

Country Report of the People's Republic of China

Chinese Ministry of Water Resources

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Summary

Since the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, the Chinese government has taken a series of actions of great significance to honor the *Agenda 21* by the United Nations. China's water sector has put enormous efforts in the implementation of a sustainable water resources development strategy, in the conservation and protection of water resources, in the steady increase of water use efficiency and water bearing capacity, in the realization of the sustainable use of water resources, and in the promotion of the harmonious development of the population, the resources, the environment and the economic society. This report, in three parts, introduces the general process, the actions and the achievements of China's implementation of a sustainable water resources development strategy, and the further action framework of implementing the same strategy.

Part I

The general process of China's implementation of a sustainable water resources development strategy

Firstly, stresses are placed upon the gravity of China's drought and flood disasters, water scarcity, water pollution and the problems alike. These problems have been so serious that they hampered the sustainable development of the Chinese economic society. Therefore, the implementation of a sustainable development strategy has become a must in China. Secondly, a description is given to the plan of action with regard to the implementation of the sustainable water resources development strategy that is based on *China's Agenda 21*, *China Water Agenda 21* developed by the Ministry of Water Resources of PRC, *China Water Sustainable Development Strategy in the Early 21 Century*, and *the Program for Poverty Alleviation Planning by Water Project Construction*. Finally, an introduction is given to the implementation of the sustainable development strategy through the implementation of the Plan of National Economy and Social Development. The 9th and the 10th Water Five Year Plan have both stressed the idea of sustainable development, and attached great importance to the harmonious co-existence of people and nature, to the strengthening of water infrastructure installation, to the allocation, conservation and protection of water resources, to the realization of the sustainable use of water resources, and to the promotion of the sustainable development of the economic society through the sustainable use of water resources.

Part II

China's actions and achievements vis-à-vis the challenges as regard to the sustainable development

1) *First challenge: urbanization and people's living environment.* It is emphasized in

China that urban development must take into consideration the bearing capacity of water resources and local water situation, the strengthening the construction of municipal flood control and water supply infrastructure, municipal water pollution control, industrial and sanitary waste water treatment, and the comprehensive control of municipal water environment.

- 2) *Second challenge: regional development and poverty alleviation.* An introduction is given to the guiding principles of poverty alleviation in a development manner by the Chinese government, and to what an important role the construction of potable water project and the Primary Stage Rural Electrification County, soil and water conservation, and small and medium-scale water projects in poverty-stricken areas play in poverty alleviation.
- 3) *Third challenge: securing food supply.* An introduction is given to the achievements China has made in irrigation expansion, basic construction of farmland water conservancy, the amelioration of low and middle yield land, the development of rural water supply, and the gradual improvement of agricultural production conditions and farmer's living standards.
- 4) *Fourth challenge: rural hydropower development.* An introduction is given to the promotion of local economy, the adjustment of production structure, the improvement of the ecological environment by rural hydropower installation and the construction of the Primary Rural Electrification County by Hydropower, and international cooperation in related fields.
- 5) *Fifth challenge: governing water wisely.* China's achievements in the sustainable use of water resources, including the formulation of comprehensive and overall planning of water resources, the improvement of water laws and regulations, the conservation and protection of water resources, the strengthening of infrastructure building and integrated water resources management, and the launching of international cooperation and public participation, are adequately reflected.
- 6) *Sixth challenge: soil and water conservation.* Ecological construction with regard to soil and water conservation. China's achievements in ecological construction with regard to soil and water conservation in implementing the sustainable water resources development strategy, including the formulation of laws and regulations, good planning, the control of key problem areas, the strengthening of prevention and monitoring, the comprehensive control of small water shed, and the rehabilitation of the ecological environment depending on the rehabilitation capacity of the nature itself, are summarized.
- 7) *Seventh challenge: protecting ecosystem.* China's achievements in ecological environment protection, including the development of water resources protection plans, the completion of the demarcation of water functional areas, the strengthening of water quality monitoring, the establishment of the water resources announcement system in key areas, the launching of the control of municipal river and lake system, the protection of water source site and wetland, the adoption of engineering approaches for water resources protection and polluted water control, the strengthening of water pollution prevention and control in key rivers and lakes, and the strengthening of integrated management

of water resources, are summarized.

- 8) *Eighth Challenge: Flood control, drought relief and disaster mitigation.* China's achievements in the promulgation of the Law of Flood Control, the formulation of national, river basin and municipal flood control planning, the building of the engineering system for flood control and drought relief, the improvement of the non-engineering measures for flood control and drought resistant, the adjustment of the thinking of water control, the coordination of the relationship between man and nature, and the strengthening of scientific studies on flood control, drought relief, are introduced.

Part III

The framework for actions to implement the sustainable water resources development strategy

- 1) Strategy for sustainable development: The principles to be adopted are overall planning, taking all factors into consideration, integrally considering water saving and water protection, integrally considering flood control and drought relief, integrating administration and management, giving priority to water shortage and pollution, meeting basic water needs for urban habitants, national economic development, food production and ecological purpose.
- 2) Challenges and opportunities: The China's water sector is facing to challenges of flood disasters, water shortage, water pollution and soil erosion which are endangering country's economic and social health. In addition, there exist also the issues like insufficient maintenance of hydraulic infrastructure, lack of auxiliary facility, imperfect managerial institution and operational mechanism. But opportunity exists too. China's government highly concerns sustainable water resources development. Water issues have attracted much attention of whole society. The setting-up of socialist market system, scientific and technical progress and the policies for acceleration of economic development in western China provide good opportunities for China's water sector.
- 3) Follow-up actions: continue to promote implementation of sustainable water resources development strategy, save and protect water resources, construct facilities for flood control and water supply, promote water and soil conservation, establish a stable financing system, promote scientific and technical development, reinforce international cooperation and encourage public participation.

Part I

The general process of China's implementation of a sustainable water resources development strategy

1.1 The implementation of a sustainable development strategy has become a must in China

China is a populous country with scarce resources and relatively poor natural conditions. Influenced by the monsoon climate and natural conditions, rainfall takes place unevenly in time and space. As flood and drought disaster occur frequently, China is also one of the countries that suffer the most from flood and drought disasters. China is water scarcity country with 2300 cubic meters of per capita per year in water resources, which is one fourth of the world's average. Water shortage has worsened the conflicts in supply and demand, needs for economic and social development and ecological environment. In the north part of the country and the inland river basins, the over exploitation of water resources from some rivers has led to successive desiccation of river courses in the lower reaches of these rivers. In some regions, overdraft of groundwater has caused serious regional declines in the groundwater table, posting a series of ecological problems such as large-scale land subsidence, reduction of ecological oasis, environment deterioration. The problems of water pollution and soil erosion are very serious in China. Floods, water shortage, water pollution, and soil erosion have seriously hampered the sustainable social development, resources, environment and the economic society in China, and they have been the main constrains for the development of the Chinese economic society. Therefore, China must implement the sustainable water resources development strategy, strengthen the construction of water infrastructure, consolidate the building up and protection of the ecological environment, conserve and protect water resources, control water pollution, improve the ecological environment, promote the sustainable use of water resources, and safeguard the sustainable development of the economic society.

1.2 The formulation and implementation of *China Water Agenda 21*

In the light with national economic reconstruction and social development, based on the framework of *China's Agenda 21* and China's present water situation, the Ministry of Water Resources of PRC conducted studies on *China Water Sustainable*

Development Strategy in the Early 21st Century and The Sustainable Use of Water Resources; formulated programs and outlines with regard to the implementation of the sustainable development strategy including *China Water Agenda 21*, *the Program for Poverty Alleviation Planning by Water Project Construction*, and *The Planning for Ecological Construction with Regard to Soil and Water Conservation*; adopted measures and countermeasures for the sustainable water resources development strategy, developed plans for the sustainable use of water resources, specified relevant key areas and priority projects, and made plans of action. Ever since the 9th Five-year Plan period, the sustainable development strategy has become the basic guiding principle for national economy and social development in China. According to *China Water Agenda 21* and relevant plans and programs, the sustainable water resources development strategy has been steadily implemented, the comprehensive control and development of major rivers and lake basins, the improvement of water supply and sanitation in poverty stricken areas consolidated. More emphasis has been placed on the rehabilitation of irrigation projects for the purpose of saving more water, on the ecological construction with regard to soil and water conservation, and on the prevention and control of water pollution, and on the comprehensive environmental improvement. The construction of water infrastructure in the western region has been strengthened. Prominence has been given to the construction of a number of water saving and water development projects which are of strategic significance. The implementation of *China Water Agenda 21* and relevant plans has provided support and guarantee for the sustainable development of China's economy and society.

*Box 1 Key areas of the sustainable use of water resources
adopted in China Water Agenda 21*

A. Increasing the efficiency of water use and saving water

- ◆ *Strengthening water conservation management*
- ◆ *Formulating national and local medium and long term plan for water supply and demand*
- ◆ *Expanding scale of water-saving irrigation*
- ◆ *Promoting water-saving practice in industry*
- ◆ *Promoting water-saving in municipal uses*
- ◆ *Publicizing vigorously water saving practices through media like radios, television and newspapers, mobilizing the public to play the role of participant and monitor*

B. Developing water resources and capacity of water supply

- ◆ *Optimizing regional and sectoral allocation in water resources management*
- ◆ *Strengthening the evaluation on water resources development and utilization*
- ◆ *Constructing water resources development and utilization projects*
- ◆ *Promoting the comprehensive use and multi-purpose development of water resources*
- ◆ *Developing substitutional water sources*

C. Protecting water resources and improving water environment

- ◆ *Drawing up overall plans for the protection of water resources and water*

environment in the unit of water basins

- ◆ *Strengthening the water environment monitoring*
- ◆ *Strengthening water environment protection in urban and rural areas*
- ◆ *Strengthening scientific research on the protection of water resources and on the improvement of water environment, popularizing new technologies of water environment control through experiment and demonstration*
- ◆ *Publicizing the importance of water resources protection and water environment improvement, mobilizing the public to play the roles of supporters and participant*

1.3 The implementation of the sustainable development strategy through national economic and social development plan

In 1995, when formulating the 9th Five-year Plan for National Economic and Social Development and the Programs for the Year 2010, the Chinese government, in the light of the planning of the sustainable development strategy, consolidated the position of water conservancy as infrastructure of the national economy, accelerated the construction of water infrastructure, and strengthened integrated water resources management. In 1997, the Chinese government organized and worked out *The National Medium and Long-term Plan for Water Supply and Demand*, put forward the principles to stick to in addressing water issues as overall planning, full consideration, thorough solution, comprehensive control, promoting what is beneficial and abolishing what is harmful, stressing both flood control and drought relief, paying equal attention to the tapping of new water sources, to water conservation and to water protection, increased investment on water conservancy, strengthened the construction of flood control projects which centered on the reinforcement of dykes and dams of major rivers and lakes. Important measures, including leveling polders to form flood way districts, returning farmlands to lakes, and returning farmlands to forests and or pastures, were taken. Water resources strategies such as rational development, optimal allocation, economical use, high efficiency, effective protection, and scientific management were put into effect. While attentions were paid to the development, utilization and control of water resources, more emphasis was placed upon the allocation, conservation, protection and management of water resources. As a result, great contributions were made to fighting against river floods, mitigating water shortage in the north, and improving ecological environment. For instance, 1999 saw the biggest flood in a century in the Taihu Lake basin. However, the economy there operated normally and the people's life was in perfect order. In the drought of 2000, the implementation of unified water resources operation avoided desiccation of main river courses in the lower reaches of the Yellow River throughout the year, realized the successful conveyance of water to the lower reaches of the Tarim River and the diversion from the Heihe River. These endeavors greatly improved the ecological environment in these river basins.

*Box 2 The Projection of Medium and Long-term
Water Supply and Demand in China*

Based on the results of projection by relevant Chinese research institutions, the total water consumption in China will reach zero growth by the middle of the 21st Century. At that time, this figure will range from 750 to 800 billion cubic meters.

In terms of water consumption by agriculture, a total rationing will be practised. Agriculture will rely on technology progress, and develop by adopting water saving measures. The increased capacity of water supply will mainly satisfy the demand for domestic and productive uses in urban areas, for the use of people's living environment, and for the use by the construction of the ecological environment. It is projected that before the year 2050, the proportion of domestic and productive water consumption in the urban areas to the total water consumption will increase to roughly 50%. And over 60% of the municipal wastewater will be treated.

In *The Program of the 10th Five-year Plan for National Economic and Social Development* formulated in 2001, the Chinese government gave more prominence to the implementation of the sustainable development strategy. It suggested that the sustainable use of water resources is a strategic issue in the development of the economic society, that vigorous measures must be taken to strengthen the construction of water, communication and energy infrastructures, that high priority should be given to the protection and management of water resources, and promote the sustainable development of national economy through the sustainable use of water resources. In constructing municipalities and the distributing industry and agriculture, the bearing capacity of water resources should be taken into full consideration. The increase in the efficiency of water use must be taken as the focal point. Various water-saving technologies and measures must be implemented in an all-round way, the water-saving type of industry be developed, and the water-saving type of society established. The traditional water conservancy will be transformed into modern ones, and the water conservancy in which structural measures play the key role will be transformed into one in which water is treated as a rare and very precious resource. Standing from a strategically high position in pursuit of the well-coordinated development of population, resources, environment and economy, the thinking of water control must keep on readjusting. The goals are to realize the harmonious co-existence of people and nature, coordinate the relationship between mankind and water, and plan as a whole the supply of water for domestic, productive and environmental uses.

Box 3 The objectives of the sustainable use of water resources in China

Establishing a highly efficient water supply and utilization system. Rational water allocation patterns should be formed through developing new water sources and

saving more water. Efforts should be made to increase the efficiency and benefit of water use, and build a water-saving and clean society.

Establishing a relatively perfect security system for flood control and drought mitigation. Taking the dykes and dams as the basis and the hydrocomplex as the backbone, efforts should be made to strengthen the harnessing of major rivers and lakes, construct flood retarding basins and build up flood control operation and command system. Flood control standard of the main protective areas should be developed to adapt to economic development level in the areas concerned, so as to protect municipalities and key areas against floods.

Establishing the security system for the safety of water ecological system. Efforts should be made to prevent and control water pollution, protect water resources, do well in the ecological construction with regard to soil and water conservation, effectively control and reduce soil and water loss and water pollution, increase the capacity of the water resources, and improve people's living environment.

Establishing modernized water resources management system. Through strengthening the legal system and relying on technology and system renovations, the multi-level management system that combines basin-level management and regional level management should be established. The integrated management of water resources and real-time monitoring should be put into effect, water allocation optimized, management strengthened, the operation of water projects in a good state ensured, and the most of water projects made.

