

WATER RESOURCES MANAGEMENT AND
PROTECTION

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MINISTRY OF WATER RESOURCES, PEOPLE'S REPUBLIC OF CHINA



Water Resources Management and Protection in China

1. Development & Utilization of Water Resources

1.1 Overview of Water Resources in China

Total volume of water resources in China stands at 2.8 trillion m^3 , ranking the 6th in the world, whereas water resources per capita in China only records $2,100m^3$, about 28% of the world average.

Water resources are unevenly distributed in space. The distribution of water resources doesn't match the layout of land resources and productive forces. North China takes up 63.5% and 46% of the total national land area and population but only 19% of the national water resources.

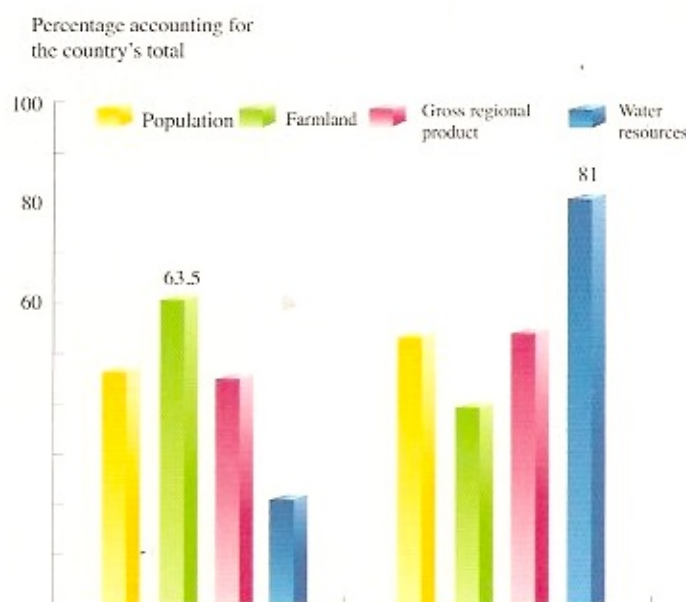


Fig.1 Comparison chart of population, farmland, gross regional product and water resources in China

Water resources are unevenly distributed in time. Precipitation and river runoff in China are highly concentrated within a year, but vary substantially between years. For most regions, precipitation in 4 consecutive months accounts for 60-80% of the annual total. In North China, precipitation in the wettest years could be 3-6 times that of the driest years; and for river runoff, the corresponding difference could come up to more than 10 times.

Severe pollution of water bodies: In 2014, rivers with a combined length of 216,000 km nationwide were monitored and assessed for their water quality. The findings indicated that in terms of water quality, 72.8% of the total river length fell in Grade I-III, and the rest 27.2% was in Grade IV or more inferior categories (See Fig. 2). For the whole year of 2014, water function zones achieved a water quality compliance rate of 51.8%; and provincial sections with Grade I-III water quality took up 64.9% of the total assessed sections.

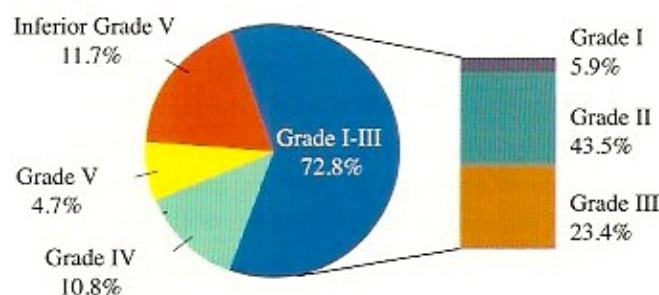


Fig.2 % of rivers nationwide by grade of water quality for the Year 2014

1.2 Development and Utilization of Water Resources

Since 1949, water development and utilization has gone through 3 phases: single-purpose development, multi-purpose development and sustainable development. In 2014, China recorded 609.5 billion m^3 of both water supply and consumption, 447 m^3 comprehensive water consumption per capita, 96 m^3 water consumption per RMB10,000 GDP (current year price), 59.5 m^3 water consumption per RMB10,000 industrial added value (current year price), 213L/d domestic urban water consumption per capita, and 81L/d domestic rural water consumption per capita.

