SFG3864 REV

Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project

Environmental Impact Assessment Report

Management agency: Zhejiang Province Municipal Engineering & Environmental Protection Project Leading Group Office

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Contents

1. General

1.1 Background

Located on the south wing of the Yangtze River Delta on the southeast coast of China facing the East China Sea to the east, Zhejiang Province borders on Fujian to its south, Jiangxi and Anhui to its west and Shanghai and Jiangsu to its north. Spanning a straight-line distance of around 450km east to west and also south to north, Zhejiang Province has a land area of 101,800 km^2, accounting for 1.06% of the land area of the nation as a whole and being the smallest province of China in terms of land area. By the end of Year 2011, Zhejiang Province had achieved an urbanization rate of 62.3%, greater than the national average of 51.27% by approximately 11 per cents.

Zhejiang Province is topographically complicated, with 70.4% of its land area being mountains and low hills, 23.2% plains and basins and 6.4% rivers and lakes while the arable land only amounts to 2,081,700 h.a, giving birth to the saying of “70% mountains, 10% water and 20% farmland”. With a terrain inclining from southwest towards northeast, Zhejiang Province roughly comprises of six terrain zones, namely, the plains in northern Zhejiang, low hills in eastern and western Zhejiang, and Jinqu Basin in the middle, the mountainous areas in southern Zhejiang, the plains on the southeastern coast and the coastal islands. There are eight water systems in the Province, namely, Qiantang River, Ou River, Ling River, Tiaoxi Stream, Yong River, Feiyun River, Ao River and Beijing-Hangzhou Great Canal (Zhejiang Section).

Over the past decades, greater social and environmental challenges have been brought about by the fast growth of Chinese economy, in particular in terms of the increased water consumption and pollutant discharge as well as ecological degradation. The PRC government has included water resource management, environmental protection and ecological protection into its important political agenda and developed specific objectives in its 13th Five-year Plan (2016-2020) in order to reduce soil erosion, effectively treat urban wastewater, reduce agricultural pollution and improve river management and enhance water resource security.

As the largest fresh water lake in Zhejiang Province, Qiandao Lake faces increasing environmental pressure caused by fast economic growth, urbanization, intensive agricultural production and improving living environment and tourism development. Having become aware of the risks in the face of Qiandao Lake, the National Development and Reform Commission (NDRC), in cooperation with multiple government departments, conducted a comprehensive study and developed a blueprint for sustainable development of the region.

In such a context, Zhejiang Provincial Government (ZPG) initiated a request for support from the World Bank and the Zhejiang Qiandao Lake and Xin’an River Basin Water Resources and Ecological Environment Protection Project emerged as time requires. The Project proposes to utilize an IBRD loan in

integrated management of the entire basin in Chun'an County and Jiande City of Zhejiang Province to reduce pollution and improve forest ecological environment in Qiandao Lake Basin and serve as a demonstration for extended application of the experiences of effective integrated river basin management in the other basins so as to promote the effectiveness and sustainability of river management and ecological environment protection.

Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project proposes to utilize an IBRD loan in an amount of US$150 million and a counterpart fund of US$150 million in protection of water resources and ecological environment of Qiandao Lake and Xin'an River Basin. The Project selects 5 small watersheds in Chun'an County and Datong Town, Shouchang Town and Hangtou Town of Jiande City for control of the agricultural NPS pollution and ecological restoration of forestry, revetment reinforcement and river rehabilitation, and rural drinking water safety promotion. See Table 1.1-1 for specific details.

Table 1.1-1 Project Overview

Subproject	Construction works
Chun'an County Small Watershed Integrated Improvement	1. Wuqiangxi Stream: dike (revetment) construction in a full length of 13.10km, including 2.67km for the main channel and 10.43km for totally 4 sections on the tributaries; construction of 5 new cofferdams and rehabilitation of 3 existing cofferdams; 2. Yuchuanxi Stream: dike (revetment) construction in a full length of 29.96km, including 13.75km for the main channel and 16.20km for totally 10 sections on the tributaries; construction of 5 new cofferdams and rehabilitation of 19 existing cofferdams; 3. Liuduyuan River: dike foundation reinforcement for a length of 2.90km; construction of 9.11km long revetment and 2 new ecological cofferdams; rehabilitation of 7 existing cofferdams for the main channel; construction of 4.08km long revetment, construction of 5 new ecological cofferdams; rehabilitation of 3 existing cofferdams and ecological treatment of bottomland at 1 site for the tributaries. 4. Shangwuxi Stream: dike reinforcement for a length of 3.89km; river rehabilitation for a length of 3km, including 3km for rural river dredging and 0.755km for dike reconstruction; 5. Zitongyuan River: dike reinforcement for a length of 3.15km; river rehabilitation for a length of 2km, including 2km for rural river dredging and 0.80km for dike reconstruction;
Chun'an County Rural Drinking Water Safety Improvement	The service area of the Subproject covers 189 administrative villages belonging to 17 towns and townships, such as Fengshuling Town, Dashu Town, Lishang Township, Weiping Town, Wangfu Township, Zhongzhou Town, Zitong Town, Jijiang Town and Pingmen Township of Chun'an County. With a total water supply capacity of 38,400m^3/day, the Subproject includes 8 centralized water supply projects for the newly established Kuacun Town (with a unit water supply capacity of 600 to 5000m^3/d and a total capacity of 19,100m^3/d) and 8 pipeline extension and water supply projects of existing WTPs (with a supply capacity of 651 to 7745m^3/d and a total capacity of 19,300m^3/d). The total length of the water transmission and distribution pipelines amounts to 1680km.

Chun'an County Dike Reinforcement and River Rehabilitation	The construction sites of this Subproject are distributed on 22 rivers in Chun'an County except the five demonstrative river watersheds and involve 16 towns and townships. Construction works include dike construction with a length of 28.71km, dike reinforcement with a length of 38.15km and river rehabilitation with a length of 98.5km.
Chun'an County Agriculture NPS Pollution Control	**1. Environment-friendly plantation demonstration** Chemical fertilizer reduction for pollution control: Extensive application of formulated fertilizers: Formulated fertilizers are extensively applied for tea, fruit trees and mulberry in the whole county at a rate of 10,000 mu per year, 50kg per mu and totally 500 tons for Year 2018 and 80,000 mu per year, 50kg per mu and totally 4,000 tons per year thereafter; amounting to totally 20,500 tons of formulated fertilizers in 5 years; Extensive application of organic fertilizers (commercial organic fertilizers): Organic fertilizers are extensively applied for tea, grain and oil crop and vegetables, mulberry and fruit trees at a rate of 20,000 tons per year, amounting to totally 120,000 tons for 6 years. Distribution of liquid fertilizer: Liquid fertilizer will be distributed at a rate of 25,000 tons or more per year, amounting to totally 150,000 tons for 6 years. Ecological interception of nitrogen and phosphate loss in tea gardens: 1 tea garden will be selected as the pilot tea garden and further extension will be conducted in the tea gardens in the whole province if proven feasible. **Pesticide reduction and hazard control:** Integrated pest management (IPM): IPM will be implemented for crops such as tea, grain and oil crops, vegetables, mulberry and fruit trees at a scope of 100,000 mu per year and totally 600,000 mu for 6 years. Soil erosion prevention and control: Soil erosion prevention and control works (i.e. grass cultivation technology) will be promoted in an extensive way in fruit gardens and tea gardens in the whole county at a rate of 50,000 mu per year and totally 300,000mu for 6 years. **Harmless treatment of pesticide packaging materials:** Waste pesticide packaging materials will be recovered in the whole county with an assured recovery rate of greater than 90% and the recovered packaging materials will be substantially subject to harmless treatment. **2. Demonstrative Agriculture and Animal Husbandry Project for Disposal of Livestock and Poultry Wastes** 3 scaled livestock and poultry breeding farms will be rehabilitated and liquid storage tanks will be constructed in the digestion tanks and sprinkling irrigation facilities will be installed in the base.
Chun'an County Forest Eco-system Restoration	Chun'an County Forest Ecosystem Rehabilitation involves 20 towns and townships and 187 villages, 16 state-owned forest farms and 61 forest areas. The forest eco-system restoration involves a total area of 167,030mu, including 138,219mu for ecological restoration of coniferous forest and 28811 mu for ecological restoration of eulalia.
Jiande City Water Conservancy Facility Rehabilitation	Rehabilitation of 70.08km long ecological revetment; construction and rehabilitation of 36 ecological cofferdams with a length of 816m; river dredging with a length of 35.0km and construction of Shouchang River Basin monitoring system, etc.
Jiande City Landscaping Afforestation and Forest Form	Totally involving 3 towns/townships, 13 villages, 2 state-owned forest farms; landscaping afforestation and forest form improvement with a total area of 23935mu, including 5116mu for landscaping afforestation and 18819mu for forest form improvement.

Improvement	
Jiande City Municipal Engineering	Located in 4 towns/townships (communities), namely, Datong Town, Hangtou Town, Xin'anjiang Community and Yangxi Community in Jiande City and including forest fire emergency access road construction, bridge rehabilitation and ecological wetland construction. 1. Forest fire emergency access road and mountain-climbing path Forest fire emergency access road: extending from Zhengfa Road of Xin'anjiang Community to Fangcun Village of Gaoling Natural Village in Yangxi Community and then to Shibahu and finally ending at Tongguan Forest Zone, this emergency access road has a full length of 11.81km and a designed subgrade width of 4.5m and a design speed of 20km/h and mainly involves rehabilitation and improvement of existing forest road. Mountain-climbing path: This mountain-climbing path to be constructed extends along the mountain ridge for a total length of approximately 9km around Bailingkeng Reservoir in Hangtou Town. With a designed subgrade width of 2.5m, the road will be constructed in three sections with a length of 5.331km, 2.756km and 0.852km respectively. 2. Bridge reconstruction Reconstruction of 12 old bridges with a length of 16m to 36m using simple hollow slabs and a designed bridge width of 4.5m. 3. Ecological wetland construction Hangtou composite ecological wetland works includes the improvement and rehabilitation of the natural wetland in the existing river flood plains with a total area of 16247.2m2. As the deep purification place for farmland backwater, the wetland will intercept and treat farmland backwater from the farmland around Nanba Village with a total area of approximately 265mu. 4. Shouchang WWTP Phase I expansion With an expansion capacity of 5000 m^3/d and using A2/O wastewater treatment process.
Jiande City Agricultural NPS Pollution Control	Including 34 villages of Datong Town, 18 villages of Hangtou Town and 23 villages of Shouchang Town. 1. Construction components and scope of agricultural NPS pollution control for crop farming: (1) Extensive application of organic fertilizers and soil-based formulated fertilizer: continuous extension of organic fertilizers and formulated fertilizers for 6 years in 3 towns in the project area with a volume of 21300 tons for organic fertilizer and 10800 tons for formulated fertilizers. (2) Green pest management: Solar vibration frequency insecticidal lamps and sticky boards will be applied extensively for food crops, fruit orchards and tea gardens in the project area. The solar vibration frequency insecticidal lamps involve an area of 18911 mu and a total number of 949 lamps; the sticky boards involve an area of 2730mu (including 1630mu of fruit orchards and 1100mu of tea garden) and a total number of 218,400 pieces per year and 1,310,400 pieces totally for continuous extension of 6 years. 2. NPS pollution control for livestock and poultry breeding (1) Feces treatment infrastructure improvement The feces treatment infrastructure improvement works involves 15 livestock and poultry breeding farms (14 egg chicken farms and 1 sheep farm) and includes the expansion of sedimentation tanks with a total area of 3660m^2, rehabilitation of pollutant discharge pipes with a length of 1400m, construction of the feces cleaning channel canopy with an area of 1500m^2, stormwater ditches with a length of 1000m, feces storage shed with an area

	of 840m^2; purchase of 2 conveyor belt feces cleaning equipment, 4 feces collection trucks and 8 sewage (Feces and wastewater) tank trucks. (1) Reconstruction and expansion of pig house fermentation bed and ancillary facilities The pig house fermentation bed and ancillary facilities reconstruction and expansion works will support 4 large-scale pig farms and includes the construction of spraying and regulating tanks with a total area of 220m^2, construction of pig house ectopic fermentation beds (tanks) with a total area of 4300m^2, purchase of 2 field transfer forklifts, 3 composting heap turners, 1 high-pressure water jet, 4 mixing pumps, 3 spraying machines, 4 wastewater (mud) cutting pumps, 3 sewage (fertilizer water) tank trucks, 3 organic fertilizer trucks and 4 automatic packing machines. 3. Ecological ditch construction Construction of ecological ditches with a total length of 56207m, including 5823m planned for Shouchang Town, 44999m planned for Datong Town and 5385m planned for Hangtou Town. According to the classification of irrigation and drainage functions, such ecological ditches comprise of irrigation ditches with a total length of 27384m and involving the typical cross section types of 0.4×0.4m, 0.5×0.5m and 0.6×0.6m and drainage ditches with a total length of 28823m and involving the typical cross section types of 0.8×0.8m, 0.8×1.0m, 1.0×1.0m, 1.2×1.2m, 1.5×1.5m, 2.0×1.5m and (4.0+2.4)×2.0m.