Part II

Challenges, Actions and Achievements

2.1 Challenge 1: Urbanization and Social Development

2.1.1 Background

Since 1990s, the progress of urbanization and the construction of urban facility in China have been quickened. From 1992 to 2000, the population in city and town in China increased by 132 million persons and the level of urbanization enhanced from 27.63% to 36.09%. With the continuous acceleration of quick economic and social development and the progress of urbanization, the water problems such as urban water supply, water use, flood control, drainage and water environment, have increasingly arisen. In 668 cities in China, there are more than 400 cities with the shortage of water to certain degree. Among them, 108 cities is serious short of water, with the shortage of water of about 6.0 billion cubic meters annually. And 625 cities have been threaten by flood and waterlog, with low flood control and waterlog drainage standards. Due to the continuous increase of urban industrial wastewater and sanitary sewage and the shortage of wastewater treatment capacity, some of such wastewater was directly poured into rivers, lakes or seas without any treatment, which causes water pollution to different degree. For this reason, the Chinese Government has paid great attention to urban construction and taken the work of comprehensive treatment of urban environment and the infrastructure construction of urban flood control and water supply as the priority fields in the sustainable development.

2.1.2 Actions and Achievement

a) Strengthening the unified management of water resources and continuously improving urban water environment.

The Chinese Government insists on the concerted development of population, resources, environment, economy and society and correctly deals with the relationship of economic development, population increase and water resources bearing capacity. In the process of economic and social development, the strategy of “determining the scale and development in accordance with water resources” has been implemented, that is, the urban construction scale and industrial deployment are determined and the economic structures is continuously adjusted to develop the production according to the conditions of water resources. The unified management of water resources has been strengthened. In many cities, the integrity management of urban and rural water affairs has been implemented. The unified enforcement of the management functions of flood control, water supply and use, water saving, drainage, wastewater treatment

and reuse have been carried out. The water-use saving and the water resources and environment protection have been strengthened. The clear production has been advocated. The reuse of wastewater and sewage has been enhanced. The water for urban ecological environment and recreational activities has been arranged rationally. The treatment of urban rivers and lakes has been strengthened. All these are aimed to construct a beautiful resident environment based on the water environment, which not only enhances the living quality of urban and rural people and improves the resident environment but also effectively promotes the unified arrangement and sustainable utilization of water resources.

Box 4 Green bank and clear water surround and accompany the buildings in Beijing City

In accordance with the principles of “unified planning, comprehensive harnessing, stressing on focal points, implementation by stages, putting the city center first and



then the suburbs”, Beijing Municipal Government has strengthened the comprehensive treatment of rivers and lakes in the city. With the efforts for many years, the treatment goal of clear water, unobstructed flow, green bank and open to navigation now is preliminarily realized.

From 1998 to 2000, the following works had been completed: the river regulation of 50 km, the treatment of 13 lakes, the dredge volume of 1.9 million cubic meters, the rehabilitation and enlargement of 27 gates, bridges and dams, the pipe laying of 60 km for intercepting wastewater, the development of 6 open swimming spaces, and the increase of the water surface area of 15 ha and the green land area of 150 ha. At present, the navigation is open up from the Summer Palace to the Longtan Lake and the Beijing Exhibition Center.

The rivers and lakes in Beijing moisten all things in the city and foster the generations of the people. Water breeds the ancient culture of Beijing City and presents a scene of harmonious coexistence of the people and water.

b) Strengthening the construction of urban flood control projects to guarantee the safety of urban



The Chinese Government has highly paid attention to the work of urban water affairs and formulated related policies and measures to guarantee the safety of urban flood control and water supply. The work of urban flood control adopts the mayor's responsibility system. The planning for urban flood control

and water logging drainage has been formulated and the construction of flood control has been strengthened so that the capacity of urban flood control and water logging drainage has been continuously increased. At present, 40% of the cities with the task of flood control have reached the flood control standards stipulated by the State. The small town development strategy also pays great attention to the construction of flood control and water logging drainage facilities.

c) Strengthening the construction of urban water supply facilities to guarantee the safety of urban water supply

The Chinese Government prioritizes the water saving and wastewater treatment, water source protection and the urban water supply strategy of strengthening the construction of water source projects and water distribution pipeline network facilities. For those cities short in water source works, the inter-basin water transfer projects have been carried out to ensure the urban water supply and continuously enhance and improve the urban water supply capacity and conditions. Since 1992, the urban industrial and domestic water use in China has account for about 30% of the country's total water use, increasing about 8%. The water supply capacity has reached 80 million cubic meters per day (not including rural towns), and the total water supply volume has increased to 23%. The urban wastewater and sewage treatment rate has been increased to 31%.

Box 5 Water Diversion Project from the Yellow River to Qingdao, Shandong Province

The Water Diversion Project from the Yellow River to Qingdao in Shandong Province is a large-scale and long-distance inter-basin water transfer project to solve the water shortage problem in Qingdao City in Shandong Province, with the total length of 253 km of water conveyance canal, the diversion discharge of 45 m³/s and the annual diversion volume of 347 million m³. The Project was completed in November of 1989, with the total investment of 962 million RMB Yuan. Qingdao City was one of the cities with the severe shortage of water in the North China. Before the completion of the Project, four emergency water supply schemes had been put into use in order to solve its water shortage crisis. The completion of the project has changed the situation of long-term water shortage in Qingdao City. Since its completion in 12 years ago, the

Project could meet the basic needs of the industrial and domestic water uses in Qingdao City. The Project has water diversion volume of 2.4 billion cubic meters, among it, 600 m³ is used for industrial and domestic purposes, 1.0 billion m³ for irrigation and replenishment of groundwater along its way.



The Project provides 710,000 people in the high fluoride and saltwater areas with good water supply and achieved in an increases of 350 million kg in grain yield per yea. Consequently, economic development and the investment environment in Qingdao City has been greatly improved. In last ten years only, 3000 joint-ventures enterprises have been

set up in the city with an investment of more than 8.3 billion RMB yuan and return economic benefit of 30 billion RMB Yuan.

2.2 Challenge 2: Regional Development and Poverty Alleviation

2.2.1 Background

To the end of 1992, there were still 88 million rural inhabitants in China without adequate drinking water supply. Most of them lived mountainous, remote or minority areas. Such areas also are the areas with serious water and soil erosion and shortage of electricity. Though the production and living conditions has been steadily progressed in these poor areas since 1992, the needs of drinking water supply of more than 24 million people are not yet met. The electricity shortage in some areas remains a problem.

2.2.2 Actions and Achievements

a) Formulation of Regional Development and Poverty Alleviation Plan

The Chinese Poverty Alleviation Plan during the 8th Five-Year Plan period, the 90's Water Resources Sector Reform and Development Master Plan and the Water Resources Development Master Plan for Western China have taken measures to solved the problems of drinking water supply, electricity shortage and poor productivity, with priority for the under-developed areas. Meanwhile, in order to promote the economy in the less developed regions, the Government of China also carried out action plans such as constructing drinking water supply projects for people and livestock, the rainwater harvesting systems and water-saving irrigation projects and rural hydropower program.

Box 6 The Key Projects for Water Resources Development in Western China

- ◆ Rural drinking water works and rural hydropower construction
- ◆ Implementing inter-basin water transfer projects such as the South-to-North Inter-basin Water Transfer Project (west line)
- ◆ Water-saving rehabilitation projects in large-sized irrigation areas
- ◆ Combining the flood prevention and control with the comprehensive clean-up program for the key rivers in the western area
- ◆ Soil and water conservation and oasis ecosystem rehabilitation projects
- ◆ Urban flood control and reinforcement projects for disease reservoirs

b) Poverty alleviation through integrated water resources development

The input from central Government in water resources infrastructures construction has been continuously increased to the poor areas in the western regions, in particular in poverty alleviation and water resources development programs. Since 1991, in order to help the poor areas solve their drinking water difficulties, the Central Government has allocated more than 5.5 billion RMB Yuan (including about 4.4 billion RMB Yuan from the local governments), in constructing small and micro scale water resources works and drinking water supply projects, this has resulted in the drinking water problem of about 64 million people in total. A total of 28.8 million kW can be generated from these small and medium hydropower stations upon their completion. The small hydropower stations can supply electricity for about 25.2 million people. All these have strongly promote the economic and social development in the remote and poor areas. The soil and water conservation, ecosystem rehabilitation, environmental protection, basic farmland construction and the increase of irrigation area have been widely developed, which has greatly improved the living and production conditions and ecological environment in the poor areas.

Box 7 Rural hydropower construction in the counties without electricity in Tibet

Since 1992, the Ministry of Water Resources has organized its subordinate river basin organizations and units to adopt the turn-key way from the design, investment, construction to completion of the project and then transfer for operation, a 320 m RMB yuan worth Rural Hydropower Station Program will be implemented in 10 counties which are rich in water resources but no electricity supply in the Tibet. A total of 8080 KW of power will be generated from these hydropower stations. The implementation of this program not only help about 10,000 households and 50,000 farmers and herdsmen with electricity history but also improves the their lives and productivity with great social, economic and environmental benefits.

With the financial support from the Central Government, Tibet is now undertaking laying electric network in the rural towns and villages. 100 rural hydropower stations will be constructed within next 5 years in order to solve the power shortage problem for 100 m people. The coverage rate of power supply will then be increased to 60%.

Box 8 The Thirsty Project in Guizhou Province

The Guizhou Province is located in the inclined slope in the east part of the Yun-Gui Plateau. Over 80% of the province is mountainous areas and 61.9% of karst topography. The unfavorable natural conditions, i.e. shortage of surface water, deep groundwater aquifer, have hindered the improvement of drinking water supply.

Since 1997, Guizhou Province has carried out 30 water supply projects to solve the problem. With the financial support from the Central Government, 84.9 million RMB Yuan has been invested to construct water diversion and hand-pump projects. Three kinds of small projects (small water cellar, small pool and small pond) have introduced in the areas without water source, which brought drinking water supply to 3.55 million rural inhabitants. As a result, the overall drinking water supply and sanitation conditions have been greatly improved in Guizhou Province.

c) Strengthening the International Cooperation in Poverty Alleviation

Since 1994, the Chinese Government and the United Nations Children's Fund have continuously developed the water supply and environmental sanitation cooperation project in two phases. Under the support of the United Nations, the Chinese Government has implemented the rural water supply and environmental sanitation improvement project in Yunnan, Shaanxi, Gansu, Xinjiang and Shanxi Provinces to solve the drinking water difficulty of farmers and herdsman and improve the rural environmental sanitation and individual sanitary conditions. The United Nations Children's Fund appointed experts to give free assistance to the implementation of the cooperation program, which makes the benefited areas gain very outstanding effectiveness in the aspects of the protection, rational development and utilization of water resources, the project management, the rural appearance, individual health, and social environment improvement.

Special Column 9 Rural drinking water and environmental sanitation program by the United Nations Children's Fund

From 1994 to 2000, the Chinese Government and the United Nations Children's Fund (Unicef) jointly launched cooperation programs in water supply and environmental sanitation. Unicef assisted the governments at local levels in formulating and implementing effective policies and measures in order to accelerate the progress in improvement of rural drinking water supply and environmental sanitation facilities. The program focused on poverty, water shortage and remote inhabitant areas, especially those areas with the shortage of oil and electricity, to popularize water, environmental sanitation and hygiene education. In accordance with the synchronous development mode, the deep-well handpumps with low-cost, easy handling and durability have been installed to improve farmers drinking water conditions and then

to improve environmental sanitation and personal hygiene, especially those of women and children. A total of financial input from Unicef was 7 million US dollars. The joint projects covered 14 counties in 6 provinces and solved the drinking water difficulties of more than 600,000 people.

2.3 Challenge 3: Securing Food Supply

2.3.1 Background

China is a developing country and 2/3 of its population is engaging in agricultural activities. However, the problem in China remains that large population with limited cultivated farmland. The amount of per capita agricultural resources is much lower than the international average. The backward farmland water conservancy infrastructure facilities and low agricultural productivity have hindered the development of rural economy. The farmers' income is still very low. The pastoral area, accounting for 44% of the total country's area, is an area inhabited mainly by Chinese minority nationalities and is a grassland ecological area. The harsh natural conditions, such as arid weather pattern, wind and sand-storm have seriously restricted the economic development in these areas.

2.3.2 Actions and Achievements

a) Developing the physical construction of farmland water conservancy works and continuously enhancing the agricultural production capability

The Chinese Government is making effort in mobilizing and organizing farmers and masses to widely reinforce the physical construction of farmland water conservancy works, irrigation projects, to reclaim saline-alkaline, water-logging, and middle- and low-yield farmland, to harness middle and small rivers, to develop the rural water supply, to popularize the water-saving irrigation, in order to enhance the capacity of agriculture against natural disasters. Since 1991, in the physical construction of farmland water conservancy works involved with more than 70 billion labor-days have been in total in the whole country. The earth-rock project quantities of over 87 billion cubic meters have been completed. The irrigation area of 5.33 million ha has been increased and that of 44 million ha has been improved. The water logging drainage area of ten million ha has been increased and improved. The middle- and low-yield farmland of 15 million ha has been reclaimed. All these have enhanced the comprehensive production capability of farmland and improved the lives and productivity and ecological environment of farmers and herdsmen. About 80% of the total country's agricultural and animal husbandry products are produced in the irrigation farmland in less than half of the total country's cultivated area. All these have strong impacts on the increasing of agricultural yield, farmer's income and the sustainable development of rural economy.