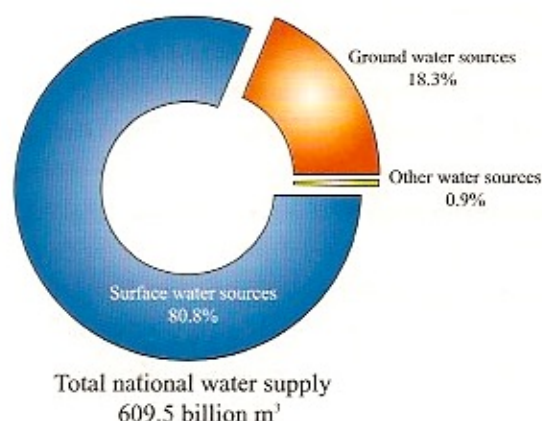


Fig.3 National water supply in 2014

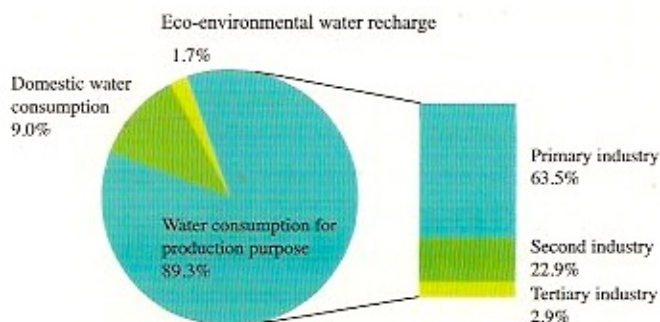


Fig.4 National water consumption in 2014

2. Achievements and Challenges

The Chinese government takes resource conservation and environmental protection as a basic policy. In accordance with the strategic plan for building an eco-friendly civilization, efforts are made to maintain harmony between man and nature, develop water conservancy for improvements to people's livelihood, and promote the construction of an eco-friendly water civilization and a water-saving society. Management and protection of water resources plays an active and significant role in facilitating rational water allocation, raising water use efficiency and effectiveness and controlling rapid increase in water demand. Fast progress of urbanization and industrialization, sustained socioeconomic development and impact of global climate change combine to expose water resources management in China to graver challenges.

2.1 Major Achievements

2.1.1 The Strictest Water Resources Management System

China has already put in place the legal framework for management of water resources with the *Water Law of the People's Republic of China* at its core, and practiced the water resources management system that combines basin-specific management and administrative region-based management. Moreover, the government has established the strictest water resources management system which centers on the "Three Red Lines" (red lines for water development and utilization control, water use efficiency control, and pollutant load control in water function zones) and four regulations (regulations of total water use quantity control, water use efficiency control, pollutant load control in water

function zones, and accountability and performance assessment system for water resources management), plus water resources-based responsibility and performance evaluation mechanisms for administrative regions at all levels. Specifically, regulations and policies such as water extraction licenses, water resource-based verification of project feasibility, paid use of water resources, quota management of water consumption, management of water function zones, monitoring of pollutant discharges along rivers have been formulated to push forward the construction of a water-saving society and an eco-friendly civilization. Efforts have also been made to improve integrated management of water related issues in both urban and rural areas. As a result, an integrated assurance system has taken shape, which is characterized by flood prevention, logging control, concentrated water supply, drainage & pollution control, protection of water resources and management of water environment.