Figure 1.1-1 Geographical Location of Zhejiang Province in China

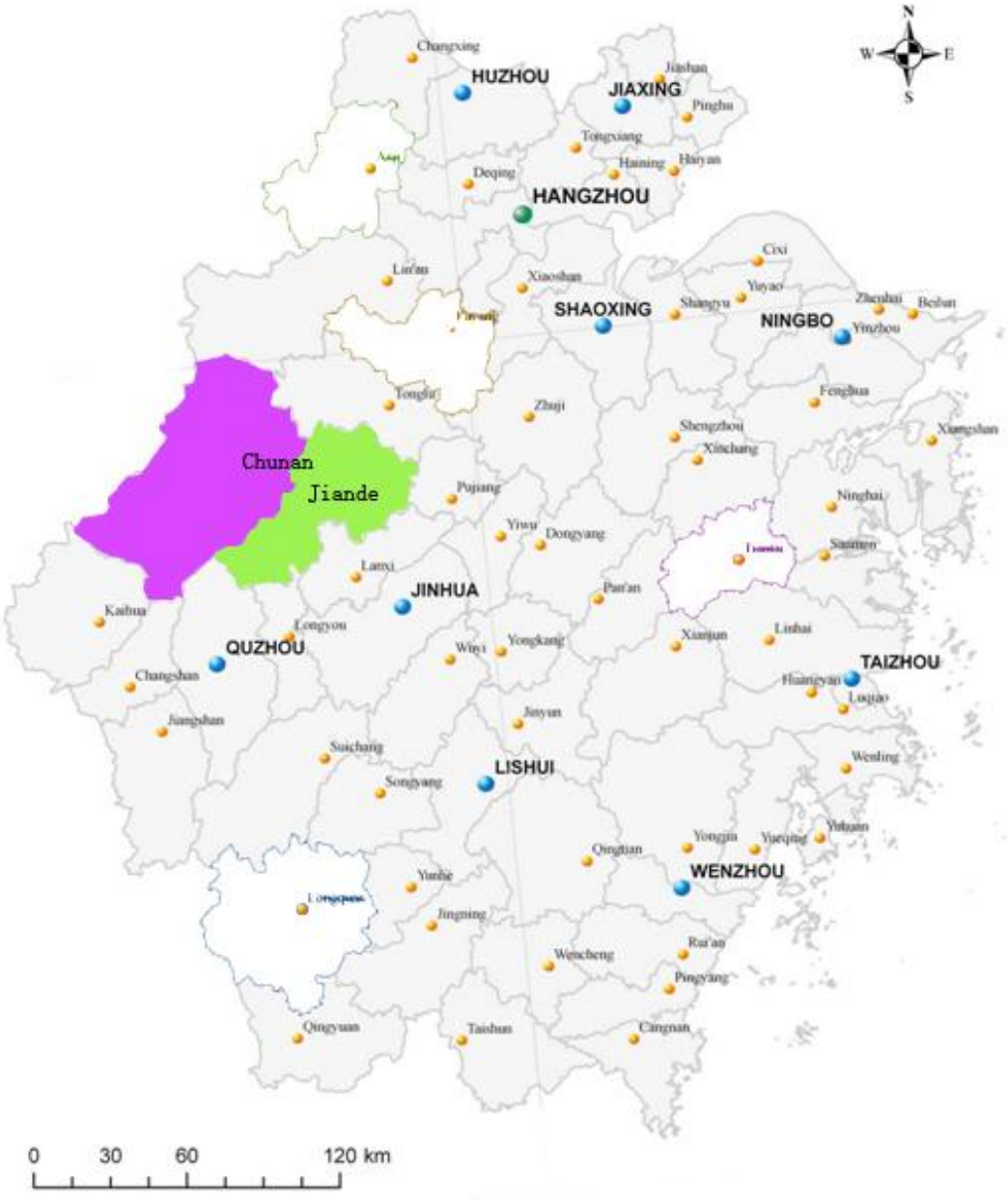


Figure 1.1-2 Geographical Locations of the 2 Project Counties/Cities in Zhejiang Province

1.2 Rationale

This report is prepared based on the requirements of the Law of the People's Republic of China on Environmental Impact Assessment, the Management Regulations on Environment Protection of Construction Projects, and the Notice on Strengthening Management of Environmental Impact Assessment of Construction Projects Utilizing Loans from International Financial Institutions as well as WB Safeguard Policies. The EIA process is carried out not only in accordance with relevant laws and regulations, policies and

standards of China, but also the relevant policies of the World Bank.

1.2.1 PRC National Laws and Regulations and Sector Regulations on Environmental Protection

(1) Environmental Protection Law of the People's Republic of China (amended in Year 2014);
(2) Law of the People's Republic of China on Environmental Impact Assessment (amended in Year 2016);
(3) Law of the People's Republic of China on Prevention and Control of Air Pollution (amended in Year 2015);
(4) Law of the People's Republic of China on Prevention and Control of Water Pollution (amended in Year 2008);
(5) Law of the People's Republic of China on Prevention and Control of Noise Pollution (amended in Year 1997);
(6) Law of the People's Republic of China on Prevention and Control of Environmental Pollution of Solid Wastes (amended in Year 2016);
(7) Water and Soil Conservation Law of the People's Republic of China (amended in Year 2011);
(8) Flood Control Law of the People's Republic of China (amended in Year 2015);
(9) Law of the People's Republic of China on Wildlife Protection (August 2004);
(10) Regulations of the People's Republic of China on Protection of Wild Plants (September 1996);
(11) Regulations on Protection of Basic Farmland, State Council Decree No. 257 (December 1998);
(12) Methods for Public Participation in Environmental Protection (MoEP Decree No. (2015)35);
(13) Regulations of Zhejiang Province on Prevention and Control of Air Pollution (Amendment in 2016);
(14) Regulations of Zhejiang Province on Prevention and Control of Environmental Pollution of Solid Wastes, (2006);
(15) Regulations of Zhejiang Province on Prevention and Control of Water Pollution, (2008);
(16) Methods for Management of Key Ecological Public Forests in Zhejiang Province (Trial) (2005);
(17) Regulations on Pest Management for Agricultural Crops in Zhejiang Province (2010);
(18) Notice on Strengthening Management of Environmental Impact Assessment of Construction Projects Utilizing Loans from International Financial Institutions (Huanjian Circular No. [1993]324);
(19) Notice by the National Development and Reform Commission on Further Strengthening Management of Projects Utilizing Loans from International Financial Institutions (NDRC Foreign Investment Circular No. [2008]1269);
(20) Management Catalogue of EIA Categories of Construction Projects

(Sept. 1, 2017);

1.2.2 Technical guidelines and specifications of EIA

(1) Technical Guidelines on Environmental Impact Assessment – General (HJ2.1-2016)
(2) Technical Guidelines on Environmental Impact Assessment - Sound Environment (HJ2.4-2009)
(3) Technical Guidelines on Environmental Impact Assessment - Atmospheric Environment (HJ2.2-2008)
(4) Technical Guidelines on Environmental Impact Assessment - Surface Water Environment (HJ / T2.3-93)
(5) Technical Guidelines on Environmental Impact Assessment – Ground Water Environment (HJ610-2016);
(6) Technical Guidelines on Environmental Impact Assessment - Ecological Impact (HJ19-2011)
(7) Technical Guidelines on Environmental Risk Assessment for Construction Projects (HJ/T169-2004);
(8) Technical specifications on determining the suitable areas for environmental noise of urban area (GB/T15190-94);
(9) Technical methods for developing local air pollutant emission standards (GB/T13201-91), 1991;
(10) Technical Specifications For Regionalizing Environmental Noise Function (GB15190-2014);
(11) Technical Specifications on Water and soil conservation in Development and Construction Project (GB50433-2008)

1.2.3 Project documents

(1) Feasibility study reports for the Agricultural NPS Pollution Management Subproject, Municipal Engineering Subproject, Landscaping Afforestation and Forest Form Improvement Subproject and Water Conservancy Facility Improvement Subprojects of Jiande City, November 2017;
(2) Feasibility study reports for the Rural Drinking Water Safety Improvement Subproject, Forest Eco-system Restoration Subproject, Agricultural NPS Pollution Control Subproject and Small Watershed Integrated Management Subproject of Chun'an County in Zhejiang Province; November 2017;
(3) Comprehensive Feasibility Study Report of Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project prepared by the joint venture of Zhejiang Province Engineering Consultant Co., Ltd. and Lishi Environmental Technology Co., Ltd., November 2017.
(4) Social Assessment Report and Resettlement Action Plan of Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological

Environment Protection Project, Hohai University, November 2017.

1.2.4 WB Safeguard Policies and Guidelines

The correlation of the project and the WB's safeguards policy / procedure is analyzed. The results are shown in Table 1.2-1 below.

Table 1.2-1 Correlation Analysis of the Project and the WB Safeguard Policies

WB Safeguard policies	Triggered	Explanation (Optional)
Environmental Assessment OP/BP/GP 4.01	√ Yes	The project triggers OP 4.01 Environmental Assessment to ensure that it is environmental sound. By demonstrating the integrated landscape management approach in the watershed, the project is designed as environmental friendly investments in Chun'an County and Jiande City of Zhejiang Province and aims at the reduction of pollutants entering Qiandao Lake and Xin'an Riverand the improvement of local ecological environment. The proposed investments include small scale drinking water facilities in rural areas, river rehabilitation of the selected small tributaries (including dredging, embankment reinforcement and greening, weir construction and rehabilitation), forest restoration and rehabilitation, improvement of wastewater collection and treatment system for towns, non-point source pollution control through the improvements of agricultural practice and wastewater management, small-scale wetland construction around the lake/rivers, construction/rehabilitation of associated roads and bridges, and strengthening of local monitoring and evaluation system for water pollution sources and water quality. All theseactivities have been proposed to address the existing environmental problems in the basin based on the "Integrated Plan for Water Resources and Eco-Environmental Protection in the Basin of Qiandao Lake and its Upstream Xin'an River (2013-2020)" issued by the national government. The anticipated adverse impacts resulting from proposed project will be limited to: (a) small size construction impacts, (b) potential dredging in numbers of secondary or even smaller tributaries of Qiandao Lake/Xin'an River and (c) operation of constructed wetland. Considering the type, location, sensitivity, and scale of the proposed project activities mentioned above, and the nature and magnitude of their potential environmental impacts, these anticipated adverse impacts are not deemed significant or irreversible. Therefore, the project is assigned as a Category B project.

Table 1.2-1 Correlation Analysis of the Project and the WB Safeguard Policies

Natural Habitats OP/BP 4.04	√ Yes	Under the project, Bank-financed investments will support the ecological protection and conservation of selected rivers, wetlands and forests in the basin, the project activities will have potential negative and positive impacts to those areas, thus the policy is triggered. As per the requirements of OP4.04, the project must be developed in an environmentally sustainable way considering the protection of local species and biodiversity. The project design will therefore include an environmental analysis of any natural habitat issue, including identification of natural habitat sites, their ecological functions, potential project impacts on the sites and mitigation measures to avoid or minimize anticipated impacts when necessary.
Physical Cultural Resources OP 4.11	√ Yes	The RAP survey also found that the subproject of central green corridor will affect 13 rural households' graves, which might be viewed connecting to local tradition. All the compensation and relocation measures for those graves have been formally planned and developed in the RAP based on detailed survey and extensive consultation among the owners. For the 1400 years old year city inundated under the lake, which is an historical relic under the protection of the Zhejiang Province, the EA will include it in the assessment mainly for clarification purpose as the proposed project activities will not have any impacts on the relic site inundated under the lake according to the information available now.
Involuntary Resettlement OP/BP 4.12	√ Yes	The proposed a waste treatment plant in Chun'an County would require the acquisition of about 5 hectares of village land and some village land might be used temporarily by pipeline laying, which will be used for wastewater collection in rural areas in Jiande City. The Bank's Involuntary Resettlement Policy OP 4.12 is therefore triggered, and a resettlement action plan (RAP) will be prepared to identify the relevant issues and develop action plan to mitigate the negative impacts. In addition, project preparation will assess potential involuntary resettlement needs for the natural resources and watershed management activities. As part of the RAP, a RPF is proposed to be prepared for guiding any potential project activities adjustments during project preperation and implementation.
Safety of Dams OP/BP 4.37	√ Yes	The proposed project areas in Jiande are largely located in the downstream of existing Xin'an Dam. The project triggers Safety of Dams policy because the insufficient dam management and maintenance might threaten the Bank investment activities. According to this policy, due diligence on the safety status, performance history, operation and maintenance of Xin'an Dam need to be conducted to avoid any potential negative impacts from the Dam management.
Indigenous Peoples OP 4.10	× No	There are about 450,000 populations in Chun'an County, including 407 (around 0.1%) populations of Chinese Miao, Hui, Man and other ethnic minorities living scattered in the

Table 1.2-1 Correlation Analysis of the Project and the WB Safeguard Policies

		city downtown area. In Jiande City, there are about 510,000 populations, including 3,500 population of (around 0.68 %) Chinese She ethnic minority living in five villages. A preliminary ethnic minority screening has been conducted including interviews to the departments in charge of ethnic minority affairs and villagers in the proposed project arears. It is concluded that the project areas are predominantly Han Chinese and there is no ethnic minority groups identified in the proposed project areas. Therefore, the Bank Indigenous Peoples Policy OP 4.10 is not triggered.
Pest Management GP 4.09	√ Yes	The proposed agricultural non-point source pollution control and forest restoration and rehabilitation activities involves the use of pesticides, therefore, the OP 4.09 is triggered. As part of the EIA document, a separate PMP will be prepared in accordance with the Bank's safeguard policy on how to promote a safe, effective and environmentally sound pest management approach. Special attention will be paid to different features of the proposed agricultural and afforestation practice during the PMP preparation in order to make it fitting well with the project activities.
Forests OP/GP 4.36	√ Yes	This policy is triggered. The rehabilitation of degraded forests and enrichment planting of conifer forests will have significant positive impacts to the health and quality of the forests. The proposed activities will be undertaken in ecological protection forest sites and the proposed project activities will not affect the rights and welfare of local communities and their level of dependence upon forests. The impacts of the forest restoration and rehabilitation will be further assessed during the EIA preparation and the results will be included in the EIA. A separate Environmental Protection Guidelines for Plantation (EPGP) are recommended as part of the project EMP in order to further enhance the ecological and environmental benefits of the project, as well as to avoid any potential negative impacts.
Projects in Disputed Areas OP/BP/GP 7.60	× No	This policy is not triggered as the project does not involve any disputed areas.
Projects on International Waterways OP/BP/GP7.50	× No	This policy is not triggered as the project does not involve trans-boundary rivers.

In addition, the applicable Environmental, Health and Safety (EHS) Guidelines of the World Bank Group are also important technical references to provide general and industry-specific examples of Good International Industry Practice (GIIP) during the EA process.