Box 10 Construction of water conservancy works for the modernization and garden-style cultivation of farmland

With the continuous deepening of the reform and opening to the outside and the rapid development of rural economy, the construction of farmland water conservancy works in the coastal regions with the developed economy has entered a new stage of comprehensive development. It has shift from only serving for agriculture into serving for the whole national economy, and from only stressing on social benefits into considering all aspects of social, economic and environmental benefits, which combines properly the construction of farmland water conservancy work with the rural economic development, rural road



construction and rural modernization construction. The problems concerning ditches, canals, farmlands, forests and roads have been tackled in an overall plan and the construction of the garden-style cultivation of modern farmland has been quickened in order to make it become important material base of rural modernization. The construction of farmland with high standard has focused on the farmland standardization, ditch and canal lining, farmland garden-style cultivation, the construction of sand-rock roads, and the installation high-effective facilities. The hydraulic structures such as canals, gates and pump stations will be built into the first-class works in accordance with the requirements of scientific design, the advanced technology, rational structure, easy management, perfect functions, beautiful appearance, diversified styles, making them have the characteristics of the supra-class awareness and the trend of our times.

b) Strengthening the construction of water resources projects in the arid and water-shortage areas to improve productivity

The Chinese Government has paid great attention to the construction of water resources projects in arid and water-shortage areas. The National Planning of Water Resources Development in Pastoral Area and the National Development Planning of Rainwater Collection, Storage and Utilization in the Tenth Five-Year Plan have been formulated and implemented. In 2010, the Government issued the technical specifications on rainwater collection, storage and utilization, water resources development and irrigation in pastoral area, water-saving, and soil and water conservation. Meanwhile governments organized technicians to go to the countryside to offer technical assistance to the farmers. The pilot programs have been conducted for pastoral water conservancy development and rainwater harvesting, storage and

utilization. These programs provided good experience for the sustainable development and utilization of water resources in the arid area. To end of 1992, more than 12 million units of small- and micro-sized rainwater harvesting, storage and utilization such as water pool, water cellar, water cabinet, small pond and dike, etc., have been completed in the whole country, with the total storage volume of 16.0 billion cubic meters. Meanwhile about 380 thousand square kilometers of soil erosion area have been treated and more than hundred million rural persons of drinking water problems have been solved. By solving the drinking water problems and implementing water supplement irrigation for fighting dry and protecting seedlings, we have provided the water resources which required for 30 million people, laid a foundation for the poverty alleviation of masses in the arid and water shortage area, thus the sustainable development of local economy and society become possible.

Box 11 Rainwater harvesting and water-saving irrigation project

The rainwater collection and water-saving irrigation project is to construct small- and micro-sized water conservancy works to collect, store rainwater to develop water-saving irrigation in the serious drought areas. The rainwater collection and storage projects not only meet the demands of the drinking water supply for people and livestock, of production uses in the areas short of water, but also can help to adjust the agricultural structure. High-efficiency and economic crops have been experimented by the farmers in the areas where water is extremely scarce. In some dry hilly areas in Sichuan Province, a lot of households use such projects to start to plant vegetables and fruits, or use the storage ponds to breed fishes and raise ducks. Some households also use it in the pig and chicken farms and producing soy sauce and vinegar, which gains good economic benefits. After the needs for food and clothing have been met, farmers gradually stopped agricultural cultivation activities on the hillside and started to plant grasses and forests. The rainwater collection and water-saving irrigation project has effectively improved the ecological environment in the mountainous area.

c) Developing the rural water supply

The rural water supply program is mainly for villagers, but small cities and towns inhabitants are also included. Since 1992, more than 13,000 rural water supply projects have been completed in the whole country, which has increased water supply capacity to 3000 cubic meters per day. Besides the progress made in the construction of water supply works for villages and towns, the drainage schemes and water-saving infrastructures have been constructed in order to protect and control water pollution in small cities and towns in the course of urbanization in China. Large numbers of farmers are now have access to improved water supply from these projects.

Box 12 Strengthening the construction of water resources works in the pastoral area to promote its sustainable development

In 2000, the water supply capacity of water resources development and utilization in

the pastoral area in China was 35.3 billion cubic meters and more than 1.12 million water conservancy works such as reservoirs, hydropower stations, and irrigation, drainage and water supply schemes have been built. The herbage irrigation area of 890 thousand km² has been developed in total, among which there are 550 thousand km² of the irrigation area for forage grasses and 340 thousand km² for natural grasslands, which increases 510.7 billion kg of forage grasses. These projects have solved the drinking water problem for about 20 million persons and 66 million livestock, developed 120 thousand km² of grasslands with the shortage of water and improved the water supply of grasslands with the total area of 60 thousand km². The development of water resources has laid a sound foundation for the economic development and social progress in the pastoral areas.

2.4 Challenge 4: Rural Hydropower Development

2.4.1 Background

China ranks the first in the world in hydropower resources. The exploitable amount of middle and small hydropower resources is 87 million kW, which ranks the first in the world as well. The middle and small hydropower resources are distributed in 1600 counties in the mountainous and remote areas in the minority regions in the western region. These regions are vast in land, but few populations, it is a difficult task to cover scattered population with power network.

The small hydropower schemes can meet the needs of power supply of the scattered population which have the advantages such as local power network connection, local power supply, proper scale, smaller investment, shorter construction period, lower construction cost which proved to be the ideal alternative solution for the economic development in these areas. The small hydropower schemes can easily be fit into the development plan of local governments and any new investment plans by the collective, enterprises and even individuals.

2.4.2 Actions and Achievements

a) Developing the rural hydropower to construct the primary electrification county of rural hydropower

The Chinese Government has formulated the power development policy of the “simultaneous development of hydropower and thermal power but the priority in the hydropower”, adjusted strongly the structures of energy production and consumption, and enhanced continuously the proportion of hydropower and other clear powers to the whole power grid. Since 1991, the annual power output in China has increased from 621.2 billion kWh to 1239.3 billion kWh, among which the annual hydropower output is 200.0 billion kWh. In the yield of hydropower, 80 billion kWh power yield is from the small hydropower station. By the end of 2000, the total installed capacity

in the whole country is 77 million kW, among which there are 24.8 million kW of the installed capacity from small hydropower stations. 653 primary electrification counties of rural hydropower have been completed. The power for 800 counties in China is mainly supplied by small hydropower stations and their power grids. The small hydropower stations provide cheap power for the remote mountainous areas and minority nationality areas.

Box 13 The construction of primary electrification county of rural hydropower

As of the end of 2000, China has constructed and completed 653 primary electrification counties of rural hydropower, involved in the population of 252 million and the area of 2.74 million square kilometers. Among them, 82% of such counties are located in the middle and central regions of China, more than 200 counties belong to



minority nationality county and more than 100 counties located in the border areas. The construction of the primary electrification county of rural hydropower has promoted the economic and social development in the poor regions. The GDP, financial revenue, farmer's pure income and power consumption per capita in the completed primary

electrification counties all have realized the goal of doubling them within 5 years and quadrupling them within 10 years", showing that their development speed is obviously higher than that of the country's average. In 1999, the taxes paid by the hydropower enterprises in the electrification counties in the whole country accounted for 8.8% of the county's total financial revenue. From 1995 to 2000, the GDP in 335 completed primary electrification counties increased from 234.5 billion RMB Yuan to 477.8 billion RMB Yuan, with the annual increase rate of 15.3%. Such increase rate is double higher than the country's average. The annual average pure income per farmer increased from 1082 RMB Yuan to 1914 RMB Yuan, increasing 8.1% per year in average that is 2.7% higher than the country's average. The construction of the primary electrification county of rural hydropower has increased the income of the farmers in the poor areas, quickened the pace of poverty alleviation, promoted the construction of small towns and small market towns and shifted about 30 million surplus labors into the second or third industry.

b) The middle and small hydropower has driven the rural economic development and promoted the improvement of ecological environment

The construction of the rural electrification county of small hydropower has driven the progress of industrialization and urbanization and promoted the adjustment of local economic structure. According to the statistics, in the primary electrification counties of rural hydropower, the proportion of industrial production to the local GDP is 33% higher than that before the electrification, which transfers a lot of agricultural surplus labors into the second or third industry and quickens the progress of urbanization. In 2000, the small hydropower output in China is equivalent to 30 million tons of standard coal so that it reduces the emission of carbon dioxide of 72 million tons and other pernicious gases. Through taking the measure of “replacing firewood by electricity”, about 20 million households in the areas powered by small hydropower stations adopts electric power cooking so that it reduces the felling of forest, saving the woods of about 9 million cubic meters annually. The forest coverage in the primary electrification counties of rural hydropower increases near 10% in average in the past 15 years, about 6% higher than that of the country. The construction of rural small hydropower works has promoted the rehabilitation and protection of ecological environment.

c) Strengthening the international cooperation of middle and small hydropower development

The Chinese Government has actively carried out the international cooperation of hydropower resources development, especially in rural small hydropower construction, organized and attended the multilateral or bilateral international meeting on small hydropower many times, participated in the construction of several hundreds of small hydropower stations in more than 50 countries, exported the technologies and equipment related to the small hydropower construction, and provided training courses for several thousands of small hydropower experts in over 60 countries and regions. In view of the achievements of the small hydropower construction in China, the United Nations has set up the Secretariat of International Small Hydropower Network and International Center on Small Hydropower in Hangzhou, China. China has contributed to promoting the development of international small hydropower.

Box 14 International Center on Small Hydropower

In the aspects of the development of small hydropower, the construction of rural electrification with Chinese characteristics, the poverty alleviation and environment protection and the realization of sustainable development, China has won highly appraisal and praise from international society. Many countries in the world including the developed countries in Europe and America also have actively spread the Chinese experience on developing small hydropower. For this reason, with the consent of Chinese Government, the United Nations Industrial Development Organization has set up the International Center on Small Hydropower in Hangzhou, China. This Center becomes the first organization in China within the legal

framework of the United Nations. 146 government and international organizations in the world have taken part in the International Small Hydropower Network.



2.5 Challenge 5: Governing Water Wisely

2.5.1 Background

Due to the unmatched distributions of its water resources and cultivated land, population and economy, China has a severe regional water shortage, especially in Northern China where the contradiction between supply and demand of water resources is highly prominent. Irrational development and utilization of water resources, water waste, water pollution and etc. in some regions are further sharpening the contradiction.

With population growth, economic and social development, urbanization progress and living quality improvement, water demand will be increasing and people will set a still higher demand on water quantity and quality. As a result, the contradiction between water supply and demand will be more sharpened and water resources have become the major constrain in realizing the strategy of sustainable development. The sustainable use of water resources is one of the major issues for economic and social sustainable development. A rational utilization, an optimized disposition, highly efficient use, effective protection and scientific management of water resources must be implemented with a view to the guarantee of the sustainable utilization of water resources for the economic and social sustainable development.

2.5.2 Actions and Achievements

a) Studying and Formulating the General Strategy of Sustainable Water Resources Utilization And Comprehensive Planning

After United Nations Conference on Environment and Development held in 1992, the

Ministry of Water Resources, PRC, under the guide of “China’s Agenda 21”, formulated “China Water Resources’ Agenda 21” in 1997 and “National Medium-and Long-term Planning for Water Supply and Demand” on the basis of *China Water Resources Utilization* put forward in early 1980s. A research on “The Strategy of China Water Resources Sustainable Development” was carried out in 1999. “The Tenth Five-year Plan and the Year 2010 Plan for National Water Resources Development” was formulated in 2001, meanwhile other national, basin and regional plans, such as “Outline of National Water Saving Plan for 2000-2010”, “National Agriculture Water Saving Plan for 2000-2010”, “National Plan for Ground Water Exploitation and Utilization”, “Water Resources Protection Plan for 7 Major Basins”, “An Overall Plan for Water Resources in Northern Areas”, “Haihe Basin Water Resources Plan” and “Sustainable Utilization Plan for Capital Water Resources in the Early 21st Century” were formulated. The overall objective and orientation, tasks and focal points as well as countermeasures and measures for sustainable use of water resources were proposed and works in exploitation, utilization, regulation, disposition, conservation and protection of water resources have been arranged in an all-round way. Intensified management of water resources planning, and coordination and supervision in process of its implementation have assured its smooth implementation. Intensified comprehensive improvement for basins and regions has promoted the raising of the whole level of sustainable water resources utilization.

Box 15 Countermeasures and Measures Of Sustainable Water Resources Utilization

A) Strategy

- ◆ *optimized disposition of water resources*
- ◆ *effective protection of water resources*
- ◆ *highly efficient use of water resources*
- ◆ *rational exploitation of water resources*
- ◆ *scientific management of water resources*
- ◆ *comprehensive control on water resources*

B) Countermeasures

- ◆ *integrated planning, rational exploitation, comprehensive utilization and coordinating development*
- ◆ *implementing integrated management of water resources*
- ◆ *reforming management system for water resources*
- ◆ *establishing a rationally pricing mechanism*
- ◆ *increasing funding for sustainable water resources utilization*
- ◆ *improving water law and regulations*
- ◆ *promoting sustainable water resources utilization through scientific and technological innovation*

b) Perfecting Water Governance System

Chinese Government successively promulgated “Water Law”, “Law on Water and Soil Conservation”, “Flood Control Law”, “Regulations for River Management”,

“Industrial Policy for Water Conservancy” and etc, and revised “Water Pollution Prevention Law” and “Water Law”, was revising “Implementing Method of Water Withdrawal Permission System”.

Chinese Government established the National Water Saving Office in 1998 with a view to strengthen the work for water saving across the country. In order to further improve the system of water law and regulations, China is now speeding up the following works: formulating planning approval document regulation; water management system for the combination of total amount-control and quota-based management; “three simultaneousness ” system for a construction project (water saving facilities in a construction project must be designed, constructed and put into operation simultaneously with the principal part of the project); water consumption metering system; the system of penalty pricing for excess over the planned water amount; the system of compulsive elimination for technologies and equipment with high water consumption and of popularizing water saving facilities; and demarcating different function areas; identifying water quality standards for water zones; restricting total amount of pollutant discharge into water areas.

China is to intensify the standardization of water administrative supervision, speed up the progress of water law enforcement system, improve a supervision mechanism, standardize water actions, build up a contingent of water administrative personnel for law enforcement with high efficiency, justice and honest, complete the network of law enforcement by water administration, reinforce means of law enforcement so as to enhance law enforcement level. Sustainable water resources utilization of China has stepped into the rail of legal system.

c) Strategy for Increasing Water-use Efficiency and Saving Water

Chinese government sticks to the policy of attaching equal importance to the development and conservation and the protection of water resources, put water saving on very important position, regard raising water-use efficiency as its core, popularize various water-saving measures, develop water-saving industry and set up water-saving society.

China defined popularization of water saving irrigation as a revolutionary measure and made a breakthrough advance in agriculture water saving. During 1996-2000, 668 pilot water-saving irrigation projects were constructed in 300 demonstration counties and 217 large-sized and 50 medium-sized irrigation districts were updated and supplemented with auxiliary projects with water saving at the center, increasing water-saving irrigation area of 8,000,000 ha with an accumulative total of 16,670,000 ha. Under the condition that total agriculture water consumption kept basically unchanged, the irrigated land area of 800,000 ha was increased annually. Water consumption per hectare dropped from 8,000m³ in 1993 to 6,500m³ in 2000.

Through readjusting production structure and taking water saving measures, water consumption per industrial output of 10,000 yuan reduced from 1,920 m³ in 1993 to 680 m³ in 1999 and the rate of industrial water recycling increased from 45% in 1993

to 55% in 2000. Through raising urban water price, modifying pipe network, popularizing water-saving facilities and installing metering facilities and etc, water loss and waste were gradually reduced and saved water accumulated more than 10 billion m³ in cities across the country from 1996 to 2000.