2.1.2 Allocation of Water Resources

China's water resources planning system has got roughly into shape, as is symbolized by comprehensive planning of water resources and all sorts of specialized plans and basin-specific preparation and revision of plans, which lays the foundation for allocation of water resources. *The National Comprehensive Plan on Water Resources* approved by the State Council has explicitly capped national peak-time water consumption at 700 billion m³ by 2030. Currently, the yearly national water supply stands at around 700 billion m³ and effectively irrigated area records 64 million ha. Work has been done to step up construction of water allocation projects so as to improve regulation and control of water resources in time and space. The completion of the first phase of both the Eastern and Central Routes of

South-to-North Water Transfer Project along with the subsequent availability of transferred water has played a significant role in alleviating the imbalance between water demand and supply in water-scarce northern China. Efforts have also been made to incorporate non-conventional water sources into integrated water allocation, intensify management of water extraction licenses and water resource-based verification of project feasibility, and stop disorderly, excessive and inefficient development of water resources. Further, the system on paid use of water resources is in full implementation, and the standards on collection of water resources fees reasonably are set to practice differentiate water pricing, i.e., enlarge the water tariff gap between high water consumption industries and other industries. 7 provinces are piloting water rights with a view to building a national water right system in China.

2.1.3 Utilization Efficiency and Effectiveness of Water Resources

So far, there are 100 geographical role models in the construction of a water saving society. With their

demonstrative example, they help drive forward the construction of a water-saving society in the whole country. 30 provinces (autonomous regions and centrally administered municipalities, except Tibet) have released water use quotas and practiced planned management of water consumption by key water users. More than 83,000 rural water users' associations have been set up. As such, the water saving mechanism enjoys gradual improvement and awareness of water saving is markedly enhanced in the whole society. The coefficient of farmland irrigation water use has gone up from 0.35 in 1978 to 0.53 in 2014; water consumption per RMB10,000 GDP down from 2,909m³ in the early 1980s to 167m³ in 2014; and water consumption per RMB10,000 industrial added value down from 953m³ to 85m³ in 2014 (calculated at 2000 comparable price). Recent years has also witnessed less than 1% growth in average annual national water consumption. Rapid growth of water consumption has been kept under effective control, with some regions registering negative growth in this regard.

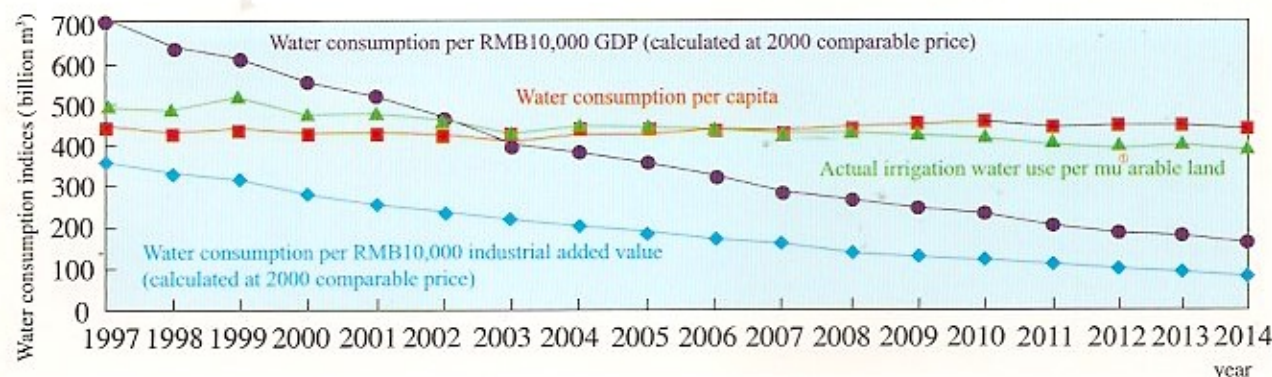


Fig.5 Change in main indicators of national water consumption 1997–2014
(① 1mu=0.667ha)