1.3 Objectives of EIA

The main objectives of the EIA is to identify the current status of natural and social environment and environmental quality; evaluate the positive

environmental impact of the project implementation; identify, screen and predict the possible negative impacts; propose effective mitigation measures and provide environmental management plan for the unavoidable negative environmental impacts so as to provide a rationale for the WB's independent assessment of the project as well as references and basis for project decision making, environmental management and engineering design optimization.

1.4 Environmental Impact Assessment

The Project is classified and also confirmed by the World Bank as Category B in terms of EIA level based on the relevant requirements of the *Circular on strengthening EIA Management of Construction Projects Loaned by International Financial Organization* (Environment Supervision [1993] No. 324) and the principles of EIA classification included in "the World Bank Operational Manual – Environmental assessment OP4.01". Authorized by Zhejiang Provincial Department of Construction World Bank Loan Project Management Office (hereinafter referred to as "PPMO"), Zhejiang Huanke Environmental Consultant Co., Ltd. is responsible for carrying out the environmental impact assessment work (hereinafter referred to as "EIA") for the Project and has developed the EIA Report and Environmental and Social Management Plan for Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project on the basis of environmental screening, site visit and impact prediction and analysis.

1.5 Environmental functional zoning

1. Water environment functional zoning

According to the "Water Environment Functional Zoning Plan of the Water Functional Zones in Zhejiang Province", the water bodies involved in the project area of Chun'an County mainly include Wuqiangxi Stream, Yuchuanxi Stream, Liuduyuan River, Shangwuxi Stream, Zitongyuan River and Xin'anjiang Reservoir. The water environmental functions are reserved areas (refering to water areas that are not developed, not highly developed or reserved for future development), landscaping and recreational water areas (referring to water areas having the basic conditions for protecting aquatic ecology, providing people with a place of sightseeing and recreation and involving no direct human contact) and drinking water source protection areas (refering to surface water areas where the structures designated by the government according to law for centralized intake of urban drinking water are located). Except Wuqiangxi Stream (Fenkou Hydropower Station ~ Junshi Village section) that belongs to Class III, all the other water bodies are managed against the Class II water quality standard.

The water bodies involved in the project area of Jiande City mainly include Shouchang River, Datongxi Stream, Wulongxi Stream and Bailingkeng Reservoir. The water environmental functions are reserved areas (refering to water areas that are not developed, not highly developed or reserved for future

development), agricultural and industrial water areas (referring to water areas supplying production water to industrial and mining enterprises and supplying water for irrigation of farmland or grassland) and drinking water source protection areas (refering to surface water areas where the structures designated by the government according to law for centralized intake of urban drinking water are located). Except Shouchang River (the section from the junction of Laocunxi Stream and Shangmaxi Stream to the junction of Shouchang River and Xin'an River) that belongs to Class III, all the other water bodies are managed against the Class II water quality standard.

According to the relevant requirements in the "Integrated Wastewater Discharge Standard" and "Zhejiang Provincial Drinking Water Source Protection Regulations", it is prohibited to have sewage outfalls along and allow direct discharge of wastewater and sewage into Class Ⅱ water bodies during the construction and operation stages.

2. Ambient air functional zoning

According to the environmental air quality functional zoning of Hangzhou City, the project is located in a functional area subject to Class II standard specified in the Ambient Air Quality Standards.

3. Acoustic environment functional zoning

No acoustic environment functional zone is involved in the scope of the Project.

4. Environmental functional zoning

According to the "Environmental Functional Zoning Plan of Chun'an County ", the project area of Chun'an County involves 5 types of environmental functional zones, including Qiandao Lake Drinking Water Source Protection Zone (refering to areas maintaining water source conservation and protecting water source safety), Chun'an Border Soil Erosion Protection Zone (referring to areas maintaining stable performance of the ecological regulation functions such as water source conservation and water and soil conservation and safeguarding regional ecological safety), Human Living Environment Protection Zone (referring to areas that guarantee the environmental safety of human habitat or gathering places and safeguard human health), and Environment Optimization and Access Zone (referring to areas that maintain and improve the environmental conditions of the industrial cluster zones and control and mitigate the hazards brought by industrial production on human health) and Food and Advantageous Crop Environment Safeguard Zone (refeerring to areas that safeguard the environmental safety of the places of origin of key agricultural and animal husbandry products and prevent and control risks brought by agricultural products to human health). The main functions are to provide drinking water source protection, water and soil conservation, provide healthy, safe, comfortable and beautiful tourism and holiday environment, and provide safe production environment for food and other crops. The main construction works of Chun'an County are river dike reinforcement and dredging, waterworks and water supply pipeline, forest

system restoration and agricultural NPS pollution control, which are not prohibited construction activities in the negative list of the various environmental functional zones and are in line with the various control measures and requirements specified for the respective functional zone. Therefore, the project construction meets the requirements of environmental function zoning of Chun’an County.

According to the "Environmental Functional Zoning Plan of Jiande City", the project area of Jiande City involves 5 types of environmental functional zones, including Jiande Food and Advantageous Crop Environment Safeguard Zone (refeerring to areas that safeguard the environmental safety of the places of origin of key agricultural and animal husbandry products and prevent and control risks brought by agricultural products to human health), Jiande Shouchang River Water Source Conservation Zone (referring to areas maintaining stable performance of the ecological regulation functions such as water source conservation and water and soil conservation and safeguarding regional ecological safety), Human Living Environment Protection Zone (referring to areas that guarantee the environmental safety of human habitat or gathering places and safeguard human health), and Environment Optimization and Access Zone (referring to areas that maintain and improve the environmental conditions of the industrial cluster zones and control and mitigate the hazards brought by industrial production on human health) and Xin’an River Drinking Water Source Protection Zone (refering to areas maintaining water source conservation and protecting water source safety). The main functions are to provide drinking water source protection and water and soil conservation, provide healthy, safe, comfortable and beautiful tourism and holiday environment, and provide safe production environment for food and other crops. The main construction works of Jiande City are river dike reinforcement and dredging, bridge and wetland construction, forest system restoration and agricultural NPS pollution control, which are not prohibited construction activities in the negative list of the various environmental functional zones and are in line with the various control measures and requirements specified for the respective functional zone. Therefore, the project construction meets the requirements of environmental function zoning of Jiande City.

