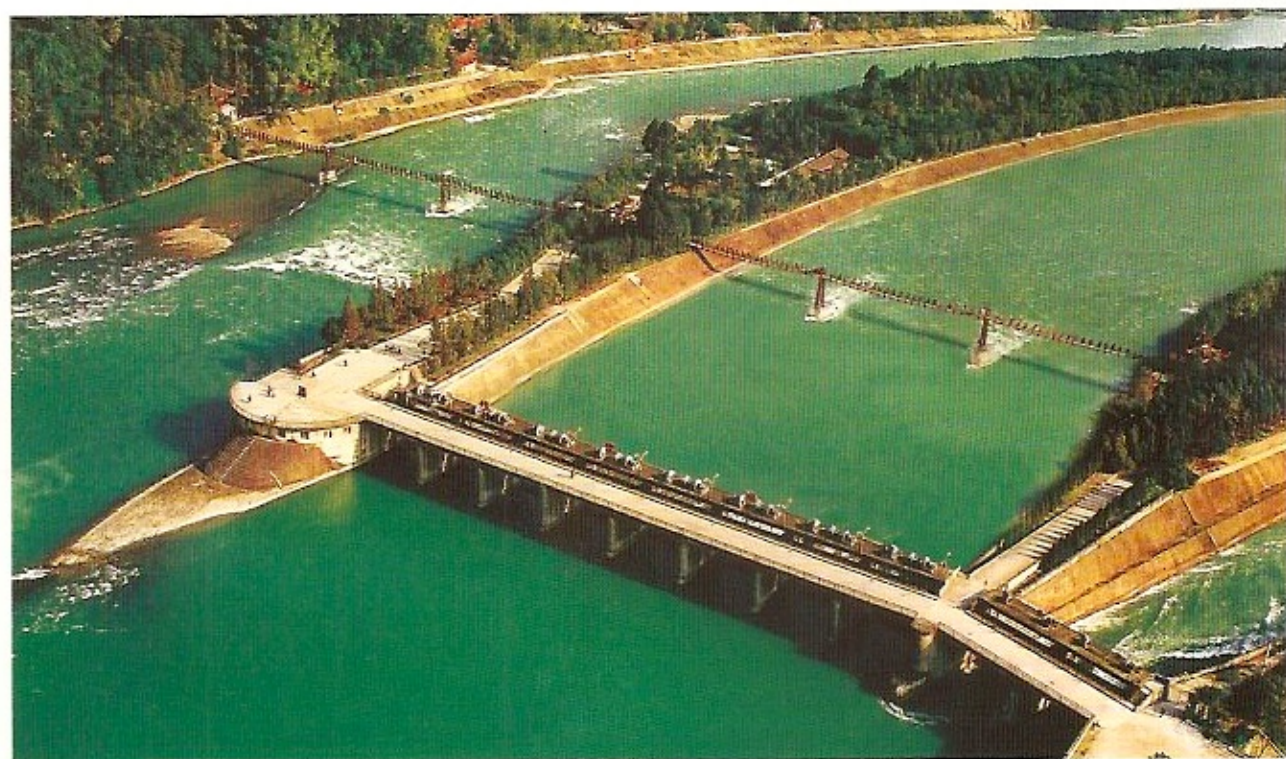
## 2. Main Achievements & Challenges

### 2.1 Main Achievements

Since the 1950s, the Chinese government has adopted a series of policies and measures to promote the development of irrigation and drainage facilities, which has resulted in marked improvements to agricultural output, farmers' living conditions and the rural eco-environment, greater agricultural resilience to natural disasters, poverty reduction and continuous income increase for hundreds and millions of farmers, and basic self-sufficiency of primary agricultural products including grain. The following are the highlights:

#### 2.1.1 Substantial Increase in Comprehensive Agricultural Productivity

Since 1949, 97,735 reservoirs in various types have been built, with a combined capacity of 839.4 billion  $m^3$ ; 4.56 million small dams and 6.89 million water cellars have been completed, which is supplemented by 4.83 million farmland electromechanical wells with installed capacity of 494.32 million kW; 434,000 fixed electromechanical pumping stations have been constructed, with installed capacity of 27.16 million kW; the installed capacity of flow irrigation and drainage, spray irrigation, and drip irrigation facilities reached 25.63 million kW; there are 7,772 irrigated districts with designed coverage  $\geq 667$  ha each, totaling 33.534 million ha in irrigated area. The size of irrigated arable land has grown from 15.933 million ha in 1949 to 64.54 million ha at present. During the same period, irrigated forage land reached 0.85 million ha; and total grain output went up from 113.2 billion kg to 601.9 billion kg.



*Headworks of Dujiang Weir*





*Sprinkler irrigation*

### 2.1.2 Effective Boost of the Second and Tertiary Industries and Marked Improvement of the Eco-Environment

Since 2000, newly developed water saving irrigation works in China have covered an area of 13.93 million ha, saving nearly 35 billion  $\text{m}^3$  of water each year. Moreover, the incremental 10.2 million ha of irrigated arable land goes hand in hand with the decline of the ratio of agricultural water consumption in the national total from 90% to less than 60%, which greatly mitigates the conflict between water demand for development of the second and tertiary industries and that for ecological flow. All these have facilitated sustainable development of the national economy and improvement to the eco-environment.

## 2.2 Challenges

### 2.2.1 Irrigation and drainage facilities remain a marked deficiency in China's infrastructure.

On the one hand, farmland irrigation and drainage facilities are aging, poorly maintained and missing supporting facilities, making the "last mile" problem very prominent in farmland irrigation. On the other hand, irrigation water use efficiency remains poor. Only 45% of effectively irrigated farmland is covered by water-saving irrigation works; ground irrigation takes up 88% of the total, while spray or micro irrigation accounts for an even smaller 12%. Water use efficiency is very limited.



2.2.2 Poorly aligned institutional setup continues to constrain sustainability of irrigation and drainage development.

First, a long-term mechanism for stable growth of investment in farmland water conservancy is yet to



*Pishihang Irrigation District, located in Anhui Province*

be established. Second, reform of the farmland water conservancy management system remains an arduous task. Third, capacity building of the farmland water conservancy sector is lagging behind. At the same time, the backward legal framework on farmland water conservancy also severely constrains its development.

2.2.3 It is a pressing task to enhance farmland water conservancy in response to global climate change, which will help minimize the impacts of extreme weather conditions on agriculture and rural areas, and enable agriculture to better prevent and withstand natural disasters such as floods and droughts.

### 3. Strategies and Key Measures for Future Development

#### 3.1 Targets of Developing Irrigation and Drainage in China by 2020

- (1) Extend national irrigated area to 73 million ha, which will include 66 million ha of effectively irrigated farmland; and basically restore and rehabilitate farmland vulnerable to surface logging, salinization, and sub-surface logging.
- (2) Cover 46 million ha of arable land by water-saving irrigation nationwide, of which, highly-efficient water-saving irrigation will cover 22 million ha; and enable 1.5 million ha of forage land in the pastoral area to be covered by irrigation systems, of which, 1.4 million ha will enjoy water-saving irrigation.
- (3) Increase farmland irrigation water use coefficient to above 0.55; raise grain output per  $\text{m}^3$  of irrigation water to higher than 1.55 kg; and cap national water consumption for irrigation purposes at 372 billion  $\text{m}^3$  (at present it is 355 billion  $\text{m}^3$ ).
- (4) Tighten irrigation water use management; establish a system that features "total quantity control and quota





*Dujiang Weir Irrigation District*

management" of irrigation water consumption; and set up a sound incentive and constraint mechanism to facilitate water saving.