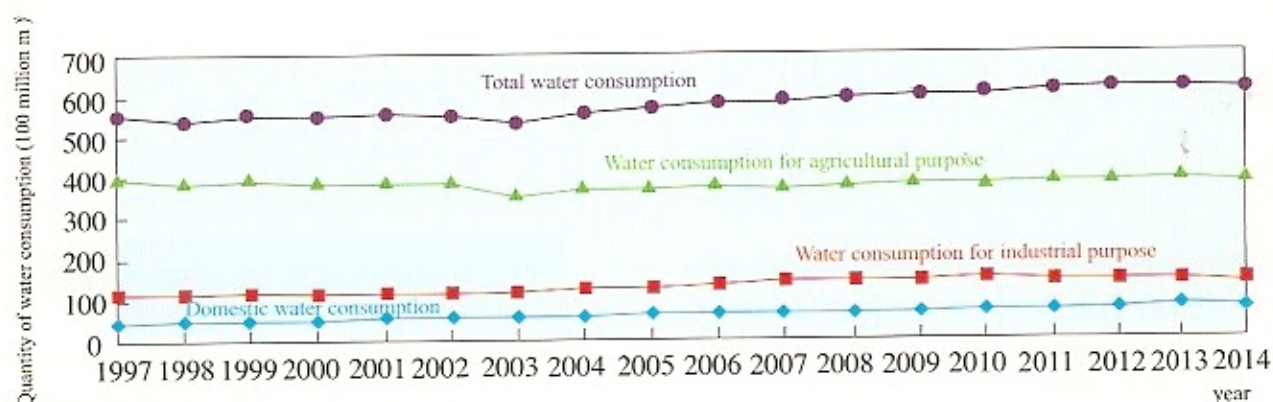


Fig.6 Quantitative change of national water consumption 1997~2014

2.1.4 Protection of Water Resources

Comprehensive implementation of the requirements on water resource-based verification of project feasibility has stopped blind construction of high water consumption and heavy pollution projects from the origins, and promoted harmony between urban development, industrial layout and carrying capacity of water resources. To reinforce monitoring and management of water function zones, the State Council has approved the national definition of water function zones represented by major rivers and lakes, with 31 provincial governments approving and executing corresponding definitions of water function zones within their respective jurisdictions. The basin authorities have verified and approved the pollutant

load capacity of major rivers and lakes nationwide and advised on limiting the total volume of pollutant discharge. Supervision and monitoring of water function zones has been enhanced, basically covering all water quality sections at buffer zones of provincial boundaries. The completion of census and registration of pollutant discharge outlets in the 7 major river basins has resulted in more stringent requirements on any new construction, renovation and expansion of pollutant discharge outlets along rivers. Measures have also been taken to ensure safety and compliance of drinking water sources by releasing the list of 175 (in 3 batches) major water sources for urban drinking water nationwide and identifying the targets for management of the drinking water sources. Continuous progress in environmental governance of key basins and



Restored wetlands in the Yellow River Estuary



Ecological improvement by integrated water resources management in the lower reach of the Tarim River

regions has reinforced local ecological protection and enhancement. The Yellow River is free from dry-off for 15 consecutive years. Ecological conditions in lower stream Hei River and Tarim River basins are restored. The ecological water replenishment project in Zhalong Wetland has rescued the local ecology and rare species. Positive results are recorded for pilot projects on protection and restoration of water ecological systems. Groundwater extraction is placed under strict control by capping the total extraction volume and the water level. Assessment of regions suffering excessive extraction of groundwater nationwide is completed, giving rise to piloting efforts in Hebei Province for comprehensive governance of local areas with extreme over-extraction of groundwater. The State Council has approved and implemented the *Plan on Pressure*

Extraction of Groundwater in the First Phase of the Central and Eastern Routes of the South-to-North Water Transfer Project. Health assessment of key rivers and lakes has been conducted nationwide. The *Water Pollution Prevention and Control Action Plan* promulgated by the State Council puts forward the general requirements and periodical objectives of water pollution prevention and control that are centered on the construction of an eco-friendly civilization and quality improvement of water environment.