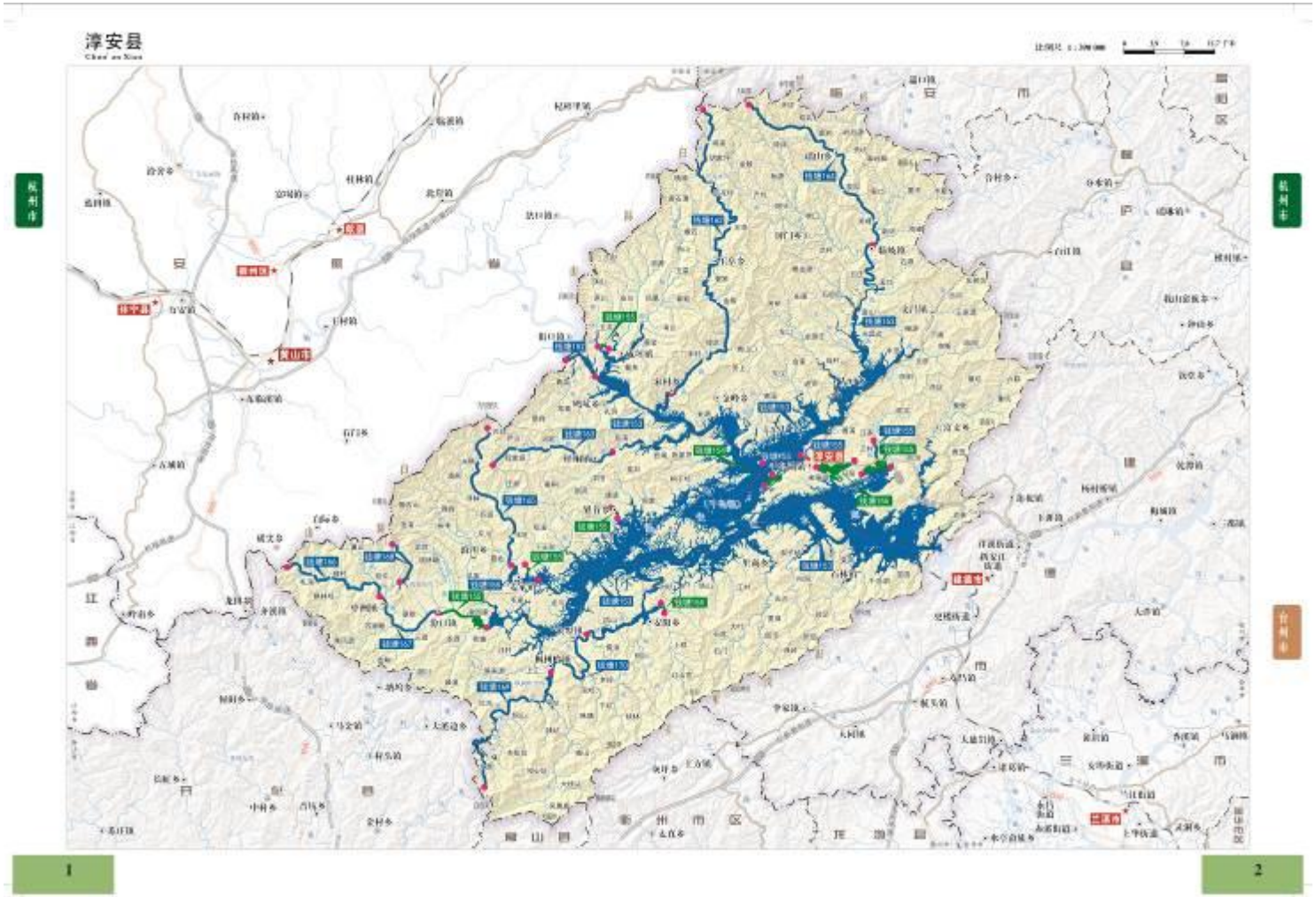


Figure 1.5-1 Water environment functional zoning of Chun’an County

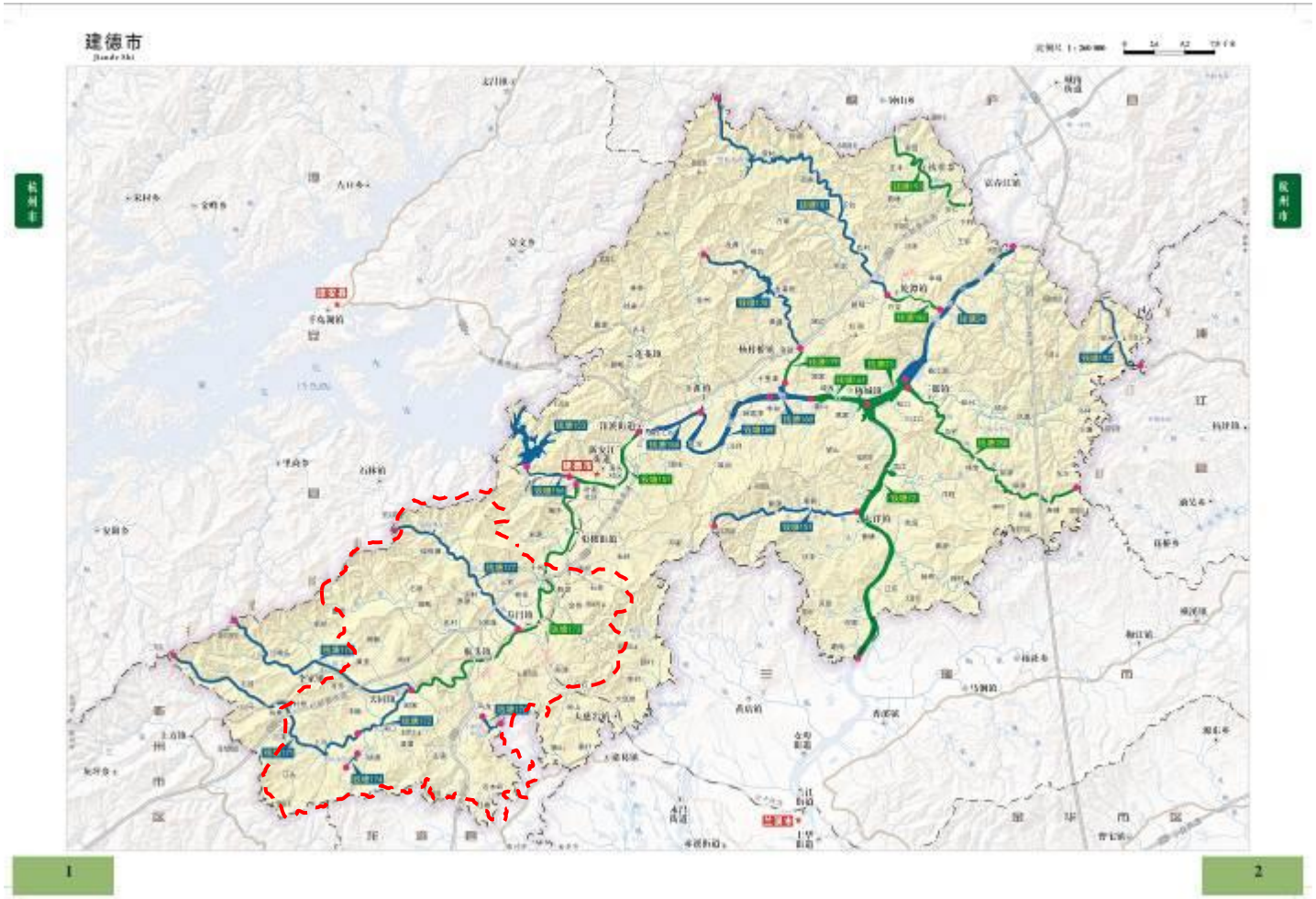


Figure 1.5-2: Water environment functional zoning of Jiande City

Figure 1.5-3: Environmental Function Zoning of Jiande City

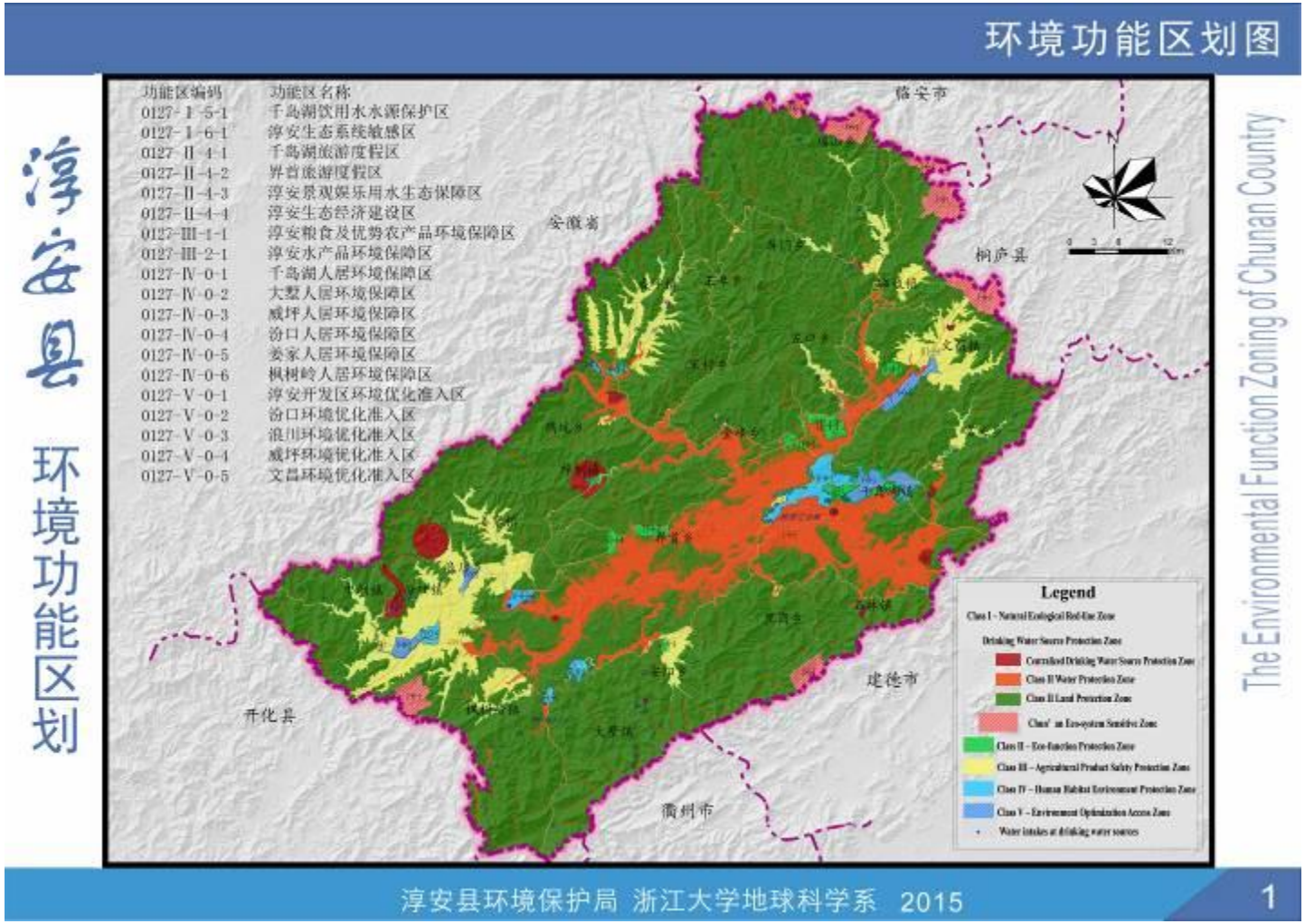


Figure 1.5-4: Environmental Function Zoning of Chun'an County

1.6 Assessment criteria

According to the characteristics and nature of the Project, a comparative analysis will be conducted in the EIA process of the Project on the applicable national environmental quality and pollutant discharge standards of China and the pollutant control standards and requirements included in the Environment, Health and Safety Guidelines issued by the World Bank Group and the stricter standards identified in such analysis shall be adopted as the monitoring and assessment criteria.

1.6.1 Environmental quality standards

1. Water environment quality standards

The WB EHS Guidelines presents no surface water environment quality standards; in the existing Surface Water Environmental Quality Standard (GB3838-200) of PRC, different quality standards are identified for different water bodies, with various quantitative water quality indicators determined for the sake of monitoring and assessment.

Class II and Class III standards of the Surface Water Environmental Quality Standards (GB3838-2002) shall be followed in the Project. See Table 1.6-1 for detail.

Table 1.6-1 Surface Water Environmental Quality Standard

(GB3838-2002)

Unit: mg/L except pH

SN	Item	Class I	Class II	Class III	Class IV	Class V
1	pH	6～9				
2	DO ≥	Saturationrate:90％ (or 7.5)	6	5	3	2
3	COD_{Mn} ≤	2	4	6	10	15
4	BOD_5 ≤	3	3	4	6	10
5	NH_3-N	0.15	0.5	1.0	1.5	2.0
6	Total Phosphorus (TP)	0.02 0.01 for reservoir and lake	0.1 0.025 for reservoir and lake	0.2 0.05 for reservoir and lake	0.3 0.1 for reservoir and lake	0.4 0.2 for reservoir and lake
7	TN (lake, reservoir, N)≤	0.2	0.5	1.0	1.5	2.0
8	Copper ≤	0.01	1.0	1.0	1.0	1.0
9	Zinc ≤	0.05	1.0	1.0	2.0	2.0
10	Fluoride ≤	1.0	1.0	1.0	1.5	1.5

SN	Item	Class I	Class II	Class III	Class IV	Class V
11	Arsenic ≤	0.05	0.05	0.05	0.1	0.1
12	Mercury ≤	0.00005	0.00005	0.0001	0.001	0.001
13	Cadmium ≤	0.001	0.005	0.005	0.005	0.01
14	Hexavalent Chromium ≤	0.01	0.05	0.05	0.05	0.1
15	Cyanide ≤	0.005	0.05	0.2	0.2	0.2
16	Volatile phenol ≤	0.002	0.002	0.05	0.01	0.1
17	Petro ≤	0.05	0.05	0.05	0.5	1.0
18	Anionic Surfactant ≤	0.2	0.2	0.2	0.3	0.3
19	Sulfide ≤	0.05	0.1	0.2	0.5	1.0
20	Fecal coliforms (No./L) ≤	200	2000	10000	20000	40000

2. Acoustic Environment Quality Standard

The project area in Chun'an County is located in the rural areas to which Class I standards specified in the Acoustic Environment Quality Standard shall apply. The towns and townships among other concentrated residential areas are classified as Class 2 while areas on both sides of the arterial transportation routes are classified as Class 4 in the aforesaid standard.

In the project areas of Jiande City, Class 2 standards shall apply to the urban areas; Class 4 shall apply to areas on both sides of the arterial transportation routes; Class 1 shall apply to the other areas. See Table 1.6-2 for detail.

Table 1.6-2 Acoustic environment quality standard (GB3096-2008)

Unit: dB(A)

Class	Day	Night	Area of applicability
1	55	45	Applicable to areas with residence, medical and health, culture and education, research and design, administrative office as the main functions and requiring quietness.
2	60	50	Applicable to areas with business and finance, market and trade as their main functions mixed with residential, commercial and industrial functions and requiring residential quietness.
3	65	55	Applicable to areas with industrial production and warehousing and

			logistics as their main functions and requiring efforts to prevent serious impacts on the environment from industrial noises.
4a	70	55	Applicable to areas on both sides of arterial transportation routes.

It is specified in the WB EHS Guidelines that the noiss standards are 55dB(A) in day time and 45dB(A) in night time for residential, office and cultural and educational function areas, 70dB(A) in day time and 70dB(A) in night time for industrial and commercial facilities; compared with the PRC standards, the PRC standards are stricter than the EHS standards. Therefore, the PRC standards shall apply.

3. Ambient air environment quality standard

According to the requirements of the WB EHS Guidelines, the national statutory standards on ambient air quality shall be executed. If there is no such statutory standard, the latest WHO Air Quality Guidelines or other internationally recognized reference standards shall apply. The applicable ambient air environment quality standard is Class II standard specified in the Ambient Air Environment Quality Standard (GB3095-2012) as detailed in Table 1.6-3.

Table 1.6-3: Standard values in the Ambient Air Environment Quality Standard (Excerpt)

Unit: mg/m^3

Assessment factor	Value time	Class II standard limit
Total suspended particles (TSP)	Annual average	0.20
	Daily average	0.30
Inhalable particulate matters (PM_{10})	Annual average	0.10
	Daily average	0.15
Sulphur dioxide (SO_2)	Annual average	0.06
	Daily average	0.15
	Hourly average	0.50
Nitrogen dioxide (NO_2)	Annual average	0.08
	Daily average	0.12
	Hourly average	0.24

4. Soil environmental quality standard

The WB EHS Guidelines presents no soil environment quality standards. Therefore, the PRC Soil Environmental Quality Standard (GB15618-1995) shall apply.

Table 1.6-4: Soil Environmental Quality Standard (GB15618-1995)

Unit: mg/kg

Item \ Class / pH		I	II			III
		Natural background	<6.5	6.5~7.5	>7.5	>6.5
Lead ≦		35	250	300	350	500
Zinc ≦		100	200	250	300	500
Mercury ≦		0.15	0.30	0.50	1.0	1.5
Nickel ≦		40	40	50	60	200
Copper	Farmland ≦	35	50	100	100	400
	Orchard≦	-	150	200	200	400
Chromium	Paddy field ≦	90	250	300	350	400
	Dry field≦	90	150	200	250	300

1.6.2 Pollutant discharge standards

1. Noise emission standards

The WB EHS Guidelines presents no noise standards to be enforced on construction sites and the boundary of industrial enterprises. Therefore, the PRC noise emission standards shall apply.

The noise limits specified in the Environmental Noise Emission Standards for Construction Sites (GB12523-2011) shall apply in the construction stage, i.e. 70dB(A) in daytime and 55dB(A) at night, with the maximum noise level at night not allowed to be greater than the limit by more than 15 dB(A) . See Table 1.6-5 for detail.

Class 1 standard specified in Ambient Noise Emission Standard on the Boundary of Industrial Enterprises (GB12348-2008) shall apply to noise control at the boundaries of rural WTPs and pump stations while Class 2 standards shall apply to centralized residential areas in rural and urban areas; Noise control for Shouchang WWTP shall follow Class 2 standard in Ambient Noise Emission Standard on the Boundary of Industrial Enterprises (GB12348-2008). See Table 1.6-6 for detail.

Table 1.6-5 Environmental Noise Emission Standards for Construction Sites (GB12523-2011)

Unit: dB(A)

Day	Night
70	55

Table 1.6-6 Ambient Noise Emission Standard on the Boundary of Industrial Enterprises (GB12348-2008)

Unit: dB(A)

Class	Day	Night
1	55	45
2	60	50
3	65	55
4	70	55

2. Wastewater discharge standards

It is stipulated in the Water, Sanitation Environment, Health and Safety Guidelines that wastewater shall meet the requirements of the relevant countries or internationally accepted standards and meet the related wastewater discharge quality objectives on the basis of end use with the assimilation capacity and the most sensitive receiving water bodies. Reference shall be made to the surface water discharge requirements in the "EHS Guidelines". The EHS Guidelines stipulates that the national or local domestic wastewater discharge standards shall be followed and, in the absence of such standards, the reference and guidance values applicable to domestic wastewater discharge in Table 1.3.1 shall apply. The specific indicators are as follows: pH: 6 ~ 9; COD: 125 mg / L; BOD5: 30 mg / L; TP: 2 mg / L. Comparative analysis indicates that China has a complete set of water pollutant discharge standards, which are more stringent than the World Bank EHS standards. Therefore, the PRC discharge standards shall apply.

According to the characteristics and pollution discharge condition of the Project, the Project is located in the neighborhood of water bodies with a Class II water quality target and allowing no discharge of pollutants. Wastewater generated in the construction stage shall be treated against the national standard for “Reuse of urban recycling water—Water quality standard for urban miscellaneous water consumption” (GB/T18920-2002) and then reused in construction and production processes, site water spraying or farmland and landscaping fertilization, etc. See Table 1.6-7 for detail; In the other areas with a Class III water quality target, the wastewater generated in the construction stage shall be discharged after treated to the Class I standard specified in the “Integrated Wastewater Discharge Standard” (GB8978-1996); in urban areas where the wastewater can be discharged into the municipal sewage network, wastewater generated in the construction stage shall follow the Class III standard specified in “Integrated Wastewater Discharge Standard” (GB8978-1996); See Table 1.6-8 for details of this discharge standard.

In the operation stage of the Project, tail water from Shouchang WWTP shall meet the required discharge limit of Class IA specified in GB18918-2002 “Pollutant discharge standard for municipal WWTPs” as detailed in Table 1.6-9.

Table 1.6-7: Water quality standard for urban miscellaneous water consumptions

SN	Item	Toilet flushing	Road cleaning, fire fighting	Urban landscaping	Car washing	Building construction
1	pH	6.0~9.0				
2	Chroma ≤	30				
3	Odor≤	Without unpleasantness				
4	Turbidity(NTU) ≤	5	10	10	5	20
5	Total dissolved solids(mg/L) ≤	1500	1500	1000	1000	--
6	BOD_5(mg/L) ≤	10	15	20	10	15
7	NH_3-N(mg/L) ≤	10	10	20	10	20
8	Anionic surface-active agent(mg/L) ≤	1.0	1.0	1.0	0.5	1.0
9	Fe(mg/L) ≤	0.3	--	--	0.3	--
10	Mn(mg/L) ≤	0.1	--	--	0.1	--
11	Dissolved oxygen(mg/L) ≥	1.0				
12	Total residual chlorine	After 30min contact≥1.0，pipeline end≥0.2				
13	Total coliform group(No./L) ≤	3				

Table 1.6-8: Integrated wastewater discharge standard

Unit: mg/L (except pH)

SN	Pollution index	Class I	Class II	Class III
1	pH	6～9	6～9	6~9
2	SS	70	200	400
3	BOD5	30	60	300
4	COD	100	150	500
5	Phosphate(P)	5	10	-
6	Petro	5	10	20
7	NH_3-N	15	25	45*

*Note: NH_3-N follows the “Water quality standard for sewage discharged into urban sewers” (GB/T 31962-2015).