Box 16 Water-saving Irrigation Project in Gannan County, Heilongjiang Province

Gannan County is in severe arid area of western Heilongjiang Province and a poverty country aided by the State as its priority. In 1996, Gannan County was defined as a demonstration water-saving county and county government proposed a strategy of “vitalizing county through water saving” in which development of water-saving irrigation was regarded as a strategic priority for promoting economic development of the county. The historical technical revolution from traditional flooding irrigation to water-saving irrigation was started in Gannan County. Up to 2000, total investment in the county was 135 million yuan and irrigation wells of 26000 were drilled and sprinkler irrigation systems of 6820 were installed with an irrigated land area of 75000 ha, accounting for 42.5% of the total irrigated land in Gannan County. Sprinkling irrigation systems covered the whole arid land of 75 villages in 6 towns. Water-saving irrigation has promoted the sustainable water resources utilization and rapid development of local economy. 100 million m³ water was annually saved in Gannan County and effectively eased the restraint of water shortage on agriculture production. Gannan County got a harvest in dry year of 2000 with total agricultural output of 800 million yuan and per capital income of 2260 yuan compared with that of 680 million yuan and 1580 yuan in 1999. At the same time, special agriculture, green agriculture and etc came into being with the guarantee of water-saving irrigation and steadily developed, greatly accelerating the pace of farmer income increase.

d) Strategy for Water Resources Protection

According to the features of rivers in China and requirements of social and economic development on the allocation and protection of basin water resources, the Chinese Government has scientifically demarcated water function areas; implemented regional management; gave priority protection to water sources; carried out supervision and control on effluent outlets; monitored water quality and quantity in rivers and water zones; periodically published water quality conditions of drinking sources and major rivers so as to the public supervision. Since 1994, water pollution prevention projects



in the Huaihe, Liaohe and Haihe rivers (three rivers in brief), and the Taihu, Dianchi and chaohu lakes (three lakes in brief) have been constructed, thus intensifying comprehensive prevention of water pollution in major rivers and water areas. China Government promulgated appropriate law and regulations, formulated implementing planning and set the target for total discharge pollutant control in rivers and water areas, exercised maximum discharge permission to major cities and towns and effluent outlets, enclosed a great number of small enterprises with serious pollution, such as paper mills, fertilizer factories and etc. Chinese Government required all industrial

enterprises to reach the standards on effluent discharges. Deterioration of water quality in “three rivers and three lakes” has been initially controlled and that in their local areas has been improved.

Chinese Government organized and formulated “National Planning for Groundwater Resources Utilization” and delimited over-exploitation areas of groundwater and intensified protection and management of these areas. Local government also formulated appropriate management measures, such as readjusting structure of water consumption, constructing substituted water sources, recharging groundwater artificially and etc, which basically controlled the continuous over-exploitation of groundwater.

Box 17 Action for the Protection of Fountains in Jinan City, Shandong Province
Jinan City, Shandong Province is famous for ‘a city of fountain’. Due to over-exploitation of groundwater, group fountains with Batuquan Fountain as the typical ceased running and an interval between runnings was getting longer in recent years. Famous Batuquan Fountain stopped running in March 1999. These made a great influence on industrial production and people’s life in Jinan, Shandong Province,

thus enormously restricting social and economic development and the unique characteristic of 'the city of fountain' will gradually disappear. Therefore, the government of Jinan City adopted the following measures: intensifying the unified management of water resources; checking and ratifying licenses for water withdrawal; enclosing wells within the city proper; reasonably distributing surface and ground water through coordinated operation of reservoirs; intercepting rain and flood for recharging and etc. These measures lead to group fountains running again after stopping for two years.

e) Raising water security and rationally developing water resources

Since 1992, China has built a great number of key water resource projects. Among them, Xiaolangdi Multipurpose Project at downstream of the Yellow River has been completed and has played an important role in ensuring the flood prevention, sediment flushing, hydropower, water supply and improving ecological environment in the lower reach of the Yellow River. Emergent diverting water from Yellow River to Tianjin, serious water shortage, was carried out in 2000, ensuring the domestic water consumption in urban area and industrial water consumption basically. Some inter-basin water transfer projects has been built, such as diverting water from Biliuhe River to Dalian, diverting water from Songhuajiang River to Changchun, diverting water from Datonghe River to Qinwangchuan have been built. A great number of running water plants in urban areas have been extended and many drinking water projects in town and rural areas have been constructed with newly increase of annual water supply capacity by 70 billion m³. The further increase on capacity of flood control and water supply in urban and rural areas will give strong supports to the rapid and healthy development of national economy.

Box 18 Xiaolangdi Multipurpose Project on the Yellow River

Xiaolangdi Multipurpose Project located in the main stream of the Yellow River, 40km north of Luoyang City of Henan Province. With catchment area of 694,000 km², comprising 92.3% of the Yellow River Basin, it has storage capacity of 12.65 billion m³, install capability of 1800MW. The comprehensive functions were as following: preventing flood and ice run, lessening silt, supplying and irrigating water and generating electricity. After the construction of the project, it will bring about the following benefits: increasing the flood control standard in the lower reach from a 60-year event to a 1000-year event. It is expected to free the lower reach of the Yellow River from the menace of ice run. The river course will not be elevated by siltation in 20 years by impounding clean water and draining turbid water, blocking off sediment by sediment control capacity. In this way, about 2 billion m³ of water can be added for reallocation so as to improve downstream irrigation and urban water supply. The annual mean generation is about 5 billion kWh.

The constructing stage of Xiaolangdi Project was eight years. The civil construction of main works was adopted by the system of international bidding, the construction

was managed in accordance with international common practice. The construction of the main works commenced in September 1994. The river closure was realized in October 1997, water storage in downstream gate chamber was in October 1999, the first unit went into operation in January 2000. The main works completed at the end of 2000.

f) Integrated management and integrated dispatching of rivers in North China winning initial success

The water interception of the Yellow River is concerned by people home and abroad. Since 1992, consecutive 8 years of water interception happened in the river course in the lower reach of the Yellow River. The most serious year was 1997, with the time of water interception of 226 days. So, the government approved “Annual Allocation Plan on Water Supply in Main Stream of Yellow River” and “Management Procedure on Water Dispatching in the Main Stream of the Yellow River”. Integrated management and dispatching of water resource commenced to be carried out throughout the river in 1999. No water interception up in the main stream of the Yellow River throughout the year was realized, which was seriously drought in North China in 2000.

Heihe River is an inland river in West China, with catchment area over 140,000 km². The upper and middle reach are in Qinghai Province and Gansu Province, the lower reach in Inner Mongolia Autonomous Region. The river basin is short of water resource. Due to more water consumption in the middle reach for a long time, the ecological environment in the downstream became more serious. So, the central government set up the Management Administration of Heihe Basin in 1999. Integrated management and integrated dispatching of water resource in the river basin was carried out. The plan of allocation of water resource between provinces was implemented in 2000. After that, the contradiction of supply and demand of water resource between upper and lower reach was solved preliminarily, creating the condition to improve the ecological environment in the river basin.

Tarim River is the largest inland river of the country, with the catchment area of 1.02 million km², but runoff is relatively small. After the large-scale development in the upper reach, water flowed into the main stream was reduced, the 320-km-long section



of the lower reaches of the river commenced to run dry. Large areas of *Populus Diversifolias* were dead along the river, resulting in spreading of desertification and increment of sandstorm. So, Xinjiang Uygur Aotonomous Region government set up the Administrative Bureau of the Tarim River, in charge of

integrate plan and integrate dispatching and management of water resource. From May 2000, Tarim River has succeeded in diverting water into green corridor downstream three times. And a total of 1.3 billion m³ water has been released from Bositeng Lake, and provided more than 700 million m³ of water through Daxihaizi Reservoir for the ecological purpose. At present, the water has flowed into the terminal lake-Taitema Lake in the Tarim River, and formed a lake with surface area of 6 km². The history that the 320-km-long section of the lower reaches of the river and the terminal lake-Taitema Lake dried up during recent 30 years was terminated. As a result, the underground water table at green corridor has risen by 3-5m, the Popular *Diversifolia* in the area of about 600 km² along the lower course has obtained water supplement and freshen with vigour, and the waterfowls have also come back. People called these activities of improving ecological environment an Green Ode.

Box 19 Project for Comprehensively harnessing Tarim River in Xinjiang for Ecological Prurpose

*Tarim River is the largest inland river in China with total length in main cannel of 1321km. There is no runoff in the main stream of Tarim River, and it is supplemented by head sources, such as Hotan River, Yarkant River Kaxgar River Aksu River Ogan River Kaidu River, Kongqi River, etc. Since 1969, the 320-km-long section of the lower reaches of the river commenced to run dry, the terminal lake-Taitman Lake dried up in 1972, the terminal lake-Lopu Lake of the lower reach of the Peafowl River dried up in 1958. The underground water table lowed from 3m in 1970s to 12m due to the water interception, below the limited water level, which the Popular *Diversifolia* could live. So, extensive Popular *Diversifolias* were dead. The area of the Popular *Diversifolia* reduced from 54,000ha in 1950s to 7000ha. Days with wind and sand increased from 42 days in 1960s to more than 130 days and days with sandstorm from 1 day to 6 days.*

The central government paid great attention to ecological environment in Tarim River. Related leaders and experts has investigated the Tarim River Basin for many times, studying the control measures and proposing to carry out measure of comprehensive treatment in Tarim River Basin. The Sate Council approved “Immediate-Term Plan on Comprehensive Improvement in Tarim River Basin” worked by Xinjiang Autonomous Government and the Ministry of Water Resource. Of which, the Improvement Project I has been approved and initiated to construct. The Improvement Project I includes construction of flood prevent dike, constructing ecological gate, desilting the river course, laying the desert road, water saving irrigation, construction of ecology and diverting water to lower reach of the river

g) Water resource development projects in West China

Vulnerable nature ecology, serious water shortage in West China is the main natural causes of impoverishment. The implementation of strategy of “Developing West China greatly” promotes strongly on the progress of water resource development in West China. As a result, a great deal of key water resource projects, such as Wuluwati



Project in Xinjiang , Manla Project in Tibet, Hequan Project in Qinghai Province, Changma Project in Gansu Province, Wang’erhe Peoject in Guizhou Province, etc. and Ningxia Diversion Project (Pumping water from Yellow River for irrigation to mountainous areas in the sough of Ningxia Autonomous Region), have been built one after another and played a big role. The construction of these projects promoted greatly local economic and social development and created favorable conditions for eliminating poverty, improving ecological environment and strengthening the unity of various nationalities in West China.

Box.20 Manla Project in Tibet Autonomous Region

Manla Municipal Project is a large sized water project aided by the central government for the 30th anniversary of the founding of Tibet Autonomous Region with marked comprehensive benefits and greatest investment in a lump sum. It has multi-function on irrigation, power generation, flood control and tourist. Its reservoir has total volume of 155 million m³. Its power station has an install capacity of 20MW, annual generation of 61 million kWh. It costs about 1.4 billion RMB. After completion, it could irrigate farmland of 16700 ha and improve people’s living condition, and raise the flood control standard in the Gyaugze, Bainang and Xigaze regions, eliminate the energy shortage in Xigaze region. It has extreme significance for stimulating economic development and social progress in Tibet.

The construction of Manla Project commenced in August 1995, and completed in November 2000. After acceptance of work in August 2001, the project went into operation. In August 2000, the project succeeded in preventing the flood with a 1000-year event when it was not completed, and gave the benefit of flood control.

h) Active in international activity and cooperation in the fields of sustainable water resource development

Chinese government still regarded flood control, sustainable utilization of water resource as key factor in international cooperation, taking part in international important activity actively. Since 1993, large-scale commemorative activity for celebrating World Water Day was held every year in China. And especially the 4th World Water Day in 1996, the main meeting-place of commemorative activity was set up in Beijing by United Nations. Chinese Government often organizes missions to attend international conference and activity on water and sustainable development and the development of infrastructure, which are sponsored by the United Nations, international organizations and regional organizations in Asia and Pacific region. Central government organized experts and scholars to attend international conference on water resource, hydrology, large dam, irrigation and drainage, small hydropower, water science, etc. China has held a number of important international water activities, such as the conference of Executive Council of International Committee on Irrigation and Drainage, International Conference on Hydrology Science, International Conference on Water Project and Science, Conference on the sediment control and basin management, International Conference on Large Dam, International Conference on Small Hydropower and International Water Exhibition.

China is the member of over 40 international governmental and non-governmental water organizations, such as International Committee on Irrigation and Drainage, International Water Resource Association, International Committee on Hydrology Science, the World Water Council, International Small Hydropower Center, International Water Association, etc. She has carried out the cooperation on sustainable utilization of water resources with some relative organization of United Nations, international financial organizations and many countries. She has successively implemented some cooperative projects with United Nations Development Program, United Nations Environment Program, Children Foundation, Food and Agriculture Organization of the United Nation, such as Master Plan of Water Resources in North Xinjiang, Study on the Management of Water Resources in North China, Study on the Management of Huaihe River basin, Rural Water Supply and Environmental Sanitation, Development of the Pilot Area Adopting New Irrigation Technology in the Arid Northwest China. She has also completed study on the Action of Water Sector in the Yellow River, Huaihe River and Haihe River Basins with World Bank, Water Sector Development Strategy in China and Plan of Water Resources Development in North Hainan with Asia Development Bank. The bilateral cooperation and exchange with Japan, France, Germany, Netherlands, Greece, Canada, Finland, South Korea, Italy and UK and others on water resources and water environment has been carried out. The International Conference on Safeguard for Metropolis Sustainable Water Resource Early in the 21 Century was held in Tianjin, and “the Tianjin Pronunciation” was issued.