2.2 Challenges

In recent years, accelerating industrialization and urbanization and intensifying impacts of global climate change expose China to severe situations of

water security where old and new problems entangle. Issues such as water shortage, high frequency of water hazards, damage to water ecology and pollution of water environment have become more prominent and constituted a bottleneck constraining economic and social development. First, water shortage is acute. From the average inter-annual perspective, annual water shortage nationwide exceeds 50 billion m^3 , which means intensive supply-demand imbalance. Second, damage to water ecology is serious. Dry-off of rivers, degradation of wetlands and grasslands, over extraction of groundwater plus water loss and soil erosion are just some of the wide range of ecological problems. Third, pollution of water environment is severe. Pollutant discharge into rivers and lakes remain high, going beyond the carrying capacity of water resources and water environments in some places. Even some water-abundant areas suffer pollution-induced water shortage. Thus, water resources management remains an arduous task and has a long way to go.

3. Future Development Strategy and Key Measures

The Chinese government will continue to practice the sustainable development concept and implement the strictest water resources management system with a holistic approach in accordance with the guiding principles of "prioritizing water saving, spatial balance, systematic governance, and equal attention to conservation and development". Efforts are made to further construct a water-saving society and an eco-friendly civilization in order to realize rational development, optimal allocation, efficient use, effective protection and scientific management of water resources, achieve coordinated development of resources, population, the environment, economy and society, and build a beautiful eco-friendly China.



The Tianchi Lake in the Changbai Mountain

3.1 Work Goals

We will develop a modernized water resources management system compatible with the all-round construction of a well-off society by 2020, or specifically, we will endeavor to attain the following 6 goals:

(1) Put in place a sound water resources management and supervision framework: The framework will include well developed water regulations and technical standards, as well as requirements and policies on water allocation, conservation and protection.

(2) Establish a system for ensuring drinking water safety and water use security for economic and social purposes: Work is to be done to develop a high-standard urban and rural drinking water safety assurance system, so as to achieve a $\geq 95\%$ water source guarantee rate of urban water supply, markedly improve water quality of urban and rural drinking water sources, and guarantee rational water



Logo for national water conservation campaign

consumption for economic and social development purpose.

(3) Establish the system of rational allocation and efficient utilization of water resources: We will keep total national water consumption below 670 billion m^3 , and reduce water consumption per RMB10,000 GDP and per RMB10,000 industrial added value by 25% and 20% from the 2015 level respectively, and raise the coefficient of farmland irrigation water use nationwide to ≥ 0.55 .

(4) Build an assurance system for protection of water resources and health of rivers and lakes: Water quality of all water sources for water supply of key cities will comply with concerned standards, and that in water function areas of major rivers and lakes will achieve a $\geq 60\%$ compliance rate. Water ecology of major regions will be greatly improved and excessive extraction of groundwater effectively controlled, so that severely over-extracted areas will enjoy a fundamental turnaround, ecological water use along rivers will be guaranteed, some rivers suffering grave ecological damage gradually restored and severe ecological degradation markedly reversed.

(5) Develop a system for assurance of capacity building and scientific & technological support to water resources management: The system will be

Table 1 Control Index of "Three Red Lines"

Control index of "Three Red Lines"(y)	Water use quantity of national total (billion m ³)	Water consumption for industrial added value (m ³) Per 10 000 yuan RMB	Effective utilization coefficient of farmland irrigation water	Water quality compliance rate in key water function zones of rivers and lakes
2015	635	decrease by 30% from 2010 level	> 0.53	60%
2020	670	< 65*	> 0.55	80%
2030	700	< 40*	> 0.6	95%

* Calculated by the constant price of 2000

3.2 Key Measures

3.2.1 Strict Quantitative Control of Total Water Consumption

characterized by sound water resources management authorities, comprehensive planning systems, extensive application of ICT and modernization technologies, higher technological level, improved monitoring, metering and ICT-based management of water resources, better approaches for water resources regulation, greater capacity for emergency response, and further refinement of the requirements on release of water statistics and information. All these will greatly improve overall water management.