Table 1.6-9: Pollutant discharge standard for municipal WWTPs

Unit: mg/L except pH

Pollution factor	pH	COD	BOD_5	SS	NH_3-N*	Petro	TP
Class I(A)	6-9	50	10	10	5(8)	1	0.5
Pollution factor	TN	Total mercury	Total cadmium	hexavalent chromium	Total arsenic	Total lead	Total copper
Class I(A)	15	0.001	0.01	0.05	0.1	0.1	0.5
Pollution factor	TZ	LAS	Total coliform group				
Class I(A)	1.0	0.5	1000 No. /L				

3. Exhaust gas emission standard

The WB EHS Guidelines presents no standard limit values for unorganized discharge and odor discharge. Therefore, the PRC standards shall apply.

Exhaust gas in the construction areas and river dredging during the construction stage shall respectively follow the requirements of the "Integrated Discharge Standard of Air Pollutants" (GB16297-1996) and the concentration limit for discharge without organized monitoring and control specified in the "Emission Standard of Odor Pollutants" (GB14554-93) as shown in Table 1.6-10 and Table 1.6-11.

Odor from Shouchang WWTP in the operation stage shall follow the odor emission limits specified in GB18918-2002 “Pollutant discharge standard for municipal WWTPs” as shown in Table 1.6-12.

Table 1.6-10： Integrated Discharge Standards for Air Pollutants

Unit: mg/m^3

SN	Pollutant	Standard limits for monitored concentration of unorganized discharge from new pollution sources	Remarks
1	PM	1.0	In the construction stage, the monitored site is the spot with the highest concentration beyond the periphery.
2	SO_2	0.40	
3	NOx	0.12	
4	TSP	5	

Table 1.6-11 Discharge standards for odor pollutants (Excerpt)

Unit: (mg/m^3)

Assessment factor	NH_3	Odor	H_2S
Class (category)	II		
Standard concentration limit	1.5	20	0.06

Table 1.6-12: Maximum permissible concentration of exhaust gas on boundaries (on the edge of shelter belt) specified in “Pollutant discharge standard for municipal WWTPs” (GB18918-2002)

SN	Indicator	Class II standard
1	Ammonia	1.5(mg/m^3)
2	Hydrogen sulfide	0.06(mg/m^3)
3	Odor concentration (dimensionless)	20

4. Solid wastes

Solic waste treatment and disposal under the Project shall be carried out in accordance with the respective provisions included in the “Standard for controlling pollution on the storage and disposal sites for general industrial solid wastes” (GB18599-2001) and its amendments. Treatment and disposal of hazardous solid wastes shall comply with the “Standard for pollution control of storage of hazardous wastes” (GB18597-2001) and its amendments.

1.7 Assessment principles and key assessment tasks

1.7.1 Assessment principles

The EIA process must follow the principle of sustainable development in its implementation and be carried out in a scientific, impartial and practical way to serve environmental decision-making and management. The principles to be followed include:

(1) Complying with the national industrial policies and environmental protection policies and laws and regulations;
(2) Complying with the regional function zoning plans and ecological protection plans;
(3) Complying with the policies on comprehensive utilization of resources;
(4) Complying with the land use policies;
(5) Complying with the requirements of compliant pollutant discharge and regional environmental quality.

1.7.2 Key assessment tasks

According to the national EIA technical guidelines and the requirements of World Bank Safeguard Policies, the key assessment tasks are to identify and assess the environmental and social impacts of the proposed project, its linked activities and any cumulative effects (if relevant), and to propose mitigation measures, as listed below:

(1) Analyzing the overall positive benefits of the Project;
(2) Assessing the effects of the tail water discharge and odor impacts of Shouchang WWTP, assessing the impacts on the river way hydrological conditions by WTP water intake; assessing and proposing mitigation

measures for the impacts on river water quality and aquatic ecological environment by the water conservancy works and analyzing the universal impacts in the construction period of the Project;;

(3) Analyzing the impacts of water and soil erosion and developing water and soil conservation programs;

(4) Screening and analysis of cumulative impacts (if any);

(5) Due diligence of linked activities;

(6) Conducting alternative analysis;

(7) Public participation and information disclosure;

(8) Resettlement plan and social impact assessment;

(9) Environment and social management plan.

2. Engineering analysis

2.1 Project overview

2.1.1 Project objectives

The objectives of Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project are:

1. To develop demonstrative integrated watershed management practices;
2. To reduce pollution and improve forest ecological environment in priority areas of the Qiandao Lake catchment in Zhejiang.

2.1.2 Project description

See Table 2.1-1 for a summary of the project components.

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
Chun'an County Small Watershed Integrated Improvement	The project area covers 7 towns and townships of Zhongzhou Town, Fenkou Town, Jiangjia Town, Langchuan Township, Anyang Township and Zitong Town and involves 5 watersheds of Wuqiangxi Stream, Yuchuanxi Stream, Liuduyuan River, Shangwuxi Stream and Zitong River. Dikes and revetment at 117 sites with a total length of 68.89km will be constructed (reconstructed or reinforced). 18 new dikes will be constructed; 31 cofferdams will be reconstructed or rehabilitated; river section with a length of 5.00km will be dredged; flood plants at 5 sites will be improved to a flood control standard of 10-year recurrence period. 1. Wuqiangxi Stream: dike (revetment) construction in a full length of 13.10km, including 5 sites with a unit length of 76 to 1133m and a total length of 2.67km for the main channel and 12 sites with a unit length of 135 to 1648m and a total length of 10.43km for the tributaries, including 4.43km for Zhangcun River, 1.05km for Xiatongxi River, 2.01km for Yecunxi River and 2.95km for Jiechuanxi River; construction of 5 new cofferdams and rehabilitation of 3 existing cofferdams; 2. Yuchuanxi Stream: dike (revetment) construction in a full length of 29.96km, including 32 sites with a unit length of 82 to 1302m and a total length of 13.75km for the main channel and a total length of 16.20km for the tributaries, including 0.96km for Panjiayuan River, 1.51km for Wanchuanyuan River, 1.14km for Jiekengyuan River, 3.81km for Hengyuan River, 2.18km for Zhuangyuan River, 0.94km for Jiangjiwuxi River, 2.24km for Fuyuan River, 1.02km for Kangtangyuan River, 0.44km for Tangjiayuan River, 1.98km for Shanyuan River; construction of 5 new cofferdams and rehabilitation of 19 existing cofferdams; 3. Liuduyuan River: dike foundation reinforcement for a length of 2.90km; construction of 9.11km long revetment at 32 sites with a unit length of 37 to 3238m; construction of 2 new ecological cofferdams; rehabilitation of 7 existing cofferdams for the main channel; construction of 4.08km long revetment at 13 sites with a unit length of 45 to 967m; construction of 5 new ecological cofferdams; rehabilitation of 3 existing cofferdams and ecological treatment of bottomland at 1 site for the tributaries;	0	22999

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
	4. Shangwuxi Stream: dike reinforcement for a length of 3.89km; river rehabilitation for a length of 3km at 2 sites, including 3km for rural river dredging and 0.755km for dike reconstruction. 5. Zitongyuan River: dike reinforcement for a length of 3.15km; river rehabilitation at 1 site for a length of 2km, including 2km for rural river dredging and 0.80km for dike reconstruction		
Chun'an County Rural Drinking Water Safety Improvement	The service area of the Subproject covers 188 administrative villages belonging to 18 towns and townships, such as Fengshuling Town, Dashu Town, Lishang Township, Weiping Town, Wangfu Township, Zhongzhou Town, Zitong Town, Jijiang Town and Pingmen Township of Chun'an County. With an existing service population of 201,600 persons and designed service population of 218,100 persons and a total water supply capacity of 38,400m^3/day, the Subproject includes 8 centralized water supply projects for the newly established Kuacun Town (with a unit water supply capacity of 600 to 5000m^3/d and a total capacity of 19,100m^3/d) and 8 pipeline extension and water supply projects of existing WTPs (with a supply capacity of 651 to 7745m^3/d and a total capacity of 19,300m^3/d), including 3 water intake cofferdams, 5 water intake pump houses, 8 water purification plants and 21 relay boosting pump houses. The total length of the water transmission and distribution pipelines amounts to 1680km. The WTP will adopt the conventional water purification process of "Coagulation + precipitation + filtration + disinfection". See Table 3-2 for detail	26749	34996

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
Chun'an County Dike Reinforcement and River Rehabilitation	The construction sites of this Subproject are distributed on 22 rivers in Chun'an County except the five demonstrative river watersheds and involve 16 towns and townships, namely, Langchuan Township, Fenkou Town, Dashu Town, Anyang Township, Lishang Township, Linqi Town, Jiangjia Town, Fuwen Township, Pingmen Township, Weiping Town, Zuokou Township, Fengshuling Town, Wenchang Town, Yaoshan Township, Wangfu Township and Songcun Township. The construction works include dike reinforcement with a length of 38.15km and river rehabilitation with a length of 98.5km, including 98.5km for rural river dredging, 28.71km for reconstruction of dikes, with a flood control standard of 10-year recurrence period. 1. Dike reinforcement in Chun'an County involves a total length of 38.15km, including dike reconstruction at 32 sits with a unit length of 450m to 1621m and a total length of 34.30km, dike reinforcement at 5 sites with a total length of 3.85km. See Table 3-4 for detail. 2. River rehabilitation works involves a total length of 98.5km, including dike reconstruction at 41 sits with a unit length of 100m to 2607m and a total length of 26.21km, dike reinforcement at 9 sites with a unit length of 50 to 580m and a total length of 2.50km, and river dredging with a length of 98.5km. See Annexed Table 3-4 for detail.	0	32635
Chun'an County Agriculture NPS Pollution Control	**1. Environment-friendly plantation demonstration** **Chemical fertilizer reduction for pollution control:** **Extensive application of formulated fertilizers**: Formulated fertilizers are extensively applied for tea, fruit trees and mulberry in the whole county at a rate of 10,000 mu per year, 50kg per mu and totally 500 tons for Year 2018 and 80,000 mu per year, 50kg per mu and totally 4,000 tons per year thereafter; amounting to totally 20,500 tons of formulated fertilizers in 5 years; **Extensive application of organic fertilizers (commercial organic fertilizers)**: Organic fertilizers are extensively applied for tea, grain and oil crop and vegetables, mulberry and fruit trees at a rate of 20,000 tons per year, amounting to	**13856**	**16352**

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
	totally 120,000 tons for 6 years. **Distribution of liquid fertilizer:** Liquid fertilizer will be distributed at a rate of 25,000 tons or more per year, amounting to totally 150,000 tons for 6 years. **Ecological interception of nitrogen and phosphate loss in tea gardens**: 1 tea garden will be selected as the pilot tea garden and further extension will be conducted in the tea gardens in the whole province if proven feasible. Adopting the ecological interception ditch and pond system technology, the ecological interception of nitrogen and phosphate loss in tea garden to be implemented under the Project comprises of 5 parts, namely, ditch and pond design, plant design, system construction, system evaluation and testing and system maintenance and management. **Ecological interception and utilization of rice field NPS pollution**: this subproject is designed for the mulberry gardens or tea gardens located on slope land where there is a certain area of rice field down the slope. One base is selected for pilot implementation. The construction contents mainly include rehabilitation of drainage ditches in the mulberry gardens, tea gardens and other plantation basses, rehabilitation of paddy field and ecological compensation. **Pesticide reduction and hazard control:** **Integrated pest management (IPM)**: IPM will be implemented for crops such as tea, grain and oil crops, vegetables, mulberry and fruit trees at a scope of 100,000 mu per year and totally 600,000 mu for 6 years. **Soil erosion prevention and control**: Soil erosion prevention and control works (i.e. grass cultivation technology) will be promoted in an extensive way in fruit gardens and tea gardens in the whole county at a rate of 50,000 mu per year and totally 300,000mu for 6 years. **Harmless treatment of pesticide packaging materials:** Waste pesticide packaging materials will be recovered in the whole county with an assured recovery rate of greater than 90% and the recovered packaging materials will be substantially subject to harmless treatment. **2. Demonstrative Agriculture and Animal Husbandry Project for Disposal of Livestock and Poultry Wastes**		

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
	3 scaled livestock and poultry breeding farms, including Hangzhou Qiandao Lake Wuxi Agriculture Development Co., Ltd., Hangzhou Qiandao Lake Tianping Agriculture Development Co., Ltd., and Chun'an County Weizheng Family Farm will be rehabilitated and liquid storage tanks will be constructed in the digestion tanks and sprinkling irrigation facilities will be installed in the base. In addition, liquid fertilizer pumping and pressuring facilities will be installed.		
Chun'an County Forest Eco-system Restoration	The watersheds for prior water source management include 5 key watersheds of Wuqiangxi Stream, Shangwuxi Stream, Zitong River, Yuchuanxi Stream and Liudu River. The second part is the Lakeside Landscaping and Ecological Conservation Zone covering the ecologically sensitive areas such as the waterfront hilly areas around the lake and lake island, involving totally 20 towns and townships and 187 villages, 16 state-owned forest farms and 61 forest areas. The construction scope of the subproject involves a total area of 167,030mu (11135.33 h.a), including 138,219mu (9214.6 h.a) for ecological restoration of coniferous forest and 28811 mu (1920.73 h.a) for ecological restoration of eulalia. Based on the type of restoration, the construction scope of the subproject comprises of the ecological restoration of 38607mu (2573.8 h.a) low-efficiency coniferous forest, 99612mu (6640.8 h.a) pest-affected coniferous forest, 2534mu (168.93 h.a) unattended and barren artificial forest land, 26277mu (1751.8 h.a) eulalia barren mountains and land.	32547	39837