The central government and relative departments tried to widen the channel of international cooperation and communication, study, introduce, digest and absorb the international advanced technology and management experience on sustainable utilization of water resource, which promoted to improve the level of sustainable utilization of water resource

*Box 21 Tianjin Declaration on Metropolis Sustainable Development
in the Early 21st Century (abstract)*

The International Conference on Sustainable Development of Mega-cities in the Early 21st Century was jointly held by the Chinese Ministry of Water Resource, Beijing Municipal Government, Tianjin Municipal Government and Brandenburg State Government of Germany during May 8 to 10, 2000. Eight appeals put forward at the conference were as follows:

- ① Solving the problem of urban water shortage from the strategy view of economic and social sustainable development and sustainable utilization of water resource.*
- ② Changing the manner of acquiring resource from the nature immoderately to coexistence between human and nature harmoniously.*
- ③ Adjusting old economic system from the view of economic and social sustainable development and sustainable utilization of water resource, from the view of deepening restructuring the system and straightening production relation.*
- ④ Depending on technology innovation, popularizing water saving measures greatly, modifying current water facilities, production pattern of the enterprises and controlling wastewater discharge central on water saving.*
- ⑤ Carrying out integrated management of water resource in river basins and regions, establishing authoritative, effective and harmonious management system on water resource.*
- ⑥ Emphasizing the water control and water management according to the law.*
- ⑦ Carrying out water diversion projects be imperative under the situation.*
- ⑧ Strengthening the international cooperation and communication further more.*

i) Promote public participation

Chinese Government has paid great attention to the propaganda and education of sustainable development. The idea on sustainable development has been extensively accepted and struck root in the hearts of the people, enhancing the positivity of public participation to the sustainable development. The Environment Resource Committee of the National People's Congress has organized 9 activities of "China Environment Protection Century Tour". The Chinese Academy of Engineering organized forty-three academicians of the Chinese Academy of Sciences and Chinese Academy of Engineering and 300 senior experts to carry out strategy investigation of sustainable utilization of water resource, and propose the "Strategy Report on China Sustainable Development of Water Resource". With the close cooperation of tens of investigation institutes and universities and related departments, they have carried out key research

on “Sustainable Development of Water Resource in Yellow River” and “Reasonable Water Utilization in Northwest Region” for 10 years. They also organized the technicians actively to go to the countryside to promote efficient water utilization and sustainable utilization. The National Women’s Organization and other departments launched activities throughout the country, such as “Protecting Mother River” and “Protecting the Source of Yangtze River, Yellow River and Lancang River.

Treasuring water, taking good care of water, saving and protecting water resources, protecting environment, and preventing and controlling water pollution have gradually become the conscious actions of the people.

2.6 Challenge 6: Soil and Water Conservation

2.6.1 Background

China is one of the countries that have the most serious problems of water and soil erosion in the world. the area of soil erosion in China is 3.67 million km², accounting for 38 percent of country's total territory. Of the total, the water erosion area is 1.79 million km² and the wind erosion area is 1.88 million km². The loess plateau is serious regions of soil erosion in China , sediment in Yellow River come mainly from this region . The soil erosion create land resource destruction, aggravate flood and drought and sand storm disasters .It seriously restrict the sustainable development of society and economy in China .Water and soil erosion has become the top environmental problem in China.

2.6.2 Actions and achievements

a) Issue and implement Water and Soil Conservation Law, Controlling water and soil erosion in accordance with law and regulations

The Water and Soil Conservation work are regard as a basic national policy by Chinese Government. In 1991, the Water and Soil Conservation Law of People's Republic of China was issued by Chinese Government, systems of supporting regulation and supervision and enforcement of the Law have been established basically in the whole country, supporting relevant regulations have been issued in every region.

b) Formulating plans on water and soil conservation and ecological environment rehabilitation , determining control objective

In 1993, Chinese Government approved the first National Program for Water and soil Conservation Planning. It has clearly determined the objectives of comprehensive control of water and soil erosion that should be completed in 1990s. National Plan of Ecological Environment Rehabilitation approved in 1998 has provided full strategic

arrangements for the work of water and soil conservation and ecological environment rehabilitation in the whole country in the 21 century , raising to stress the key points , making more efforts and promoting the progress of the control of soil erosion , almost all the water and soil erosion will be treated in coming 30 years.

c) Determining key control areas and promoting the progress of water and soil erosion control

The key control areas of water and soil erosion that involve the sand and coarse sand area in Shanxi, Shaanxi and Inner Mongolia in the middle of Yellow River , the upper of Yangtze River , Three Gorges Reservoir area and main tributaries regions ,the sandstorm zone at north of Great Wall ,particularly, sandstorm zone surround beijing-tianjing zone have been selected by Chinese Government and government determines to make more efforts on water and soil erosion control . Since 1992 , chinese government has controlled water and soil erosion area of 38000 km² per year .

Box 22 Key points of water and soil conservation and ecological rehabilitation

- ◆ *Water and soil erosion control in the upper reaches of Yangtze River and limestone regions;*
- ◆ *Water and soil erosion control in the upper and middle reaches of Yellow River;*
- ◆ *Water and soil erosion control in the upper of other rivers;*
- ◆ *Water and soil erosion control in sandstorm and grassland zones;*
- ◆ *Comprehensive control in inland river basins;*
- ◆ *strengthen the monitoring and supervision of water and soil conservation, implement self-rehabilitation project of natural environment.*

f) Setting up key prevention and protection areas and supervision areas of water and soil conservation, strengthening prevention and supervision of water and soil erosion

The middle and upper of Yangtze River and Yellow River are determined as key areas, in these region, the prevention and protection works in river source area, main reservoir water sources area and slight soil erosion and good vegetation regions are strengthened, various activities of development and construction are rigidly restricted and water loss and soil erosion caused by human activities recently are firmly controlled . With the implementation of the Report System on Water and Soil Conservation Scheme for Development and Construction Projects, the domestic development and construction projects must carry out "three-simultaneousness"(that is, the design, construction and operation of water and soil conservation facilities of construction projects shall be simultaneous.) system , the supervision and inspection will be strengthened so that the possible water and soil erosion caused by human activities in the development and construction projects can be controlled and prevented . Since 1992, more than 200,000 km² slight water and soil erosion area

were carried out prevention and protection, more than 170,000 development and construction projects have carried out schemes report on water and soil conservation, according to expound and prove scheme carry out water and soil conservation rehabilitation and construction.

Box 23 Water and Soil Conservation and Ecological Rehabilitation in Ulanqab League, Inner Mongolia

Ulanqab League in Inner Mongolia has been a great beautiful pasture with abundant water and plentiful forage grass. With the increase of population and the deforestation and reclamation for agricultural cultivation, ecological environment is destroyed seriously. By 1994, 73.8 percent cultivated land with a total area of 1.6 million hectares was desertificated, 50 percent natural pasture was desertificated and degraded, and the area of soil loss accounted to 93 percent of total area.

In order to curb the progress of ecological deterioration and eliminate poverty, the Government of Ulanqab League combines the water and soil erosion control and ecological environment rehabilitation with basic farmland construction. From 1994, the strategy of "one-unit area construction, two-unit area withdrawal and three-unit area return" was carried out for the development and utilization of soil resources. That is, after one mu of high-standard farmland was constructed, two mu of poor farmland in hillside will be withdrawn from cultivation, and three mu farmland will be returned to vegetation. By 2000, total 800,000 hectares of farmland returned to vegetation, about 1.56 million hectare of water and soil erosion area was controlled, accounting for 31 percent of total erosion area, and the rate of forest cover increased from 6.8 percent in 1994 to 8.7 percent. The GDP, financial income, total crop product, average pure income of farmer and herdsman, and the payable income of citizen in urban area was increased by a hundred percent on the condition that the cultivated land area had reduced by fifty percent.

e) Spreading experiences gained from the treatment of small watersheds and carrying out comprehensive control of water and soil conservation

With a small watershed as a unit, a county as an agency and a household-responsibility contract system as a basis, the problems concerning mountains, rivers, farmland, forests and roads can be tackled in a comprehensive way. The engineering measures, biological control and farming practices with water storage and soil conservation have been adopted according to local conditions and in scientific plan in order to achieve comprehensive control. Since 1992, the comprehensive treatment of small watershed with household-responsibility-contract has been developed. With the development of control work of water and soil erosion, market mechanism has been adopted in every region, some reform measures such as auction of the use right, land leasing, shareholding cooperation and other ways have been taken, this speeds up the progress of the control of "four wastelands" (meaning barren mountainous area, gully area, hilly and shoaly land) resources control, various form job responsibility system of water and soil erosion control are

established. According to incomplete statistic, about 241000 million km² of "four wastelands" resources had been purchased, contracted, leased and shareholding cooperation by peasant household, staff and workers and entrepreneurs with a number more than 8.78 million in the whole country ,about 127000 million km² water and soil erosion lands had been preliminary treated.

f) Accelerating the restoration of vegetation and improving ecological environment by giving play to the self-rehabilitation ability of natural environment

Following natural law, insisting on the principle of "prevention first and protection priority", and giving fully play to the self-rehabilitation ability of nature, the natural vegetation can be restored .The measures taken in this progress of restoration include closing hillsides to livestock grazing, forest reservation and rotate grazing, and returning farmland to vegetation . Great achievements had been obtained by



conducting these measures in Jiangxi, Sichuan, Hubei and Guizhou Province in the upper and middle reaches of Yangtze River. At present, the vegetation in Shaanxi, Inner Mongolia, Hebei, Shanxi Province/Autonomous Region in North China and Tarim River and Hehe River basins which are undergoing serious soil erosion had been restored gradually after adopting

closing hillside to livestock grazing and allocating ecological water use reasonably.

Box 24 Ecological Restoration Project in Wuqi County, Shaanxi Province

Wuqi County is located in the Northwest of Yan'an City, Shaanxi Province, and belongs to the transition zone of Loess Plateau rolling terrain and desert. The total population in this county is 120,000. The area of territory is 3,791 km² and cultivated land area is 123,000 hectares. The area of water loss and soil erosion is 3,693 km², accounting of 97 percent to total territory, and annual erosion modulus is about

15,700 tons per km². It is one of the counties that have the most serious water loss and soil erosion in Loess Plateau. Since 1998, according to local conditions, local government formulated an ecological rehabilitation plan with emphasis of "closing hillsides to livestock grazing, raising sheep in circled sheepfold and making great



efforts in green mountains and clear rivers rehabilitation ". After changing the agricultural structure and development idea, an ecological agriculture development

mode with characteristic of "intensive and self-supporting agriculture, benefit-protecting forestry, and good-prosperous livestock farming" were established. In recent years, about 280,000 goats of local species destroyed vegetation seriously were eliminated and about 95,000 herds of sheep were raised in sheepfold, 85,000 hectares of ecological and economic forest and 73,600 hectares of herbage were planted. All territory had been closed for vegetation and treatment, and the self-rehabilitation ability of nature was increased obviously.

g) Strengthening the international cooperation and standardizing project management in the field of water and soil conservation

The Chinese Government has actively expanded and participated in the international exchange and cooperation in the field of water and soil conservation. Since 1994, continuous two stage loans from the World Bank have been used in the soil erosion control projects in the Loess Plateau. Its first-stage project with a soil erosion control area of 14000 km² in 22 counties in Shanxi, Shaanxi, Inner Mongolia and Gansu Province/Autonomous Region has been examined and accepted. Experts of World Bank give highly appraisal. In addition, the Asia Development Bank also provided supporting to the study on the strategy of Chinese water and soil conservation. In 2002, the 12th International Water and Soil Conservation Conference was held successively in Beijing. At the same time, the control project of water and soil erosion have gradually changed from masses build to government invest, the government increase investment and strengthen management of projects, the control projects of water and soil erosion implement in accordance with the procedure of capital construction.

Box 25 Water and soil conservation project in loess plateaus financed by the World Bank

The water and soil conservation project in loess plateaus financed by World Bank was developed in May 1994. According to local conditions, comprehensive control measures are taken, it combines closely the control of water and soil erosion with solving peasant difficulties of the production and live, achieves fairly good ecological, economic and social benefits, promotes the adjustment of economic structure in country regions, and lays a foundation for social and economic sustainable development in this region. Its first-stage project covers 22 counties in 7 regions (cities) in Shaanxi, Shanxi, Gansu, and Inner Mongolia Province/Autonomous, total investment is 2.073 billion Yuan RMB, including loan of 1.243 billion Yuan RMB (150 million US dollars). Its second-stage project starts in 1999, its scope covers 37



countries in 12 regions (cities) in Shaanxi , Shanxi , Gansu ,and Inner Mongolia Province/Autonomous, total investment is 2.095 billion Yuan RMB , including loan of 1.245 billion Yuan RMB (150 million US dollars) .

By 2000 , 0.606 million hectares water and soil erosion areas are controlled ,the countermeasures of control include building newly 0.138 million hectares basic farmland ; planting 0.119 million hectares arbor; 0.143 million hectares scrub, 0.042 million hectares economic forest and 0.038 million hectares orchard ; planting 0.116 million hectares grass by man-made ; closing hillsides and planting trees 0.009 million hectares .

2.7 Challenge 7: Protecting Ecosystem

2.7.1 Background

China's water pollution issue is increasingly outstanding. According to China Water Resources Bulletin 2000, the discharge of industrial wastewater and domestic sewage in the whole country is of 62 billion t / year, among which the industrial wastewater accounts for 66%, the domestic sewage accounts for 34%. Some untreated or substandard wastewater and sewage are directly discharged into rivers, lakes and reservoirs, resulting in pollution in different degrees. The evaluation results of water environment monitoring for 114,000 km long evaluated river stretch in over 700 major rivers of the country show that 30% of the river stretch has type I and II of water quality, 32% has type III and 38% has type IV to worse than type V. Some freshwater lakes are in severe eutrophication and shallow groundwater has been polluted in different degrees. Water pollution has intensified the ecological degradation and the water supply conflicts in some areas and threatened the sustainable utilization of water resources. The protecting water resources, improving water environment and controlling water pollution has been a task of top priority in the ecological environment protection.