(6) Establish a sound system to ensure effective management and operation of water resources: Efforts will be made to further improve the water resources management system that combines basin-specific and administrative region-based management of water resources. Further, an integrated water resources management system for urban and rural areas covering flood control, logging elimination, water supply and drainage, and wastewater disposal and recycling will take a preliminary shape. More coordinated inter-department consultation and cooperation mechanisms will materialize hand in hand with more extensive participation of the public in water resources management.

Efforts will be exerted to further improve the water resources planning system, and reinforce plan implementation, monitoring and inspection. Water allocation arrangements for major rivers and basins will be made at a quicker pace; an indicator system for total quantity control of water withdrawal and consumption will be put in place covering all river/lake basins and three levels of administrative regions (province, city and county); and the water right transfer system will be established and improved. Water resource-based verification of project feasibility and management of water extraction licenses will be tightened. Water resources fees will be collected, used and managed in better ways. More efforts will be carried out to strengthen groundwater management and protection, monitoring of groundwater dynamics, and control groundwater level and total quantity of groundwater extraction. Programs, plans and emergency response plans for regulation of water resources will be formulated and refined in accordance with law, so as to regulate water resources in a unified manner, coordinate water consumption for domestic, production and ecological purposes and enhance water resources regulation in response to emergency.



Zhangye, Gansu Province, a pilot project of water-saving society development

3.2.2 Push Forward the Building of a Water-saving Society

To promote the construction of a water-saving society, we need prioritize water saving throughout the processes of economic and social development as well as people's daily life and work. Better policies and regulations on water saving should be formulated and the quota standard system advanced. Further, water conservation should be actively practiced in all sectors including agriculture, industry, urban life and the service industry. Water saving demonstration communities can serve as the vehicle for creating the prevailing custom of water conservation in the whole society. The early warning mechanism pertaining to the carrying capacity of water resources will be put in place at all administrative levels starting from the counties, so that a rigid constraint mechanism compatible with the requirements of economic and social development will come into being and force optimization of industrial structure and adjustment of industrial layout.

3.2.3 Strengthen the Construction of An Eco-friendly Water Civilization

To deepen the construction of an eco-friendly water



Water-saving irrigation

civilization, we need explore a uniquely Chinese model in line with the conditions of water resources and water ecology in China and the requirement that mountains, water, forests, farms and lakes are one life community. Management of water function zones should be used as a platform to strengthen layered management of water function zones by category, promote water-system linkage of rivers and lakes as well as ecological protection and restoration of water ecology, thereby creating a water ecology protection layout featuring "unified planning, all-round layout, comprehensive consideration and division of duties in implementation". Work is to be done to ensure safety compliance of important drinking water sources, improve regulations on verification and safety



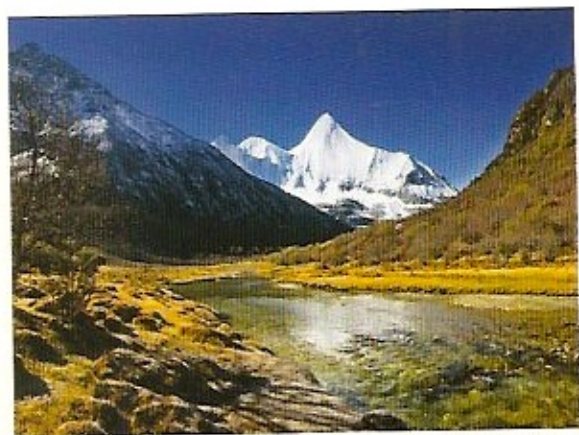
The Moon Bay in Wuyuan County, Jiangxi Province, a renowned eco-tourist spot

assessment of drinking water sources, and prepare emergency response plans for drinking water sources to safeguard water supply security. More efforts will be invested to enhance protection of key ecological reserves, water source cultivation areas, river source areas and wetlands, establish an indicator system for assessment of ecological flows and river ecology, and conduct regular health assessment of major rivers and lakes across the country.