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
Jiande City Water Conservancy Facility Rehabilitation	This subproject involves 6 towns/townships (communities) of Lijia Township, Datong Town, Hangtou Town, and Shouchang Town, Genglou Township and Xin'anjiang Town and 6 small watersheds of Datongxi Stream, Zhenyuan River, Qingtan River, Fengjia River, Wulongxi Stream and Xihu Water System in Shouchang Town. The water conservancy facility rehabilitation includes the construction and rehabilitation of 70.08km long ecological revetment, including 9.3km for Datongxi Stream, 6.57km for Zhenyuan River, 14.87km for Qingtan River, 5.038km for Fengjia River, 24.4km for Wulongxi Stream, 3.5km for Shouchang River main channel, 4.6km for Shimulingxi River, 1.8km for Shouchang River and 1.8km for Donghuagban; construction and rehabilitation of 36 ecological cofferdams with a length of 816m; river dredging with a length of 35.0km and construction of Shouchang River Basin monitoring system, etc. 1. Datong Town 1) Datongxi Stream: To be implemented together with Datong-Shangmaxi Stream dike reinforcement works, involving the rehabilitation of 9.3km long ecological revetment mainly including the addition of landscaping greenbelt; construction of a 30m long flap dam. 2) Zhenyuan River: Ecological rehabilitation of 6.57km long revetment for the Wansheng-Songxi Section; construction of a 8m long ecological dam; rehabilitation of 8 ecological dams with a total length of 67m; river dredging with a length of 5.13km; landscaping site construction at the entrance of Wansheng Village and Tianpengli Village and at 2 sites in Zhenyuan Village. The project area will involve a flood control population of 3,400 persons and the protection of arable land in a total area of 1500mu. 3) Qingtan River: Ecological rehabilitation of 14.87km long revetment for the Shimenzhuang-Xikou Section; construction of 7 ecological dams with a full length of 84m; rehabilitation of 6 ecological dams with a total length of 117m; river dredging with a length of 8.136km; landscaping site construction at the entrance of Chaoyang Village (corridors and landscaping) and at the village committee office and entrance to Qingtan Village. The project area will involve a flood control population of 7,200 persons and the protection of arable land in a total area of 2000mu. 4) Fengjia River: Ecological rehabilitation of 5.038km long revetment for the Shanzhawu Reservoir - Langjia Section; river dredging with a length of 3.038km. The project area will involve a flood control population of 3,800 persons and the protection of arable land in a total area of 2000mu. 2. Hangtou Town 1) Hangchuan Section of the main channel of Shouchang River: Ecological rehabilitation of 3.5km long revetment; construction of a 50m long ecological dam; rehabilitation of 2 ecological dams with a total length of 210m; river dredging	10338	13708

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
Jiande City Landscaping Afforestation and Forest Form Improvement	Located in Jiande City, the subproject area comprises of the areas on both sides of the Shouchang River, a tributary of Xin'an River mainly involving the barren mountains and land and burned area in the water source protection zone and the ecologically sensitive areas on both sides of the villages, towns and trunk highways, totally involving 3 towns/townships, 13 villages, 2 state-owned forest farms. Landscaping afforestation and forest form improvement covers a total area of 23935mu, including 5116mu for landscaping afforestation and 18819mu for forest form improvement and, based on the locations of construction sites, 9113mu for Datong Town, 6060mu for Hangtou Town, 1850mu for Shouchang Town, 4732mu for Shouchang Forest Farm and 2180mu for Xin'anjiang Forest Farm.	8881	664

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
Jiande City Municipal Engineering	Located in 4 towns/townships (communities), namely, Datong Town, Hangtou Town, Xin'anjiang Community and Yangxi Community in Jiande City and including forest fire emergency access road construction, bridge rehabilitation and ecological wetland construction. 1. Forest fire emergency access road and mountain-climbing path Forest fire emergency access road: extending from Zhengfa Road of Xin'anjiang Community to Fangcun Village of Gaoling Natural Village in Yangxi Community and then to Shibahu and finally ending at Tongguan Forest Zone (the Lovers Valley Scenic Area), this emergency access road has a full length of 12km and includes 10km long drainage ditches, 8800m^3 of retaining walls, 40 drainage culverts and 4 public toilets. The subproject will benefit forests in a total area of 29km^2. With a designed subgrade width of 4.5m (0.5m wide earth shoulder + 3.5m wide carriageway + 0.5m wide earth shoulder) and a design speed of 20km/h and mainly involving rehabilitation and improvement of existing forest road, this access road will be constructed against the Class III forest area highway standard and adopt the asphalt concrete pavement structure. Mountain-climbing path: This mountain-climbing path to be constructed extends along the mountain ridge for a total length of approximately 9km around Bailingkeng Reservoir in Hangtou Town. With a designed subgrade width of 2.5m, the road will be constructed in three sections with a length of 5.331km, 2.756km and 0.852km respectively. 2. Bridge reconstruction Reconstruction of 12 old bridges over Qingtan River and Zhenyuan River, two tributaries of Datongxi Stream, with a length of 16m to 36m using simple hollow slabs and a designed bridge width of 4.5m. 3. Ecological wetland construction Hangtou composite ecological wetland works includes the improvement and rehabilitation of the natural wetland in the existing river flood plains with a total area of 16247.2m^2. As the deep purification place for farmland backwater, the wetland will intercept and treat farmland backwater from the farmland around Nanba Village with a total area of approximately 265mu. In addition, the existing rolling dam will be utilized to construct a water diversion gate with a diversion capacity of no less than 1000t/day to serve as the standby water supply of this wetland. Technological process: farmland backwater (supplementing with river water when the water level is low) →→Multi-stage enhanced biofilm system→→ High-efficiency self-purification eco-system →→ composite ecological filter system →→ effluent.	4968	6213

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
	4. Shouchang WWTP Phase I expansion Phase I expansion works of Shouchang WWTP of Jiande City is located in Shanfeng Village south of Jiande City (in Shouchang) and close to and within the fencing wall of the existing Phase I WWTP. The existing treatment capacity of Phase I WWTP is 5000m^3/d and the expansion capacity will be 5000 m^3/d, bringing the total treatment capacity of Phase I WWTP up to 10,000m^3/d. Sewage treatment process: biological nitrogen and phosphorus removal process → deep treatment process → disinfection process. The deep treatment process will comprise of coagulation ramp sedimentation and activated sand filter; the disinfection process will adopt UV disinfection while sludge treatment will adopt the gravity thickening + deep dewatering treatment process. Biological deodorant will be used for odor removal. The design water quality standard is Class IA specified in the "Pollutant Discharge Standard for Municipal Wastewater Treatment Plants". Tail water from the existing Phase I WWTP is discharged into Shouchang River in the middle of the river. The existing river discharge pipelines will be used continuously for the expansion works.		
Jiande City Agricultural NPS Pollution Control	Including 34 villages of Datong Town, 18 villages of Hangtou Town and 23 villages of Shouchang Town, totally 75 villages in 3 towns and townships. 1. Construction components and scope of agricultural NPS pollution control for crop farming: (1) Extensive application of organic fertilizers and soil-based formulated fertilizer: continuous extension of organic fertilizers and formulated fertilizers for 6 years in 3 towns in the project area with a volume of 213000 tons for organic fertilizer and 10800 tons for formulated fertilizers. (2) Green pest management: Solar vibration frequency insecticidal lamps and sticky boards will be applied extensively for food crops, fruit orchards and tea gardens in the project area. The solar vibration frequency insecticidal lamps involve an area of 18911 mu and a total number of 949 lamps, with 1 lamp per 20mu; the sticky boards involve an area of 2730mu (including 1630mu of fruit orchards and 1100mu of tea garden) and 80 pieces per mu, ending up with a total number of 218,400 pieces per year and 1,310,400 pieces totally for continuous extension of 6 years. 2. NPS pollution control for livestock and poultry breeding The NPS pollution control for livestock and poultry breeding involves 19 livestock and poultry breeding households and	3817	6030

Table 2.1-1: Project Overview

Subproject	Construction works	World Bank Fund (CNY10000)	Total Investment (CNY10000)
	comprises of two parts, namely, Feces treatment infrastructure improvement and Reconstruction and expansion of pig house fermentation bed and ancillary facilities. (2) Feces treatment infrastructure improvement The feces treatment infrastructure improvement works involves 15 livestock and poultry breeding farms (14 egg chicken farms and 1 sheep farm) and includes the expansion of sedimentation tanks with a total area of 3660m^2, rehabilitation of pollutant discharge pipes with a length of 1400m, construction of the feces cleaning channel canopy with an area of 1500m^2, stormwater ditches with a length of 1000m, feces storage shed with an area of 840m^2; purchase of 2 conveyor belt feces cleaning equipment, 4 feces collection trucks and 8 sewage (Feces and wastewater) tank trucks. (3) Reconstruction and expansion of pig house fermentation bed and ancillary facilities The pig house fermentation bed and ancillary facilities reconstruction and expansion works will support 4 large-scale pig farms and includes the construction of spraying and regulating tanks with a total area of 220m^2, construction of pig house ectopic fermentation beds (tanks) with a total area of 4300m^2, purchase of 2 field transfer forklifts, 3 composting heap turners, 1 high-pressure water jet, 4 mixing pumps, 3 spraying machines, 4 wastewater (mud) cutting pumps, 3 sewage (fertilizer water) tank trucks, 3 organic fertilizer trucks and 4 automatic packing machines. 2. Ecological ditch construction Construction of ecological ditches with a total length of 56207m, including 5823m planned for Shouchang Town, 44999m planned for Datong Town and 5385m planned for Hangtou Town. According to the classification of irrigation and drainage functions, such ecological ditches comprise of irrigation ditches with a total length of 27384m and involving the typical cross section types of 0.4×0.4m, 0.5×0.5m and 0.6×0.6m and drainage ditches with a total length of 28823m and involving the typical cross section types of 0.8×0.8m, 0.8×1.0m, 1.0×1.0m, 1.2×1.2m, 1.5×1.5m, 2.0×1.5m and (4.0+2.4)×2.0m.		
Total		101156	1179419

2.2 Identification and scope of assessment of project impacts

2.2.1 Identification of environmental and social impacts

The project has 10 components, namely, rural area drinking water safety improvement, river dike and revetment, forest eco-system restoration, agricultural NPS pollution control, etc. The EIA summarized the contents, identified the potential environmental and social impacts and proposed safeguard measures under the WB policy for these components. Details are summarized in Table 2.2-1.

Table 2.2-1 Project activities and identification of potential environmental and social impacts and key stakeholders

Project activity	Contents	Potential environmental impacts	Potential social impacts	Safeguard tools
Chun'an County Small Watershed Integrated Improvement	1. Wuqiangxi Stream: dike (revetment) construction in a full length of 13.10km and rehabilitation of 3 existing cofferdams; 2. Yuchuanxi Stream: dike (revetment) construction in a full length of 29.96km and rehabilitation of 19 existing cofferdams; 3. Liuduyuan River: dike foundation reinforcement for a length of 2.90km; construction of 9.11km long revetment; construction of 2 new ecological cofferdams; rehabilitation of 7 existing cofferdams for the main channel; construction of 4.08km long revetment; construction of 5 new ecological cofferdams; rehabilitation of 3 existing cofferdams and ecological treatment of bottomland at 1 site for the tributaries; 4. Shangwuxi Stream: dike reinforcement for a length of 3.89km; river rehabilitation for a length of 3km, including 3km for rural river dredging and 0.755km for dike reconstruction; 5. Zitongyuan River: dike reinforcement for a length of 3.15km; river rehabilitation for a length of 2km, including 2km for rural river dredging and 0.80km for dike reconstruction.	Construction stage: dusts, wastewater, noise, solid wastes (disposal of debris and construction wastes and setting up of waste disposal sites), soil erosion, impacts of construction camps and impacts of transportation vehicles; these impacts are temporary and insignificant and only limited to a very small scope of the construction areas and will disappear as the construction activities end. Impacts on hydrological regime from river dike and cofferdam construction; temporary impacts on traffic from construction activities. Operation stage: construction of river dike and cofferdam will produce insignificant impacts on hydrological regime.	Temporary land occupation	EIA ESMP ECOP for River Rehabilitation SA RAP
Chun'an County Rural Drinking Water Safety Improvement	With an existing service population of 201,600 persons and designed service population of 218,100 persons and a total water supply capacity of 38,400m^3/day, the Subproject includes 8 centralized water supply projects for the newly established Kuacun Town and 8 pipeline extension and water supply projects of existing WTPs, including 3 water intake cofferdams, 5 water intake pump houses, 8 water purification plants and 21 relay boosting pump houses. The total length of the water transmission and distribution pipelines amounts to 1680km.	Construction stage: dusts, wastewater, noise, solid wastes (disposal of debris and construction wastes and setting up of waste disposal sites), soil erosion, impacts of construction camps and impacts of transportation vehicles; these impacts are temporary and insignificant. Temporary impacts on traffic from construction activities. Operation stage: Production wastewater generated in the WTP will be reused and	There are 13 tombs to be relocated in the area of permanent land acquisition, temporary land occupation and WTP land occupation. Impacts will be generated by	EIA ESMP ECOP for Small Civil Works SA RAP

Table 2.2-1 Project activities and identification of potential environmental and social impacts and key stakeholders