2.7.2 Action and achievement

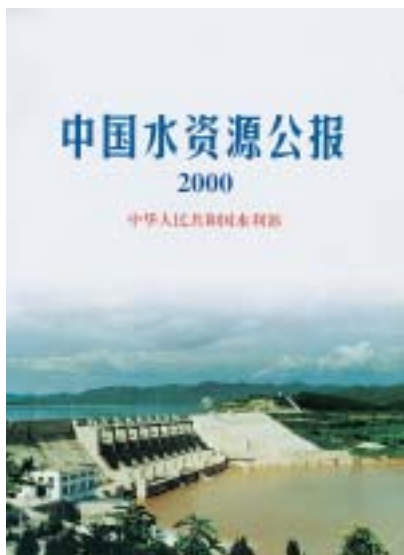
a) Drawing up water resources protection plans, classifying scientifically water function zones

Chinese government has organized to draw up the plans on the protection of water resources in whole country and major river basins, providing scientific basis for the effective protection of water resources and the effective control of water pollution. Water areas in the whole country are classified into two-level function zones on the basis of taking basin as a unit. In first-level function zones, 884 protection zones, 771 reserve zones, 390 buffer zones and 1441 development and control zones are designated. Water quality control objectives and total pollutants load control scheme for these water function zones are identified based on different uses. Besides, both

structural and non-structural measures are proposed according to planned objectives, thus the water resources protection and water pollution control can be progressed sound and in order.

b) Strengthening the monitoring of the quantity and quality of water, establishing water resources bulletining system for key areas

China has set up 251 water quality monitoring centers and over 2600 water quality monitoring stations under the control of central and local governments, thus a water



quality monitoring network with its spatial coverage over the whole country has been established basically. 329 water quality monitoring stations are set up at provincial boundary sections of main rivers in seven major river basins such as Yangtze River, Yellow River and Huaihe River basins. Water quality of surface water and ground water in whole country and in provincial boundary sections of main rivers can be monitored through the monitoring network. From 1989, National Water Quality Bulletin for Key Reaches of Major River has been issued monthly to the public. From 1999, Water Quality Bulletin for Source Areas of Water Supply in 19 Key Cities has also been issued once every ten days. At present, China Water

Resources Bulletin has been issued once a year. Water resources bulletining system has been established by most local governments too, and the local water quality has been issued to the public for supervision through local media.

c) Determining management objectives, carrying out the protection of the source areas of water supply and the wetlands

Chinese government attaches great importance to the protection of source areas of water supply. The protection zones have been demarcated for key water sources areas, the management objectives of water sources protection have been determined and the activities impeding water sources protection and creating pollution are strictly restricted in the protection zones. The safety water supply capacity is continuously being improved by combination of structural and non-structural measures. The government attaches great importance to the wetland protection, too. The wetlands water use is made overall consideration and the plans of water delivery timely to the wetlands have been drawn up. In 2001, the Zhalong Wetland Reserve which is located in Songhua River basin and protects rare birds composed mainly of cranes was drought, Chinese government diverted timely 35 million m³ of water to the wetland, improving efficiently its ecological environment. Some big cities such as Beijing, Shanghai, Tianjin are actively carrying out the integrated regulation of rivers and

lakes in cities and are strengthening the wetland protection, thus improving efficiently water environment in cities.

Box 26 Allocating ecological water use for the protection of the Zhalong Wetland

The Zhalong Wetland is located in the west of Heilongjiang Province, in marsh and reedy areas in the lower reaches of Wuyuer River, in the Songnen Plain. It is near the Jiangdou irrigation district in Qiqihaer City, with a total area of 2100 km². It is the largest national nature reserve for rare birds composed mainly of cranes and other huge waterfowls and the wetland ecosystem. In order to mitigate drought and water



shortage situations and to rehabilitate ecological environment of the wetland, a water diversion plan diverting 100 million m³ of water to the wetland each year has been drawn up by the government and will be completed in May 2002. At present the wetland has temporarily been supplemented water with existing water works. In

July 12 – September 3, 2001, 35 million m³ of water was temporarily diverted to the wetland, relieving efficiently the water shortage situation and increasing the wetland area from 130 km² to 300 km².

d) Taking structural measures for protecting water resources and controlling water pollution

Chinese government attaches great importance to water pollution control. The notable results of the water pollution control have been achieved in the heavily polluted basins such as Taihu Lake, Dianchi Lake, Huaihe River, Haihe River and Liaohe River, after adopting some measures as carrying out inter-basin water transfer through existing or new water projects, constructing sewage collection facilities, comprehensive control of the upper reach areas, optimizing the dispatch of water resources and improving ecological water use. In Taihu Lake basin, the water from Yangtze River has been diverted to Taihu Lake through the existing flood control and drainage projects, thus speeding the water displacement of Taihu Lake, shortening the period of water



displacement of Taihu Lake, enhancing natural purification capacity of the lake water, improving the water environment in some areas of Taihu Lake basin. In order to improve water quality of Guanting and Miyun reservoirs in Beijing, the government

has arranged special funds for the implementation of engineering measures including water-saving, pollution control and water and soil conservation in the upper reach areas in Shanxi and Hebei Province. In main channel of Huaihe River, through combined operation of downstream and upstream gate dams to provide reasonable discharge and flow velocity needed for maintaining ecological environment, heavy pollution in main course is effectively prevented.

BOX 27 Transferring water from Yangtze River to Taihu Lake for the improvement of the water quality of Taihu Lake

With the development of economy and the increase of human activities, the eutrophication of Taihu Lake is becoming more and more serious and the water environment quality is being deteriorated continually. In July – August 2000, a climactic growth period of blue algae in Taihu Lake, the emergency water transfer of 460 million m³ were carried out using existing water projects from Yangtze River to Taihu Lake basin, of which 222 million m³ were delivered to Taihu Lake and 73 million m³ to Huangpu River. In 2001, water transfer trial was kept on. At present,



1100 million m³ of water has been delivered from Yangtze River, of which 140 million m³ has been delivered into Taihu Lake and 740 million m³ to the lower reaches through Taihu River. The water environment quality in northeast Taihu Lake has been improved obviously and the water supply conflict in the areas around Taihu Lake and the lower reaches has been reduced. A

water transfer project from Yangtze River to Taihu Lake aimed at improving the quality of water environment of Taihu Lake is to be carried out after experiments and researches.

e) Making initial results of the water pollution control in key basins

Chinese government has determined “three rivers and three lakes” (Huaihe River, Haihe River, Liaohe River, Taihu Lake, Dianchi Lake and Chaohu Lake) as key areas of water pollution control, has approved their water pollution control plans one after another and has done more jobs in their water resources protection. Their water pollution control has made initial success. Water pollution has been mitigated obviously in main stream of Huaihe River and improved to some extent in Haihe River and Liaohe River basins. The tendency of water quality deterioration has been controlled initially in Taihu Lake basin. The severe eutrophication condition has been mitigated to some extent in Dianchi Lake and controlled in the main in Chaohu Lake. At present, on the basis of the experiences of water pollution control in key basins,

some jobs including tightening up the sewage outlet management and the water quality management of water abstraction and so on are being considered. While water



pollution control in “three rivers and three lakes” is continued, the water resources protection and water pollution control in Huanghe River and Yangtze River and the water pollution control and ecological environment rehabilitation in the water

sources areas and water supply areas of the South-to-North Water Transfer Project are being strengthened.

2.8 Challenge 8: Flood Control, Drought Relief and Disaster Mitigation

2.8.1 Background

China is a country with severe frequent flood and drought disasters. Six severe floods occurred since 1991, have caused over 1000 billion Yuan of direct economic losses, which account for 1/5 of national financial incomes. The 1998 floods in Yangtze, Songhua and Nenjiang river basins are the most serious, which have caused over 255 billion yuan of direct losses. In the same period, five severe droughts occurred around the country, the severest one in 2000 hit over 20 provinces, more than 40.67 million ha of farmland were affected, of which 2.66 million ha suffered a production loss, water shortage problems in major cities in North China were increasingly serious.

In the 21st century, the management of major rivers will face more difficulties, the areas and risks of flood and drought disasters will be increasing, thus bring about the arduous tasks of flood control and drought relief.

2.8.2 Action and achievements

a) Laws and Planning

A lot of plans to effectively mitigate flood disasters and droughts have been made by Chinese government since 1992. They are National Flood Control Plan, Flood Control

Plan of Major Rivers, Flood Control Plan of Major Cities, National Long-term and Mid-term Water Demand and Supply Plan and National Water Sources Planning for Cities Suffering Water shortage, and so forth. The train of the thought and the objectives of flood and drought disasters mitigation were set, the construction standards were made, and the implementing schedules were formulated in these plans. Meanwhile, the legal system establishment work has been strengthened. The laws and regulations such as Flood Control Act, Safety Regulations for Reservoirs and Dams, Compensation Interim Procedures for Storage and Detention Basins, Water industry Policy were made and enacted so as to provide powerful support to the mitigation works.

b) Strengthen leadership, make massive efforts to disaster mitigation

Emergency flood fighting and disaster relief institutions are set in the central and local governments, and administrative officer-responsible systems at different levels were exercised. Organizations undertake emergency relief works are established. When emergency flood and drought disasters occur, the masses could be mobilized in time by governments at different levels to join flood fighting and drought relief works so as to minimize the losses caused by floods and droughts. The earmark funds are provided by central government to disaster areas according to degree of losses. People all over the country are organized to provide assistance to disaster affected areas and people. After disaster, special funds are provided by central government to rehabilitate structures damaged by floods and strengthen construction of flood control and drought relief structures.

c) Speed up construction of structural flood control and drought relief system

A number of key flood control projects were started since 1991, the Three Gorges Project on Yangtze River, the Xiaolangdi Project on Yellow River and Feilaixia Project on Pearl River are among these projects, some of them have been completed and put into operation. The central government made it clear that further strengthen the harnessing of Huaihe River and Taihu Lake in 1991, strengthen the building of dikes along Yangtze River, Yellow River and Songhua River in 1998. Pro-active financial policies to increase budget expenditures and issue more treasury bonds, have been implemented in recent four years, thereby bring about the increasing investment to public development projects such as flood control and drought relief projects. According to statistics, over 30000 km of levees have been upgraded, or new built, of the levees, 6100 km are along the middle and lower reaches of Yangtze River, 1840 km along the Songhua River. A number of aged and dangerous reservoirs have been

consolidated, the urban flood prevention capabilities have been upgraded. More than 200 large and medium irrigation districts have been upgraded with their focus on water-saving. So far, structural flood control system, which consist of key control projects, levees, storage and detention basins, have been basically completed. The farmland drainage system building on large and medium irrigation districts have also been completed. Both flood prevention standards of main rivers and drought relief standards of most regions have been upgraded obviously. It is calculated that the damage prevented from big floods since 1991 by flood control system has reached to 1500 billion yuan.



Box 28 The Three Gorges Project

The Three Gorges Project is located at town of Sandouping, Yichang City of Hubei Province, with a control area of 1 million km². The Three Gorges Dam will create a reservoir with a total storage capacity of 39.3 billion m³, of which 22.1 billion m³ is for flood control. The Three Gorges Dam is designed to have an installed



hydroelectric capacity of 18200 megawatts. The turbines will generate up to 84.68 billion kilowatt-hours of electricity per year. The project is planned for construction over a period of 16 years. The construction goes

ahead in 1994. In 1997, the Yangtze River was blocked and diverted in preparation for actual construction on the dam. The permanent ship locks are planned to be putting in to operation in June 2003, the first electricity is scheduled to be produced in October of the same year, and the project is to be completed in 2009. The Three Gorges Project is the key project for preventing floods on middle and lower reaches of the Yangtze River, after completion it will raise the flood control standard in Jinjiang section from a 10-year to 100-year return period. Then it will not be necessary to use Jinjiang storage basin to divert floodwater when a 100-year flood occurs. The project makes

the Yangtze much safer than before.

Box 29 Embankment construction along the Yangtze River

The Chinese government decided to upgrade sub-standard levees along the Yangtze River over 3 to 5 years, soon after 1998 devastating flood. The total investment will be 30.7 billion-yuan. So far, 26.8 billion-yuan has been used to reinforce levees along middle and lower reaches of the Yangtze River. Nearly 416-million m³ earth work and 32.12 million stone work on the dike consolidation have been completed, 2634 km levees up to the state-set section standards, which account for 80% of total levees planned to be upgraded. The massive construction is expected to be completed in 2002.

d) Pay great attention to construction of non-structural flood control and drought relief system

So far there are more than 20000 hydrological stations and over 8000 reporting stations throughout the country, the network of hydrological stations and forecasting



system has been established. Flood control commanding systems for some major river basins and key regions have been set up, the state flood control commanding system is building and improving step by step. Plans to fight against extraordinary floods on major rivers such as the Yellow, Yangtze, Huaihe and Yongding rivers and plans to fight against storm tides of coastal areas affected by typhoon have been made and improved. 333 anti-flood forces with 60000 people

have been organized at different levels of the whole country, about 3400 large and medium anti-flood equipment have been prepared to fight against floods. Over 9300 organizations with 400000 anti-drought equipment throughout the country have been set up to fight against drought. These well-prepared



non-structural measures could be used in time, in fact, they have already play important roles during floods and droughts occurred.

e) Manage water according to natural laws and bring about a coordinated relationship between human and nature.

Decision to clear obstacles in low-lying lands around rivers and lakes is made by Chinese government, so that the flood diversion capabilities could be increased. This



decision is made based on causes and characteristics of floods, and on the facts that the flood storage and diversion capabilities of rivers and lakes are losing as the result of development. A lot of measures have been taken in middle and lower Yangtze River areas after 1998 floods. The measures are to level the

floodplain areas for flood water discharging, to restore the land around the lake, to build new towns for relocated people who are needed to move from key floodplains and lake areas. The focus is to move people out of low-lying lands, which are natural floodwater diversion areas, so that their farmlands could be turned into areas to store seasonal floodwater. So far, nearly 2075 km² farmlands have been turned into flood storage areas by means of migration. The restored area can store an extra of 7.4 billion m³ of floodwater.

Box 30 leveling the floodplain areas for flood water discharging, restoring the land around the lake, and building new towns for relocated people in middle and lower reaches of Yangtze River

Historically, people living in middle and lower reaches of the Yangtze River are used to reclaim low land (i.e. Polder) from lake and river for farming and housing.

Up to 1997, a total number of 2620 big and small polders have been reclaimed in middle and lower areas of the Yangtze River. As the result, the flood storage and releasing capabilities of the river and lakes are reduced. Compared to



1954 flood, the flood volume of 1998 flood was smaller than that of 1954, but the flood level was much higher than that of 1954, that is why the 1998 floods cause so

enormous damage to lives and properties. Floods breached totals of 557 polders in 1998 and 1999.

Following the disastrous floods in 1998, the Chinese government decided to build new small towns to relocate people from dangerous polders and to restoration of the land around the lakes. About 1514 polders were planned to be returned to the lake. They cover a total area of 4950 km² and were then home to 3.36 million people. The restored area can store an extra of 17.2 billion m³ of water. Because these measures follow the natural laws, they are welcome and supported by local people. So far, the above works are proceeding smoothly.

f) Strengthen scientific research on flood and drought disaster mitigation, make knowledge of disaster mitigation widely available

In order to raise the research level of disaster mitigation, flood disaster mitigation research units have been set up in some institutes, universities and colleges. A large outlay for research are provided to study of special subjects, including new technology for flood fight, new materials application, flood risk analysis, flood control and drought relief commanding decision supporting systems, satellite remote sensing of flooding and water-logging disasters, automatic hydrometric survey and report, flood insurance policy, and research on optimal distribution of water resources in North and Northeast and so forth.