3.2.4 Improve the Water Resources Management System

Great efforts are in progress to reform the existing water resources management system, rationally divide mandates and responsibilities between basin and administrative region authorities to strengthen integrated water planning, allocation and regulation of water resources in basins, and promote the establishment of a basin affair coordination mechanism and an efficient execution mechanism that are characterized by participation of all parties, democratic consultation, joint decision-making and division of

duties. Work needs to be done to further promote integration of urban and rural water affairs for improved comprehensive management of water related administrative matters in the administrative regions, and coordination of water source development, flood control, water extraction, water supply, water use, water conservation, drainage, and wastewater treatment and reuse. All these aim at integrated water resources management at all dimensions, in all



The Yangmaiying Snow Mountain, Sichuan Province



areas and throughout the entire process and gradual advancement of market-oriented reform of the water industry. It is also imperative to step up development of regulations on water resource-based verification of plan feasibility and supervision/inspection of water resources, and steadily push forward reform of the water right system.

3.2.5 Build Capacity for Better Foundation and Assurance of Water Resources Management

More intensive efforts will be exerted to develop the system of laws, regulation and standards on water resources management so as to formulate a sound legal framework and a high-quality technical standard system. Scientific studies, surveys and assessment of water resources will be carried out on a regular basis to obtain timely and accurate knowledge of water resources and their development and utilization. Moreover, specialized plans dedicated to water resources management and protection will be formulated and implemented. National capacity building for better water monitoring will

be reinforced to enhance regulation over water resources management on all fronts. Release of water related statistics and information is to be enhanced for greater information transparency, and correct guidance of public opinion and behavior. Water resources emergency response planning and disposal mechanisms will be further improved to upgrade emergency response capability.

3.2.6 Implement the Tasks Stipulated in the *Water Pollution Prevention and Control Action Plan*

Efforts in this regard will be carried out in accordance with the phased targets set out in the *Water Pollution Prevention and Control Action Plan* and the requirements of the ten tasks, namely, comprehensive control of pollutant discharge, transformation and upgrading of economic structure, vigorous conservation and protection of water resources, stronger technological support, full leverage of the market mechanism, tougher supervision over environment law enforcement, more intensive management of the water environment, full safety assurance of the water eco-

environment, clear division and effective discharge of duties, and more effective public participation and social monitoring. Specifically, with focus placed on implementing the strictest water resources management system, water resources management and protection will build a water use efficiency assessment system including the indicator on water consumption per RMB100,000 GDP, vigorously develop water saving facilities for agriculture, push forward industrial water saving, improve the performance evaluation system for protection of water resources, strengthen flow regulation of rivers, lakes, and reservoirs, define ecological flows in a scientific manner, strictly restrict groundwater over-extraction, and adjust the structure and layout of the planting industry.