Project activity	Contents	Potential environmental impacts	Potential social impacts	Safeguard tools
		not discharged; sludge generated by the WTP is ordinary solid wastes that may be used in gardening, landscaping or disposed in landfill. Impacts on water resources in rivers and reservoirs by water intake of the WTP under the Project:	water intake on the power generation of 4 hydropower stations.	
Chun'an County Dike Reinforcement and River Rehabilitation	The construction sites of this Subproject are distributed on 22 rivers in Chun'an County except the five demonstrative river watersheds and involve 16 towns and townships.	Construction stage: dusts, wastewater, noise, solid wastes (disposal of debris and construction wastes and setting up of waste disposal sites), soil erosion, impacts of construction camps and impacts of transportation vehicles; these impacts are temporary and insignificant and only limited to a very small scope of the construction areas and will disappear as the construction activities end. Impacts by dike and revetment construction on irrigation ditches; temporary impacts on traffic from construction activities. Operation stage: Impacts on hydrological regime from river dike and cofferdam construction are insignificant.	Temporary land occupation	EIA ESMP ECOP for River Rehabilitation SA RAP
Chun'an County Agriculture NPS Pollution Control	1. Environment-friendly plantation demonstration: chemical fertilizer reduction for pollution control includes subsiding formulated fertilizers in an amount of 6000 tons (1000 tons/year), organic fertilizers in an amount of 25,200 tons (4200 tons/year), non-local distribution of liquid fertilizer in an amount of 36,000 tons (6000 tons/year); the pesticide reduction and hazard control includes pest monitoring and warning system and extension of IPM in an area of 276,000 mu	Construction stage: Construction of the ecological interception works and livestock waste treatment infrastructure will generate dusts, wastewater, noise, solid wastes. These impacts are temporary and insignificant and only limited to a very small scope of the construction areas and will disappear as the construction activities end. Operation stage: Application of formulated	Land occupation and subsidy of formulated fertilizer will have impacts on farmers.	EIA ESMP PMP ECOP for Small Civil Works SA

Table 2.2-1 Project activities and identification of potential environmental and social impacts and key stakeholders

Project activity	Contents	Potential environmental impacts	Potential social impacts	Safeguard tools
	(46,000 mu/year), IPM and organic fertilizer and formulated fertilizer subsidy management information system and water and soil conservation prevention and protection for an area of 90,000 mu (15,000 mu/year), harmless treatment of pesticide packing materials in an amount of 7,200,000 (1,200,000 per year); village agricultural technology extension team system building for 101 villages (66,000,000). 2. Demonstrative Agriculture and Animal Husbandry Project for Disposal of Livestock and Poultry Wastes: including subsidy for field biogas liquid storage tanks and subsidy for biogas liquid transmission pipelines.	fertilizers and organic fertilizers and implementation of IPM will help reducing usage of chemical fertilizers and pesticides and strengthening of recovery of pesticide packaging materials will help reducing agricultural NPS pollution.		
Chun'an County Forest Eco-system Restoration	The construction scope of the subproject involves a total area of 167,030mu (11135.33 h.a), including 138,219mu (9214.6 h.a) for ecological restoration of coniferous forest and 28811 mu (1920.73 h.a) for ecological restoration of eulalia.	Construction stage: In the construction stage, forest land reclamation and hole preparation will generate dust, noise and solid wastes and also result in slight soil erosion. These impacts, however, are very temporary and insignificant and limited to a very small part of the construction areas and will disappear as the construction activities end. Operation stage: In the operation stage of the project, certain impacts will arise from forest land culture, fertilization and pesticide application. However, upon the completion of the Project, the entire forest system as well as the biomass and carbon sequestration capacity will be improved.	Temporary land occupation and forestland will have impacts on the land contracting farmers.	EIA ESMP PMP Environmental Codes of Practice for Afforestation SA
Jiande City Water Conservancy Facility	The water conservancy facility rehabilitation includes the construction and rehabilitation of 70.08km long ecological revetment, ,construction and rehabilitation of 36 ecological cofferdams with a length of 816m;	Construction stage: dusts, wastewater, noise, solid wastes (disposal of debris and construction wastes and setting up of waste disposal sites), soil erosion, impacts	Temporary land occupation	EIA ESMP ECOP for River Rehabilitation

Table 2.2-1 Project activities and identification of potential environmental and social impacts and key stakeholders

Project activity	Contents	Potential environmental impacts	Potential social impacts	Safeguard tools
Rehabilitation	river dredging with a length of 35.0km and construction of Shouchang River Basin monitoring system, etc.	of construction camps and impacts of transportation vehicles; these impacts are temporary and insignificant and only limited to a very small scope of the construction areas and will disappear as the construction activities end. Temporary impacts on traffic from construction activities. Operation stage: Impacts on hydrological regime from river dike and cofferdam construction are insignificant.		SA RAP
Jiande City Landscaping Afforestation and Forest Form Improvement	Landscaping afforestation and forest form improvement covers a total area of 23935mu, including 5116mu for landscaping afforestation and 18819mu for forest form improvement and, based on the locations of construction sites, 9113mu for Datong Town, 6060mu for Hangtou Town, 1850mu for Shouchang Town, 4732mu for Shouchang Forest Farm and 2180mu for Xin'anjiang Forest Farm.	Construction stage: In the construction stage, forest land reclamation and hole preparation will generate dust, noise and solid wastes and also result in slight soil erosion. These impacts, however, are very temporary and insignificant and limited to a very small part of the construction areas and will disappear as the construction activities end. Operation stage: In the operation stage of the project, certain impacts will arise from forest land culture, fertilization and pesticide application. However, upon the completion of the Project, the entire forest system as well as the biomass and carbon sequestration capacity will be improved.	Temporary land occupation and forestland will have impacts on the land contracting farmers.	EIA ESMP PMP Environmental Codes of Practice for Afforestation SA
Jiande City Municipal Engineering	The subproject is located in 4 towns/townships (communities), namely, Datong Town, Hangtou Town, Xin'anjiang Community and Yangxi Community in Jiande City and including construction of forest fire emergency access roads with a total length of 21km, rehabilitation of 12 bridges and ecological wetland	Construction stage: dusts, wastewater, noise, solid wastes (disposal of debris and construction wastes and setting up of waste disposal sites), soil erosion, impacts of construction camps and impacts of transportation vehicles; these impacts are	Temporary and permanent land occupation	EIA ESMP ECOP for Small Civil Works ECOP for Road Construction

Table 2.2-1 Project activities and identification of potential environmental and social impacts and key stakeholders

Project activity	Contents	Potential environmental impacts	Potential social impacts	Safeguard tools
	construction with a total area of 16247.2m^2 in Hangtou Town. Phase I expansion works of Shouchang WWTP involves a treatment capacity of 5000m^3/d.	temporary and insignificant and only limited to a very small scope of the construction areas and will disappear as the construction activities end. Temporary impacts on traffic from construction activities. Operation stage: Impacts from tail water and odor of WWTP. Impacts of the operation and maintenance of Hangtou Wetland.		SA RAP
Jiande City Agricultural NPS Pollution Control	The construction sites of the subproject includes 34 villages of Datong Town, 18 villages of Hangtou Town and 23 villages of Shouchang Town, totally 75 villages in 3 towns and townships. (1) Extensive application of organic fertilizers and soil-based formulated fertilizer: continuous extension of organic fertilizers and formulated fertilizers for 6 years in 3 towns in the project area with a volume of 213000 tons for organic fertilizer and 10800 tons for formulated fertilizers. (2) Green pest management: Solar vibration frequency insecticidal lamps and sticky boards will be applied extensively for food crops, fruit orchards and tea gardens in the project area. The solar vibration frequency insecticidal lamps will be applied in food crops, orchards and tea gardens in the project area. (3) The NPS pollution control for livestock and poultry breeding involves 20 livestock and poultry breeding households and comprises of two parts, namely, feces treatment infrastructure improvement and reconstruction and expansion of pig house fermentation bed and ancillary	Construction stage: Construction of the ecological interception works and livestock waste treatment infrastructure will generate dusts, wastewater, noise, solid wastes. These impacts are temporary and insignificant and only limited to a very small scope of the construction areas and will disappear as the construction activities end. Operation stage: Application of formulated fertilizers and organic fertilizers and implementation of IPM will help reducing usage of chemical fertilizers and pesticides and strengthening of recovery of pesticide packaging materials will help reducing agricultural NPS pollution.	Land occupation and subsidy of formulated fertilizer will have impacts on farmers.	EIA ESMP PMP ECOP for Small Civil Works SA

Table 2.2-1 Project activities and identification of potential environmental and social impacts and key stakeholders

Project activity	Contents	Potential environmental impacts	Potential social impacts	Safeguard tools
	facilities. (4) Ecological ditch construction with a total length of 56207m.			

2.2.2 Scope of assessment

In order to make sure that the assessment is conducted in a more scientific and site-specific way, spatial scope for environmental elements baseline survey, impact prediction and assessment, and accumulative impact assessment are identified for the project implementation and associated facilities, based on the nature of the project, regional environmental characteristics, impact characteristics, World Bank requirements, national technical guidelines, and lessons learned and experience gained from similar domestic projects. They are summarized in Table 2.2-2.

The scope of assessment for the Project covers not only the scope required by domestic technical guidelines, but also the relevant activities to be considered according to the World Bank Safeguard Policies, including waste disposal sites to be set up for the dredging activities, the hydropower station, irrigation canals, county roads, provincial roads and underground facilities to be involved in the construction works, the Lovers' Valley Scenic Area and Jiupao Scenic Area as well as the rivers and reservoirs serving as water intakes for the WTPs and the construction camps, construction access roads neeeded for the main works as well as the 8 WTPs involved in the link project of Chun'an County Pipeline Extension Project, Hangzhou Lijia Environment Service Co., Ltd., Jiande City Domestic Solid Waste Landfill, Jiande Yitian Microbial Organic Fertilizer Co., Ltd., etc..

In terms of timeframe, the scope of prediction and assessment over the various elements covers both the construction stage and operation stage.

Table 2.2-2 Spatial scope of assessment

Elements	Spatial scope	
	Baseline survey	Impact assessment
Surface water	Rivers and reservoirs involved in the project construction and rivers for discharge of tail water from Shouchang WWTP; rivers and reservoirs serving as water intakes for Shouchang WTP	Shouchang River: all the river sections and reservoirs affected by the construction activities downstream and within a 2km section downstream of the wastewater discharge outlet.
Ambient air	Site of the expansion works of Shouchang WWTP; Jiande Municipal Landfill as a linked project of the Project	Areas within a distance of 50m from the construction sites of the Project; Areas within a distance of 50m from the boundaries of the construction camps, construction access roads and waste disposal sites of the temporary works under the Project; Areas within a distance of 500m from the boundary of the proposed Shouchang WWTP; Areas within a distance of 100m from the linked projects of Jiande Municipal Landfill and Hangzhou Lijia Environmental Service Co., Ltd.

Table 2.2-2 Spatial scope of assessment

Elements	Spatial scope	
	Baseline survey	Impact assessment
Acoustic environment	Villages, towns and institutions at or around the project sites	Areas within a distance of 30m from the boundary of the construction sites
Ecological environment	Terrestrial ecological environment: areas within a distance of 200m on both banks of the rivers and reservoirs affected by the Project; areas within a distance of 200m outside the construction sites of Shouchang WWTP and along the pipelines; Aquatic ecological environment: rivers and reservoirs affected by the project and Qiandao Lake.	Terrestrial ecological environment: areas within a distance of 200m on both banks of the rivers and reservoirs affected by the Project; areas within a distance of 200m from the boundary of stockpiling sites of surface soil and construction wastes; areas within a distance of 200m from the boundary of the other construction sites. Aquatic ecological environment: rivers and reservoirs affected by the project and Qiandao Lake.
Social environment	Towns, townships, farmers, forest farms, livestock and poultry farms and hydropower stations, irrigation canals, county roads, provincial roads and underground facilities to be involved in the construction works, the Lovers' Valley Scenic Area and Jiupao Scenic Area involved in the project construction.	Towns, townships, farmers, forest farms, livestock and poultry farms and hydropower stations, irrigation canals, county roads, provincial roads and underground facilities to be involved in the construction works, the Lovers' Valley Scenic Area and Jiupao Scenic Area involved in the project construction.

2.2.3 Identification of key targets for environmental protection

According to the domestic laws and regulations for EIA and World Bank Safeguard Policy, the specific targets of environmental protection likely to be affected during the implementation of the Project are screened in association with the level of impacts that the sensitive sites may receive from the Project. See Table 2.2-3 for detail.

1. Survey of water environment protection objects

The key objects of protection of water environment mainly include reservoirs and rivers involved in water intake, river rehabilitation and WWTP tail water discharge under the Project. The rivers involved in Chun'an County are Wuqiangxi Stream, Yuchuanxi Stream, Liuduyuan River, Shangwuxi Stream, Zitong River and Xin'anjiang Reservoir; the water bodies involved in Jiande City mainly include Shouchang River, Datongxi Stream, Wulongxi Stream and their tributaries. See Table 2.2-3 for detail.

Table 2.2-3: Key Objects of Surface Water Environment Protection in the Project

SN	Objects of protection	Nature of protection
1	Tongshanxi Stream	Water source for Fengshuling New WTP
2	No. 3 open diversion channel of Guanchuan Hydropower Station	Water source for Baima WTP
3	Yanjia Reservoir	Water source for Wangfu WTP
4	Yejiayuan Reservoir	Water source for Yejia WTP
5	Xin'anjiang Reservoir	Water source for Zitong No. 2 WTP and Weiping WTP
6	Wuqiangxi Stream (Huixi Stream)	Water source for Xiashan WTP
7	Qiuyuanxi Stream	Water source for Pingmen WTP
8	Shouchang River	Water quality of the receiving water body of Shouchang WWTP
9	Wuqiangxi Stream, Yuchuanxi Stream, Liuduyuan River, Shangwuxi Stream, Zitongyuan River and their tributaries in Chun'an County; Shouchang River, Datongxi Stream and Wulongxi Stream and their tributaries in Jiande City	Water quality of rivers involved in the dike construction and river dredging subprojects

2. Survey of air and acoustic environment protection objects

The key objects of protection of air and acoustic environment under the Project mainly include villages and residential areas along the construction sites of the Project. The construction impacts from the construction works of dike and revetment construction, river rehabilitation and water transmission pipelines under the Project are short and insignificant and the key objects of protection are villages around the WWTP, WTP and pump stations as detailed in Table 2.2-4.

3. Survey of social impact protection objects

The key objects of protection of social impacts under the Project include 13 tombs, 4 hydropower stations, 40 irrigation channels and county highways, provincial highways and underground facilities, the Lovers' Valley and the Jiupao Scenic Areas to be interfered by the project as detailed in Table 2.2-5.