### **3.2 Priority Tasks**

(1) Accelerate technological renovation and transformation of medium and large-scale irrigation and drainage facilities: carry out water-saving renovation in 434 large irrigation areas and add water-saving facilities to 2,157 medium-sized ones; prioritize the water-saving renovation of 268 large irrigation areas and 666 medium-sized ones covered by the *Capacity Plan to Increase 100 billion Kilograms of Grain Output in China*; initiate upgrading and renovation of medium-sized irrigation and drainage pumping stations after completing renovation of 251 large ones at a quicker pace; attach more importance to restoring and rehabilitating key areas vulnerable to flooding and logging; and make improvements to the irrigation and drainage systems.

(2) Vigorously develop water-saving irrigation by promoting high-efficiency water saving irrigation technologies including pipe water conveyance, spray irrigation and micro-irrigation; guide local and social capital to invest in water-saving irrigation; strengthen the construction of metering facilities; improve the methods used for collection of water tariff; better integrate water-saving solutions that are respectively



*West Liaohe Irrigation District in Inner Mongolia Autonomous Region*





*Jiangdu Pumping Station in Jiangsu Province*

based on structural measures, agricultural processes and water management; accelerate the implementation of regional economy-of-scale high-efficiency water-saving irrigation; and make sure high-efficiency water-saving irrigation systems cover an additional 3.3 million ha of farmland during the 12th Five-Year Plan period, so that such irrigated area will total 6.6 million ha.

(3) Comprehensively push forward the construction of small farmland water conservancy works: strengthen pooling of funding for pro-agriculture water-related programs at all levels in all categories; promote the construction of small farmland water conservancy facilities, including the development of farmland works, end-canal systems in irrigation areas, and the "5 types of small water conservancy works" (i.e., small dams, small pumping stations, small ditches, small ponds, and small water cellars) in hilly and mountainous areas, thereby comprehensively elevating







*Small waterworks in Guizhou Province*



*Sprinkler irrigation in Guangxi Zhuang Autonomous Region*

the construction and management levels of small farmland water conservancy projects.

(4) Vigorously drive forward the construction of water source projects and new irrigation areas: build a number of modernized irrigation areas with matching soil and water conditions at a faster pace; effectively

facilitate the construction of key water source projects in the 5 provinces (autonomous regions and municipalities directly under the central government) in southwestern China; accelerate the construction of a group of water source projects for contingency drought relief; and strengthen the construction of the "5 types of small water conservancy works" in the







*Experiment of micro and sprinkler irrigation technology*

mountainous southwestern regions for better drought relief preparedness.

(5) Pace up the construction of water-saving irrigation facilities for forage land: tailor such construction in accordance with local circumstances so that an incremental 1.15 million ha of forage land will be covered by water-saving irrigation systems by 2020.

(6) Quicken reform of farmland water conservancy: Continue to deepen the reform of water management systems including irrigation areas and pumping stations, as well as the reform of the ownership system of small rural water conservancy facilities; effectively engage water users' cooperatives in the management of water resources, so that 80% of the irrigation areas will be managed with participation by water users by 2020; improve the water pricing mechanism, and

gradually implement the regime that features terminal water price, progressive pricing for above-the-quota water consumption, and charging of water use based on water metering.

#### 4. International Cooperation and Exchanges

China has always been dedicated to enhancing international cooperation and exchanges. We have joined global efforts to explore irrigation and drainage technologies, address management bottlenecks, and thereby facilitate breakthrough development of irrigation and drainage programs.

Since China's reform and opening up, we have engaged in both multilateral technical exchanges and cooperation with international organizations including UNFAO, UNICEF, EU, World Bank, Asia



*Nigerian engineers visited water tank in Dingxi City, Gansu Province*



Development Bank, International Water Management Institute, and 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 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, which 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.

China is a member of the International Commission on Irrigation and Drainage (ICID). Its cooperation with ICID covers multiple dimensions and takes a variety



*ICID Heritage Irrigation Structures in China*

of forms such as international meetings, bilateral exchanges, and participation in running for ICID leadership.



*Headworks of Yintang Irrigation District in Heilongjiang Province*



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