4. International Cooperation and Exchanges

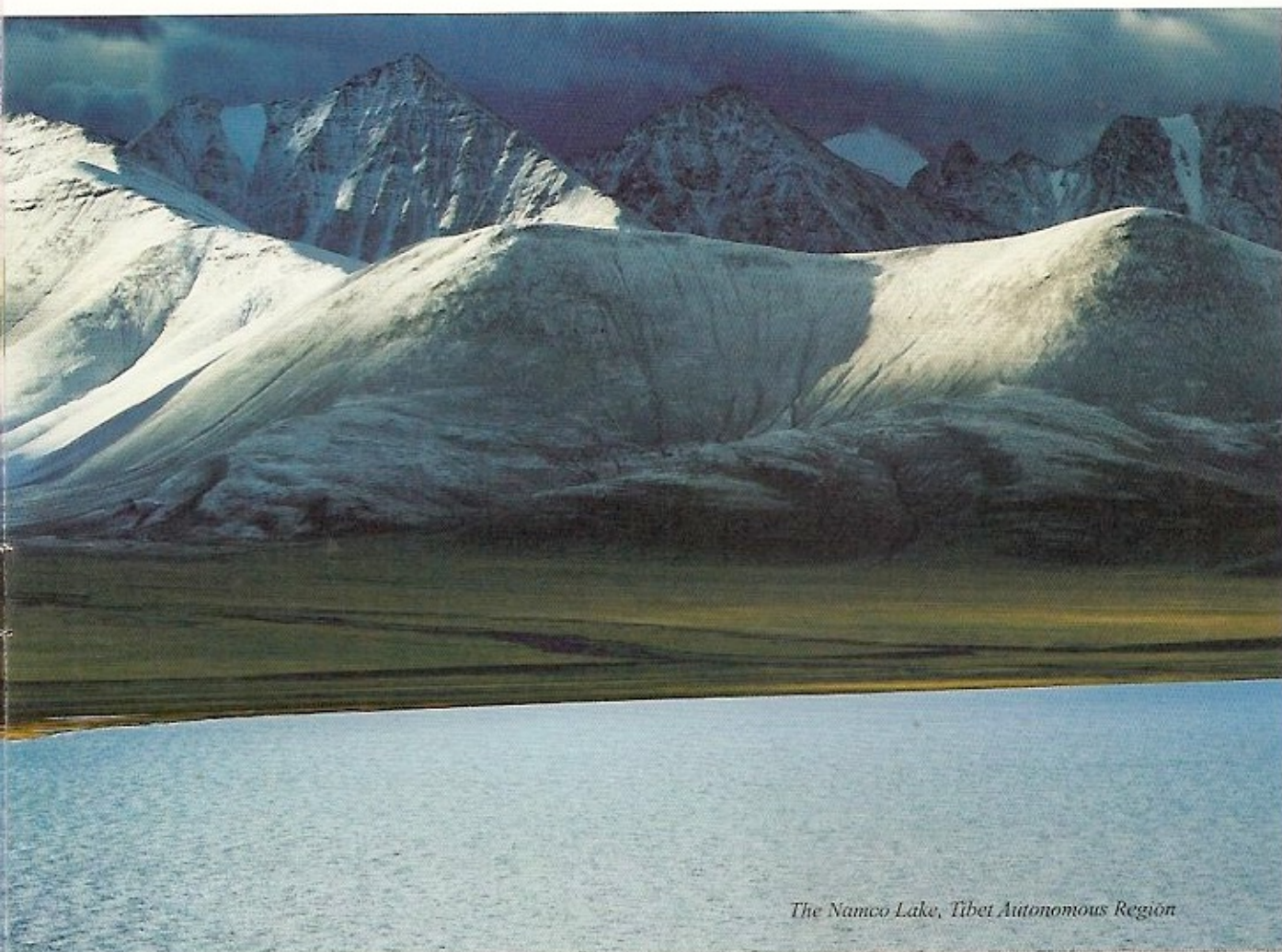
The Chinese government lays great emphasis on international cooperation and exchanges in water resources management. Over the past years, we have established friendly relationship with Japan, ROK, Australia, Italy and UK. Our collaboration covers numerous projects such as the China-UK Water Demand Management Project, China-UK Project on Comprehensive Management of Water Resources and Water Environment in the Hai River Basin, China-Australia Project on the Construction of a Water Right System in China, China-Japan Project on the Construction of a Water-Saving Society, China-



Australia Environment Development Project, and China-EU River Basin Management Project. The Ministry of Water Resources will further expand its partnership in various forms with all countries and international organizations in multiple areas including but not limited to integrated water resources management, water conservation, protection of water ecology, urban wastewater treatment and recycling, and response to climate change, in the hope of building long-term collaboration mechanisms with all counterparties.



China-Europe Water Platform High-Level Dialogue Meeting, Zhengzhou, Henan Province



The Namco Lake, Tibet Autonomous Region

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