Contents of water resources knowledge have been added to the textbook of Natural Resources for primary school and textbook of Physical for middle school. Specialized courses are offered to students in water related departments in colleges and universities. Popular science books and TV programs on natural disaster defense, water resources conservation, soil erosion and land slide control, flood fighting and water-saving have been published. Above measures are aimed to raise the national wide awareness of flood control and drought relief.

Part III

Framework for Future Actions

3.1 Strategic Planning for Sustainable Water Resources development

The realization of sustainable utilization of water resources is an important strategy of the sustainable development of economy and society in China, which is of vital importance to the progress of national economic construction, social safety and modernization build. The implementation of sustainable development strategy of water resources should put development first, take the sustainable utilization of water resources as main direction, use the motive force of reform and scientific and technical progress, proceed from meeting the basic water demands of the people and masses. We should persist in the water control principles of “overall planning with all aspects taken into account, comprehensive harnessing, combining with benefit promotion and disaster control, simultaneously developing flood control and drought prevention projects and paying equal attention to the work of water source development, water conservation and water resources protection, and the transformation from the engineering-oriented water resources development into the resource-oriented one, from the traditional water conservancy into the modern and sustainable water resources development”. The flood control and disaster alleviation, the sustainable utilization of water resources, the soil and water conservation, the ecological rehabilitation and the ecological environment protection should be taken as the key fields of implementing sustainable development strategy. The development of water resources should be taken as the first of infrastructure construction. The security system of the sustainable utilization of water resources should be continuously perfected in order to make use of the sustainable utilization of water resources to support the sustainable development of economy and society. In a few words, it should meet the following five requirements. Firstly, the water demands of urban and rural domestic water use should be met in priority. It should provide the urban and rural people with safe and clear drinking water, improve the public facilities and living environment and gradually enhance the living quality. Secondly, the water demands of national economic construction should be basically met. A comparatively stable water supply should be provided for the increasing economic construction, especially the development of city and industry, in order to guarantee rapid, continuous, health economic development. Thirdly, the requirements of economic development and social safety on flood control should be basically guaranteed. The safety of people’s life and properties should be basically guaranteed through flood control in order to provide the support and security for the safe operation and stable development of economy and society. Fourthly, the water demands for the safe grain production should be basically met. The agricultural water supply assurance

coefficient should be enhanced and the agricultural production conditions should be improved in order to provide water security for the safe grain production in our country. Finally, the water demands of ecological environment should be improved. The water use for the ecological environment should be gradually increased in order to improve continuously the natural ecology, beautify the living environment and build the beautiful residence environment with the harmonious coexistence of people and nature.

a) Insisting on the harmonious coexistence of people and nature and realizing the sustainable utilization of water resources

We should change the past sense of the over-emphasis on that “the man can conquer nature” for extorting from the nature without control. We should respect the natural laws, advocate the sciences and technology and coordinate orderly the relationship of the people and nature. While controlling the damage of water to human, we will pay special attention to the damage of human to water. We will protect water resources and ecological environment, in accordance with the requirements of the coordinative development of the population, resource, environment and economy. The deployment of productivity, industrial structure and development scale should be based on the status quo of water resources. We should change those production and consumption ways that are unfavorable to the sustainable utilization of water resources and avoid the actions of the irrational development of water resources and the wanton occupation of rivers and lakes in order to realize the sustainable utilization of water resources.

b) Raising the bearing capacity of water resources and solving various water problems with due consideration for all concerned

We will adjust the industrial structures and promote the water conservation, carry out the scientific planning and optimal allocation of water resources, raise the bearing capacity of water resources and promote the sustainable utilization of water resources, in order to provide the guarantee for the sustainable development of economy and society. We should insist on the principles of overall planning with all aspects taken into account, disaster treatment by seeking both its root cause and symptoms and comprehensive treatment. We will follow the policy of promoting benefits while mitigating disasters, paying equal attention to water source development and water conservation and simultaneously developing flood control and drought prevention, in order to guarantee the safety of flood control and domestic water supply, the water demands of economic construction. Meanwhile the water demands of ecological environment should be arranged with due consideration for all concerned. In the poor regions deficient of water, we will adopt the policy that the open-type poverty alleviation by water resources development. Under the important support of the State, the shortage of water and electricity should be firstly solved. Meanwhile, we will strengthen the construction of the drinking water works for the people and livestock,

soil and water conservation projects, ecological rehabilitation projects, medium- and small-sized hydropower projects, and small- and micro-sized rural water conservancy works, in order to provide strong water support for improving fundamentally the living and production conditions and the poverty looks in those poor areas.

c) Increasing the utilization efficiency of water resources and striving for building our country into a society oriented to water conservation

We will vigorously carry out water conservation, popularize the water use in a planned way, strengthen fully the management of water use and demand, reduce the ineffective water demands, spread various kinds of water-saving techniques and measures, increase the utilization efficiency of water resources, reduce the discharge volume of wastewater and sanitary sewage, develop the water-saving agriculture, industry and service trade, set up a water-saving kind of society, enhance the safety of water supply, lighten the burden on wastewater treatment and alleviate water pollution.

d) Making full use of market mechanisms and promoting the optimal allocation of water resources

We will set up an all-round input mechanism for the development, utilization, treatment and protection of water resources and a rational water price formation mechanism, carry out the paid use system of water resources, bring the function of economic levers into full play, clear the water rights, set up gradually the water market, implement the flow system of the paid use of water in an orderly way, and promote the rational utilization of water resources and the water conservation in order to accelerate the high-effective use of water resources.

e) Persisting in controlling water in accordance with laws and managing water resources in a scientific way and carrying out the strategy of making use of sciences and technologies to rejuvenate water resources development

We will insist on the sustainable development strategy and carry out controlling water in accordance with laws and managing water resources in a scientific way, under the guidance of the concept of sustainable utilization of water resources. We will accelerate revising the Water Law and the Water-drawing Permit System and other laws and regulations concerned, and study and formulate the Water Drainage Permit System and the Audit System for Water Use in order to set up and perfect the laws and regulations on water. We will rely on the scientific and technical innovations to raise the integral technical level of the development and utilization of water resources. We will learn and import the modern technologies of the development and utilization of water resources and the advanced water resources management experience in order to increase the turning rate of the scientific and technical research results on the development and utilization of water resources and promote gradually the

modernization of water resources causes in China.

e) Reforming the water management system and strengthening the unified management of water resources

We will take the river basin as a unit to set up a system of the unified management of river basin water resources in an authoritative, high efficiency and coordinative way in order to carry out the unified planning, dispatching and management of water and hydropower resources. We will take cities as key point to perfect the unified management system of local water resources and implement the unified management on municipal flood control, water logging drainage, water storage and supply, water use and conservation, wastewater treatment and reuse, groundwater recharge and other water affairs concerned. We will practice strict water conservation, popularize water-saving irrigation, rehabilitate the pipeline network and equipment of municipal water supply, and adopts the comprehensive economic, administrative and technical measures to strengthen the unified management of water resources and raise the utilization efficiency of water resources.

3.2 Opportunities and Challenges

3.2.1 Opportunities

a) The State has paid great attention to the sustainable utilization of water resources

The Chinese Government has made clear that the sustainable utilization of water resources is a strategic problem of the economic and social development in China and puts forward that it will change the increase way of economy, save and protect vigorously the water resources, grasp the water-saving irrigation as a revolutionary measure, and strengthen the work of agricultural, industrial and urban domestic water conservation. We will make every effort to solve the problems of drought, flood, water logging, and environment deterioration. Starting with the formulation of the measures of investment and policies, we have listed the water conservation, the security of water supply, the safety of flood control, and the control and improvement of water environment into the National Tenth Five-Year Plan and the Planning Goal By 2010 and started to carry out them thoroughly.

b) Having the thinking awareness and material base of sustainable development

The achievements gained in the field of sustainable development in China within ten years have laid a foundation for the further implementation of sustainable development. On the one hand, the masses' awareness on the sustainable development, water disasters and ecological environment protection is increasingly heightening and the consciousness of the public concerns and participation of the sustainable utilization of water resources also is continuously enhancing. On the other hand,

China has preliminarily set up the engineering systems of flood control for seven major rivers, the municipal water supply system and the general patterns of farmland irrigation throughout the country. Meanwhile it has solved a lot of drinking water difficulties in the poor areas and completed a number of primary electrification counties of rural hydropower. Therefore, the infrastructure facilities of the development, utilization, harnessing and protection of water resources has been continuously perfected. The poor crowds have gradually reduced. The material base of sustainable development has been strongly rammed.

c) The increase of comprehensive national strength provides the conditions for the sustainable utilization of water resources

With the increase of economic development, social progress, comprehensive national strength and social wealth in China, the governments at all levels have continuously strengthened the construction capacity of the sustainable utilization of water resources, extended the financial raising canals and increased continuously the input of the construction of the public-welfare infrastructure facilities such as flood control and water supply projects. All these have provided favorable conditions for quickening the development of water resources and promoting the sustainable utilization of water resources. Especially in recent four years, the Country has carried out the active fiscal policy and issued fiscal bonds to construct infrastructure facilities so that the investment for the construction of water resources works has been greatly increased, which fully reveals the Chinese actual strength after the enhancement of its comprehensive national strength and the socialist superiority that can concentrate forces to do big business.

d) The market economy and the policy of opening to the outside have provided a broad space for the sustainable utilization and development of water resources

According to the requirements of market economy system and economic and social development, we will deepen the reform of water resources development and promote continuously the establishment, perfect and development of water right system and water market. We will carry out the development, utilization, protection and management of water resources in accordance with the requirements of market economy. We will strengthen the policy of opening to the outside and actively introduce foreign capital and use the experience of other countries for reference in the field of the sustainable utilization of water resources. All these have provided a broad space for the sustainable utilization and development of water resources.

e) Scientific and technical progress have provided a strong support for the sustainable utilization of water resources

The development of modern sciences and technology and information processing of water resources and the rapid progress of new materials, new technologies and new

methods will promote the transformation of traditional water resources development into the modern water resources development and the sustainable development of water resources, in order to accelerate the realization of the sustainable utilization of water resources.

f) The strategy of Great Western Development has provided new opportunities for the construction of water resources works

The strategy of Great Western Development carried out by the Chinese Government focuses on the ecological rehabilitation and the construction of infrastructure facilities related to water resources, communications and energy. The drought and water shortage is the basic cause of the weak ecological environment, poor conditions of production, living and existence in the western region, so that the construction of infrastructure facilities and the ecological rehabilitation all need the support of water resources. The Chinese Government has called for that a breakthrough progress should be made in the Great Western Development within five to ten years, which provides a new development opportunity and requirement for the construction of water resources works and the sustainable utilization of water resources in the western region.

3.2.2 Challenges

a) Four major water problems are still serious

China is one of the countries that have the most serious problem of flood and drought disasters and soil erosion in the world. With the development of economy, the problem of water pollution is increasingly prominent. Although the great development has been gained in the construction of water resources works in China since the founding of new China for more than 50 years, especially in 10 recent years, the construction of infrastructure facilities of water resources in China at present is still weak due to arduous and heavy construction tasks. With the development of economy and society and the increase of social wealth, the requirement for the construction of water resources works is increasingly raised. The four major water problems of flood disaster, water resources shortage, water pollution and soil erosion in China are still serious, which becomes key restriction factors affecting the sustainable development of economy and society in China.

b) The relationship between water resources and economic and social development is inharmonious

The construction of existing water infrastructure facilities such as water supply and flood control could not meet the needs of economic and social development on water resources. The situation of the irrational development and utilization of water resources are still relatively serious. In some regions, the many dikes were built to reclaim land from rivers and lakes for the development and construction, which

occupies a lot of rooms for discharging and storing floodwater, or the water shortage coexists with the waste of water use and the water pollution. In some river basins, the development of water resources is unbalance, causing zero flow in the downstream channel or the local groundwater drop and bringing a series of social and ecological environment problems. Such inharmonious relationships between the construction of water resources works and the development of economy and society and between the economic development and water have to be settled urgently.

c) The water projects is poor in its auxiliary facilities, with serious aging and short of repair

Most of water resources projects in China were built in 1950s and 1960s. Because of historical causes, many projects is low in design standards, short of auxiliary facilities, extensive in management, backward in management methods, lack in good operation mechanism, serious aging and short of repair, and regressive in benefits. Some projects have reached up to its service life, being confronted with abandonment or rehabilitation. Some projects need urgently reinforcement and rehabilitation. Therefore the task of the reconstruction and rehabilitation of water resources projects in China is very arduous.

d) Water management system and operation mechanism are imperfect

The imperfect water management system and operation mechanism and the multi-department and multi-tier water management system among surface water and groundwater, water supply and use, and wastewater emission and treatment have not met the needs of the sustainable utilization of water resources and market economy. Especially the prices of water, electricity and water service have deviated from the law of value so that the water resources project is too deficient of management and maintenance expenditure to implement the rational allocation, high-efficiency use and effective protection of water resources. The problems in the water management system and operation mechanism have become a heavy obstacle to the sustainable utilization of water resources.

3.3 Follow-up Actions

According to the national situations, water regime and practice experience in China, we will take the following concrete measures in order to further carry out the strategy of sustainable development and realize the sustainable utilization of water resources.

3.3.1 Keeping on the promotion and implementation of the strategy of sustainable development of water resources

Firstly, according to the requirement of the sustainable development, we will conscientiously make population, resources and environment to be harmoniously developed. The economic and social development should fully take the bearing capacity of water resources into account. The determination of the pattern and scale of economic development should be in accordance with the conditions of water resources in order to avoid the development of water resources without control and order. We should develop and utilize water resources in a scientific, orderly and rational way, coordinate well the water use of living, production and ecology, and deal well with the relationships among water supply and use, water use and drainage, water volume and quality, water and nature.

Secondly, the traditional water resources development should be shifted into the modern and sustainable water resources development. While paying attention to the development, utilization and treatment of water resources, a great attention should be paid to the water allocation, conservation, and protection and the unified management of water resources in order to promote the sustainable utilization of water resources and to use the sustainable utilization of water resources to guarantee the sustainable development of economy and society.

Thirdly, the way of the development and utilization of water resources, including the increment and consumption ways of water use volume and the water resources management modes, all should be changed from extensive type into intensive type. We cannot only depend on the project quantities but should rely on the quality of water project and the rational allocation, high-efficiency use, effective protection and scientific management of water resources to increase the efficiency and benefits of the development and utilization of water resources and to realize the sustainable utilization of water resources.

Fourthly, we will take emphasis on the construction of three major security systems of the sustainable utilization of water resources to meet the water needs of the masses of the people in five aspects. The three major security systems are as follows: 1) the harmonious coexistence of the people and flood to set up a perfect security system of flood control and disaster alleviation; 2) simultaneous development of increasing water sources, saving water use and protecting water resources to set up a security system of reliable water resources supply and high-efficiency use; 3) coordinating the water use of living, production and ecology to set up a water resources security system of keeping the safety of ecological environment. The five aspects of water need are as follows: the safety need of drinking water, the safety need of flood control, the safety of foods, the need of economic development and the need of ecological environment.

Fifthly, we will reform the water resources management system to provide power and guarantee for the sustainable utilization of water resources. The unified management of water resources will be carried out to shift the water supply management to the

simultaneous implementation of water demand, supply and use management. We also will strengthen the drainage management and set up new river basin water resources management system. We will deepen the system reform of water project administrative organization to realize the good operation of water project management and make full use of the functions and benefits of existing water resources projects. We will study and practice the water right theory and carry out the reform of water and electricity prices according to the requirement of market economy in order to set up a rational mechanism of water price determination. We will carry out the paid use of water resources and use the economic lever to promote the sustainable utilization of water resources.

3.3.2 Conserving and protect water resources to realize the sustainable utilization of water resources

We will exercise the planned water allocation and the water conservation and set up two sets of indexes of macro and micro, and total amount control and quota management to allocate rationally water resources and strive for establishing a water-saving society. We will insist on seizing the water-saving irrigation as a revolutionary measure to stop basically the increase of the gross water amount of agricultural irrigation and to develop agricultural production by relying on water conservation and efficiency increase. According to the conditions of water resources and the inflow amount in different years, the control on the gross amount of water use shall be carried out in accordance with the rural administrative division. The technical transformation of water conservation and the construction of auxiliary facilities in the irrigation districts should be accelerated by taking the large-scale irrigation district as the key objective while persisting in the principles of effective implementation according to the local conditions and with emphasis on practice.

The water conservation of industry will pay great attention to those units and trades with big water consumption amount. In combination with the needs of water environment improvement and the structural adjustment of industries and products, we will adopt various measures for water conservation to improve the production techniques, conduct the technical transformation of water conservation, popularize the clear production and water-saving equipment, raise the reuse rate of industrial water and formulate the industrial water use quota and water conservation standards in order to control gradually the increase of water demands and enhance the utilization coefficient of water resources.

The focus of the water conservation in domestic water use is in the city. We will widely spread the propaganda and education of water conservation to raise the water-saving awareness of the public. We will strengthen the management, construction and development of water conservation and spread water-saving facilities and tools. We will strengthen the quota control of domestic water use and deepen the reform of the management system of water resources to set up the rational water resources management system and water price determination mechanism in order to

use the water price mechanism and economic lever to promote the water conservation.

We will strengthen the protection of the sources of rivers and the water supply sources and enlarge the control and treatment of wastewater and sanitary sewage. We will rationally utilize the groundwater resources, strictly control the overdraft of groundwater and actively develop the new water sources such as artificial rainfall, wastewater reuse after the treatment and the desalination of seawater in order to raise the bearing capacity of water resources.

3.3.3 Strengthening the construction of the public-welfare water infrastructure facilities such as flood control and water supply projects in a overall arrangement way

We will strengthen the comprehensive harnessing of seven major rivers of the Yangtze River, Yellow River, Pearl River, Songhua River, Liaohe River, Haihe River and Huaihe River. We will effectively control floodwater to guarantee the safety of flood control according to the engineering system of the flood control in the construction of river basin. We will rationally develop and utilize the water and hydropower resources, strengthen the work of soil and water conservation and ecological environment rehabilitation in the upstream area of the river basin, and give full play to the comprehensive benefits of water projects such as water supply, power generation, irrigation, navigation, ecology and tourism works, in order to promote the sustainable development and rehabilitation of economy, society and ecologic system in the river basin. Through the construction of the South-north Inter-basin Water Diversion Project (east-line, middle-line and west-line projects), the rational allocation of water resources in four river basins of the Yangtze River, Huaihe River, Yellow River and Haihe River could be realized to form the mutual supplement of the water resources in the southern and northern regions and in the eastern and western regions in order to alleviate the serious water shortage in the western and northern regions.

Box 31 South-North Inter-basin Water Diversion Project

The South-North Inter-basin Water Diversion Project is a strategic project to solve the water shortage problem in the North China, including the east-, middle- and west-line projects. It is planned to divert water from the lower-, middle- and upper-reach of the Yangtze River to the Huang-Huai-Hai Plain, the Shandong Peninsula and the Middle- and Upper-reach of the Yellow River, especially the water shortage areas in Beijing, Tianjin and North China, with the total water diversion amount of about 45 billion cubic meters. The east-line project is to pump water near Yangzhou City, located in the main stream of the Lower Yangtze River, then to use the existing channel and the tunnel in Weishan County through the Yellow River towards the north region and to Tianjin City by gravity flowing, with the total length of water conveyance trunk of 1156 km. Meanwhile, a West-East Water Diversion Project will be built to divert water from the Dongping Lake in the south of the Yellow River to Jiaodong Region, with the total length of the water conveyance channel of 700 km. The east-line project will pump water from the Yangtze River, with the discharge of 500 m³/s and the diversion

volume of 9.0 billion m³ in the near future.

The middle-line project is to divert water from the Danjiangkou Reservoir in the Hanjiang River, the branch of the middle reach of the Yangtze River, to enter Beijing City by the way of gravity flow, using the canal excavated along the western edge of the Huang-Huai-Hai Plain and through Henan and Hebei Provinces, with the total length of trunk canal of 1267 km. The Tianjin Trunk Canal diverts water in Xushui County in Hebei Province to Tianjin City, with the total length of 154 km and the diversion water volume of 9.5 billion cubic meters in the near future.

The west-line project is to build dams and reservoirs in the three branches, the Dadu River, Yalong River and Tongtian River in the upper reach of the Yangtze River, and then to use the tunnel passing through the Bayankala Mountain to convey water into the Yellow River for supplementing its insufficiency. The first-stage west-line project will divert water with the volume of 4.0 billion cubic meters, with the total length of water conveyance channel of 260 km.

The problems concerning mountains, rivers, farmlands, forests and roads should be tackled in an overall plan and in a comprehensive way. We should carry out the technical transformation of water conservation in irrigation district, the basic construction of farmland water conservancy works, the reclamation of soil, the protection of basic farmland, and the rehabilitation of the garden-style cultivation and ecological agriculture. We will combine with the construction of villages and towns and urbanization to perfect the infrastructure facilities of water and power supply, water drainage and wastewater control and to beautify the rural environment. We will raise the comprehensive utilization efficiency of soil and water resources, increase the production capacity of farmland and unit water resources and heighten the living quality of the farmers.

For the poor areas, we will carry out the development-oriented aid-the-poor program by water conservancy and develop the work of soil and water conservation, ecological rehabilitation, and farmland cultivation suspension for planting forests (grasses) in order to protect and conserve soil and water. We will strive for the construction of basic farmland to make the people in the poor mountainous regions have the cultivated land area of 0.03 ha per capita. We also will develop the rural small hydropower, construct the hydropower electrification county and change the energy consumption ways in order to protect ecological environment and to improve the production and living conditions. All these have provide favorable conditions for the economic development and poverty alleviation in the mountainous areas.

3.3.4 Stressing on the key points and developing the work of soil and water conservation, ecological rehabilitation and environment protection

The work of soil and water conservation and ecological rehabilitation will focus on the these regions, that is, the middle and upper reach of the Yangtze River, the middle

reach of the Yellow River, the crisscrosses of farmland and pastoral field in the inland river area, and the source area of wind and sand. The engineering and biological measures and the scientific management should be adopted. We will carry out the artificial afforestation, farmland cultivation suspension for planting forests (grasses), closing the hillside for afforestation and the development of small hydropower to implement “the replacement of firewood by electricity” program. We will pay great attention to the ecological rehabilitation around the big city, especially the Ecological Circle around Beijing and Tianjin Cities. The municipal water system of rivers and lakes should be treated in a comprehensive way to do well the water environment rehabilitation and to beautify the resident environment in towns and cities. We will strengthen the construction of water source conservation forests in the origins of rivers. We will continue to develop the work of water resources protection and water pollution control, with the emphasis on the river basins of the Huaihe River, Liaohe River, Haihe River, Dian Lake, Taihu Lake, Chaohu Lake, the middle and lower reaches of the Yellow River, Tarim River and Heihe River. We will strengthen the protection of the origins of water supply, especially the water origins for the urban water supply, in order to raise the quality of water supply. We will strengthen the monitoring work of water pollution, superintend the emission of wastewater after the treatment, and strictly practice the control of the gross emission volume of wastewater and pollutant to reduce the pollutant sources. We will enlarge the treatment of wastewater and sanitary sewage and spread the neutral-water pipeline in possible areas to increase gradually the reuse rate of wastewater after the treatment. In those areas with the overdraft of groundwater, we will carry out the mandatory measures to manage and control the mining amount of groundwater and create conditions for recharging gradually the groundwater.

We will further strengthen the control and harnessing of the rivers, lakes and environment in the cities, arrange reasonably the municipal environment water use and beautify the resident environment.

3.3.5 Establishing a stable input mechanism to guarantee the implementation of the sustainable development strategy

We will reasonably divide the duties and responsibilities among the government, market and beneficiary and then make clear the major investment body of various projects according to the principle of the unity of responsibility, right and benefit. For this reason, we will formulate the corresponding policies and adopt diversified measures in order to absorb widely the social funds, to widen the financial raising channel and to set up and perfect the multi-source, multi-channel and multi-tier investment mechanism, so that it can guarantee the smooth implementation of the sustainable development strategy. Those programs that take the social benefits as main and have big strong public-welfare, important impact on the whole national economy and ability to ensure the sustainable development, are mainly invested and constructed by the government fiscal budgetary funds at different levels. The non-public-welfare programs will be undertaken by the beneficiary, in accordance

with the principles of “the person who benefits from the project will invest it”. Such programs can adopt many ways to raise the construction funds and can be operated in accordance with the laws and mechanisms of market economy. The governments at various levels should continue to increase steadily the financial input to enlarge the investment of those public-welfare or semi-public-welfare infrastructure facilities such as flood control, irrigation, soil and water conservation, rural hydropower electrification county establishment. Meanwhile, the functions of market mechanism should be brought into full play. For those programs that have outstanding economic benefits, the government can input the capital in cash, authorize a special permit operation rights, relax the restriction conditions of the social funds participating in the construction of infrastructure facilities, increase the loans at home, strive for the foreign preferential loans, make full use of the capital market to raise funds and encourage the foreign tradesmen, personalities of all circles, enterprises, institutions, and individuals to take part in the investment and operation of the infrastructure facilities of water resources.

3.3.6 Relying on the progress of sciences and technologies to provide the technical support for the implementation of sustainable development strategy

We will strengthen the development and training of talent and rely on the scientific and technical innovations to strengthen the theoretical study on the sustainable development and utilization of water resources and the study on the index system of sustainable development. The studies on the key technologies for the important fields, key regions and the major water resources projects should be made in a special subject manner and can be tackled jointly by the trans-department and inter-discipline. The above-mentioned key fields are mainly as follows: flood control, drought prevention, disaster reduction, water saving, soil and water conservation, ecological environment water demand, environment management, policy system. The key regions are the arid and semi-arid areas in the northwest of China. The major important project is the South-North Inter-basin Water Diversion Project. We also will actively explore the new theories, new methods and new technologies and spread and apply new techniques and new materials. Meanwhile we will make full use of the scientific research results from various departments and absorb widely the existing advanced technologies and management experience at home and abroad. We will formulate the technical and economic standards and specifications and codes on the allocation of water resources, the water shortage, the water saving and the water waste to set up the index system of the sustainable utilization of water resources. We will make full use of the computer network and information technology to enhance the level of water resources prediction and forecasting, water demand prediction, optimal water allocation, and management and policy decision, in order to promote the high-efficiency utilization and effective protection of water resources and to raise the general level of sustainable utilization of water resources.

3.3.7 Strengthening the construction of the sustainable development capacity and security system

We will strengthen the build of legal system on the sustainable utilization of water resources, revise and perfect the laws and regulations concerning water and increase the law enforcement strength in order to realize the water control and management according to the laws. We will study and formulate the technical and economic policies, price and investment policies on the sustainable utilization of water resources and the construction and development of water conservancy works.

We will deepen the reform of the system of the administrative organizations of water resources and water projects, build the communication, commander and dispatching system for flood control and the real-time supervisory system of water resources, and set up the supervision troop for the enforcement of water administration and soil and water conservation, in order to enhance the management level and tools and to strengthen the unified management of water resources. We will classify the types of administrative units according to the functions of the project to give full play to the action of government's macro-control and market economic mechanism. Meanwhile we will determine the policies on classification management and make clear the sources of management, operation and maintenance expenditure in order to guarantee the good operation of engineering management organizations, to enhance the management level and to give full play to the actions and benefits of water projects.

We will strengthen the basic education and staff training and strive for fostering a lot of the qualified personnel of water scientific research and the construction and management of water conservancy works, which provides a sound talent security for the sustainable utilization of water resources and the construction of water conservancy works.

3.3.8 Strengthening the international cooperation and exchanges and mobilizing the public participation in the sustainable utilization of water resources

We will strengthen the international cooperation and exchanges on the fields of flood control, disaster alleviation and the sustainable utilization of water resources and widen the international cooperation field. We will also actively introduce the foreign capital, rationally use and absorb the advanced foreign technologies of water resources and hydropower and management experience. We will spread the engineering technologies and non-engineering measures and experience of increasing water-saving strength, reducing flood and water logging disasters, and alleviating the unfavorable impacts on the ecology and environment, in order to enhance the integral research level of water sciences. We will strengthen the project management invested by foreign capital and increase the use benefit of foreign capital. We will also

strengthen the international academic exchanges and personnel training to promote the progress of the water modernization.

We will further strengthen the propaganda and education and popularize the sustainable development theory and the goals and tasks of national sustainable development, in order to make the common awareness of the government, society, enterprises and institutions, and the masses of the people, to raise the integral awareness of the coordinative development of the population, resources, environment, economy and society, to increase the public awareness of water disasters, water conservation and protection, and to enhance the sense of responsibility and the consciousness of treasuring and protecting water resources. We will strengthen the propaganda and education of water-saving knowledge and popularize the new water-saving technologies and equipments to mobilize the masses of the people to participate consciously in the activities of the sustainable utilization of water resources. We will set up and perfect a mechanism of the public participation in various water affairs and the sustainable utilization of water resources, strengthen the democratic management and consultation and encourage the whole society to take part in the management and protection of water resources, in order to produce a good atmosphere of cherishing and treasuring water resources in the whole society.