Table 2.2-4 Objects of atmospheric and noise environment protection

Name of environmentally sensitive objects			Related component	Nature	Direction	Distance (m)	Basic information of scope of impacts	Impact factor
Town / township	Administrative Village	Natural village						
Wangfu Township, Chun'an County	Xinhe	Yanjiaping	Wangfu WTP	Residential	S	80	40 households	Noise, dust
		Yanjia		Residential	W	100	210 households	Noise, dust
Zhongzhou Town, Chun'an County	Xiashan	Wangjia	Xiashan WTP	Residential	S	30	15 households	Noise, dust
		Xujia		Residential	S	100	14 households	Noise, dust
Pingmen Township, Chun'an County	Pingmen	Hepu	Pingmen WTP	Residential	SW	100	10 households	Noise, dust
Weiping Town, Chun'an County	Qinkeng	Qinchuan	Weiping WTP booster pump 1	Residential	N	130	10 households	Noise, dust
	Lianhe	Lianhe	Weiping WTP booster pump 2	Residential	N	60	12 households	Noise, dust
	Zhechuan	Longtan		Residential	S	60	15 households	Noise, dust
	Pingcun	Xiangjia	Weiping WTP booster pump 3	Residential	SW	70	20 households	Noise, dust
Shouchang Town, Jiande City	Datangbian	Hecun	Phase I expansion of Shouchang WWTP	Residential	E	145	50 households	Dust, odor
	Shanfeng	Shanfeng		Residential	S	225	10 households	Dust, odor

Table 2.2-5 Objects of protection of social impacts

Administrative region	Name of environmentally sensitive spots	Component	Nature	Impact factor
Fengshuling Town	Guanchuan Hydropower Station	Baima WTP	Hydropower station	WTP intake with a capacity of 600t/d will lead to an annual loss of 59258kwh of power generation capacity and an electricity revenue of CNY 29614.
	Fengshuling Reservoir Power Station	Fengshuling New WTP	Hydropower station	WTP intake with a capacity of 5000t/d will lead to an annual loss of 51956kwh of power generation capacity and an electricity revenue of CNY 25978.
Weiping Town	Yejiayuan Reservoir Power Station	Yejia WTP	Hydropower station	WTP intake with a capacity of 1400t/d will lead to an annual loss of 17647kwh of power generation capacity and an electricity revenue of CNY 8814.
Wangfu Township	Yanjia Reservoir Power Station	Wangfu WTP	Hydropower station	WTP intake with a capacity of 2200t/d will lead to an annual loss of 14443kwh of power generation capacity and an electricity revenue of CNY 7721.
Weiping Town	Underground electricity facility	Weiping WTP expansion works	Underground infrastructure	Impacts from excavation and pipeline laying in the construction stage
Jieshou Township	Underground weak electricity facilities	Jieshou WTP pipeline extension	Underground infrastructure	Impacts from excavation and pipeline laying in the construction stage
Fenkou Town Jiangjia Town	Underground fuel gas pipeline	Fenkou and Jiangjia WTPs pipeline extension	Underground infrastructure	Impacts from excavation and pipeline laying in the construction stage
Fengshuling Town	Da-Guan Pipeline	Baima WTP	Township highway	Road overhaul is planned and actions should be taken to avoid repetitive excavation.
Qiandaohu Town	No. 06 Provincial highway	Pingshan WTP pipeline extension	provincial highway	Pipe jacking of 2 underpasses will affect traffic.

Table 2.2-5 Objects of protection of social impacts

Administrative region	Name of environmentally sensitive spots	Component	Nature	Impact factor
Wenchang Town	No. 05 Provincial highway	Qiandaohu WTP pipeline extension	provincial highway	Pipe jacking of 2 underpasses will affect traffic.
Qiandaohu Town	County highway(X704)	Pingshan WTP pipeline extension	county highway	Road overhaul is planned and actions should be taken to avoid repetitive excavation.
Pingmen Town	County highway(X727)	Pingmen WTP pipeline extension	county highway	Pipeline excavation and backfill in the construction stage will affect local traffic and traffic condition in Jiupao Scenic Area.
Xin'anjiang Community, Chun'an County	Lovers' Valley Scenic Area	Jiande Forest Zone emergency response access road	Scenic spot	Excavation activities in the construction stage will affect accessibility of the scenic spot.

Irrigation ditches to be affected in the construction stage

Village	Construction works	Type of land use	Area of irrigation (mu)	Water consumption (m^3/year)	Impact factor
Chun'an County					
Xinhe Village, Wangfu Township	rehabilitation of ditches	dry land	50	2300	rehabilitation of irrigation channels will affect farmland
Longyao Village, Fenkou Town	restoration of ditches	dry land	10	500	
Longyuan Village, Fenkou Town	restoration of ditches	dry land	35	1700	
Huiyuan Village, Langchuan Township	rehabilitation of ditches	dry land	19	900	
Baojia Village, Langchuan Township	restoration of ditches	dry land	85	3900	
Duchuan Village, Weiping Town	restoration of diches170m	dry land	47	2200	
Wenchang Village, Wenchang Town	rehabilitation of diches450m	dry land	32	1500	
Sunjiawu, Jiangjia Town	restoration of diches107m	dry land	8	400	

Table 2.2-5 Objects of protection of social impacts

Administrative region	Name of environmentally sensitive spots	Component	Nature	Impact factor	
Sunjiawu, Jiangjia Town	restoration of diches205m	dry land	12	600	
Shangwangquan, Jiangjia Town	restoration of ditches	dry land	20	1000	
Aiguo Village, Yaoshan Township	rehabilitation of ditches 145m	dry land	76	3500	
Kantou Village, Pingmen Township	rehabilitation of ditches 20m	dry land	17	800	
Banxia Village, Linqi Town	Drainage ditch: 78m	dry land	21	1000	
Yecun, Zhongzhou Town	rehabilitation of ditches	dry land	16	700	
Changgeng Village, Zhongzhou Town	restoration of ditches	dry land	115	5200	
Weishan Village, Fenkou Town	restoration of ditches	dry land	96	4300	
Sixia Village, Fenkou Town	restoration of ditches	dry land	94	4200	
Zhangcun, Jiangjia Town	rehabilitation of ditches	dry land	43	2000	
Guocun, Jiangjia Town	restoration of ditches	dry land	38	1700	
Yingfeng, Jiangjia Town	restoration of ditches	dry land	38	1700	
Yingjiawu, Jiangjia Town	restoration of ditches	dry land	20	900	
Muwang Village, Jiangjia Town	rehabilitation of ditches	dry land	38	1700	
Huangqiao Village, Jiangjia Town	restoration of ditches	dry land	116	5200	
Fulin Village, Jiangjia Town	restoration of ditches	dry land	32	1400	
Chicheng Village, Jiangjia Town	restoration of ditches	dry land	27	1200	
Sanzhou (Guojia) , Weiping Town	restoration of ditches	dry land	22	1000	
Yejia Village, Weiping Town	restoration of ditches	dry land	67	3000	
Yangjiaban Village	restoration of ditches	dry land	143	6400	
Hongyin Village	restoration of ditches	dry land	55	2400	
Jiande City					

Table 2.2-5 Objects of protection of social impacts

Administrative region	Name of environmentally sensitive spots	Component	Nature	Impact factor	
Hangtou Village, Hangtou Town	Cofferdam construction	Dry land	50	2400	Farmland irrigation will be affected during cofferdam construction.
Wulong Village, Hangtou Town	Cofferdam construction	Dry land	80	4000	
Dadiankou Village, Hangtou Town	Cofferdam construction	Dry land	60	2900	
Hangchuan Village, Hangtou Town	Cofferdam construction	Dry land	100	5000	
Shimuling Village, Hangtou Town	Cofferdam rehabilitation	Dry land	20	1000	
Wenjia, Shangma Village, Datong Town	Cofferdam construction	Dry land	30	1400	
Zhenyuan Village, Datong Town	Cofferdam construction	Dry land	100	4800	
Songxi Village, Datong Town	Cofferdam rehabilitation	Dry land	20	1000	
Chaoyang Village, Datong Town	Cofferdam construction	Dry land	60	3000	
Qingtan Village, Datong Town	Cofferdam construction	Dry land	50	2400	
Panshan Village, Datong Town	Cofferdam construction	Dry land	60	2900	

Information of Monitoring Sites of Sediments Complying with Class III Soil Environment Quality Standard

Village or river	Construction works	Dredging length (km)	Dredging volume (m^3)	Monitoring site	Impact factor
Changning Village, Zitong Town, Chun'an County	River rehabilitation and dredging for Zitongyuan River	2	1800	No. 1 and No. 2 monitoring site of Zitongyuan River	According to the Soil Environment Quality Standard (GB15618-1995), the dredging sediments comply with Class III standard and are only usable as forest land soil and delivered to Changning Village Construction Waste Landfill for disposal.
Datong Town, Jiande	River dredging of	5.13	1250	Monitoring site of	According to the Soil Environment

Table 2.2-5 Objects of protection of social impacts

Administrative region	Name of environmentally sensitive spots	Component	Nature	Impact factor	
City	Zhenyuanxi Stream			Zhenyuanxi Stream	Quality Standard (GB15618-1995), the dredging sediments comply with Class III standard and are only usable as forest land soil. The sediments are not used for site leveling in the industrial parks of Datong Town and Hangtou Town.
Hangtou Town, Jiande City	River dredging of Shimulingxi Stream	2.3	2000	Monitoring site of Shimulingxi Stream	
Hangtou Town, Jiande City	River dredging of Wulongxi Stream	13.1	1050	Monitoring site of Wulongxi Stream	

3. Due Diligence of Linked Projects

3.1 Linked Project Screening

According to the project appraisal, the linked projects of the World Bank Loan Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project mainly include Jiande Municipal Landfill, 8 WTPs and 1 WTP expansion project linked with the pipeline extension component, Hangzhou Lijia Environmental Service Co., Ltd., Jiande Shouchang WWTP, Jiande Yitian Microbial Organic Fertilizer Co., Ltd. and the 22 livestock and poultry farms to be rehabilitated under the Project. See Table 3.1-1 for detail.

Table 3.1-1 Linked Projects Screening Results

Subproject	Linkage with the Project
Chun'an County Rural Drinking Water Safety Improvement	8 WTPs including Linqi Town WTP, Pingshan WTP, Jieshou WTP, Langchuan Township WTP, Fenkou Town WTP, Qiaobei WTP, Jiangjia Town WTP, and Qiandao Lake WTP; the surplus water supply capacity of the existing WTPs will be used to increase the coverage of WTP via pipeline extension. Weiping Town WTP: to be expanded under the Project.
Chun'an County Agriculture NPS Pollution Control	Hangzhou Lijia Environmental Service Co., Ltd.: to receive waste pesticide packaging materials recovered under the Project; Hangzhou Qiandao Lake Wuxi Agriculture Development Co., Ltd., Hangzhou Qiandao Lake Tianping Agriculture Development Co., Ltd. and Chun'an County Weizheng Family Farm, the three large-scale livestock and poultry farms, will be improved under the Project by adding liquid storage tank and drip irrigation facilities at the digestion sites.
Jiande City Municipal Engineering	Shouchang WWTP: to be expanded under the Project. Jiande Municipal Domestic Solid Waste Landfill: Sludge generated by Shouchang WWTP is delivered to this landfill for disposal.
Jiande City Agricultural NPS Pollution Control	19 livestock and poultry farms: to be enhanced and improved under the Project. Jiande Yitian Microbial Organic Fertilizer Co., Ltd.: an enterprise engaged in feces digestion and organic fertilizer manufacturing.

3.2 Due Diligence

3.2.1 WTPs

1. Linqi Town WTP

Built in 2015 with a design capacity of 3500m^3/d and an actual capacity of around 2200m^3/d, Linqi Town WTP still has a surplus water supply capacity. Pingmen River, as the WTP's water source with an annual runoff of 17468.63m^3, has an abundant water reserves and excellent water quality. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

This linked project has passed the environmental protection acceptance test and the sludge generated from this linked project is stored in the sedimentation tanks and cleared on a periodical basis by the authorized sanitation teams. Domestic sewage is treated in septic tanks and then discharged into the sewers and finally into the WWTP of Linqi Town. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

2. Pingshan WTP

Built in 2004 with a design capacity of 30000m^3/d and an actual capacity of around 21000m^3/d, Qiandaohu Town Pingshan WTP has Xin'anjiang Reservoir as its water source with abundant reserve and excellent water quality. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

This linked project has passed the environmental protection acceptance test and the wastewater generated from this linked project is directly discharged into the sewer network and no sludge is generated. Domestic solid wastes are removed by the sanitation teams with authorization. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

3. Jieshou WTP

Jieshou WTP has a design capacity of 5000m^3/d and has Xin'anjiang Reservoir as its water source with abundant reserve and excellent water quality. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP is not yet put into production and operation.

The EIA procedures have been fulfilled for this linked project and sludge and domestic solid wastes are removed by the sanitation teams with authorization. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

4. Langchuan Township WTP

With a design capacity of 6000m^3/d and an actual capacity of around 1000m^3/d, Langchuan Township WTP still has a surplus water supply capacity. Linjiawu Reservoir, as the WTP's water source with a total capacity of 1,183,800m^3, has an abundant water reserves and excellent water quality. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

This linked project has passed the environmental protection acceptance test and the sludge generated from this linked project is stored in the sedimentation tanks and cleared on a periodical basis by the authorized sanitation teams. Domestic sewage is treated in septic tanks and then discharged into the sewers and finally into nearby farmland for fertilization. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

5. Fenkou Town WTP

Built in 1992 with a design capacity of 15000m^3/d and an actual capacity of around 12000m^3/d, Fenkou Town WTP has a surplus water supply capacity. Xiayuan Reservoir, as its water source with abundant reserve and excellent water quality, has a total capacity of 13,520,000m^3. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

Built years ago, this project was not required to fulfill any EA approval procedure upon the commencement of its operation. According to the latest Catalog for Management of EIA Classification of Construction Projects and EIA review and approval requirements of China, it is not necessary for this linked project to develop EIA documents; and the plant has fulfilled the record filing and registration procedure at the local EPB per the requirements. Wastewater is discharged into the municipal sewage pipelines and no sludge is generated. Domestic sewage is treated in septic tanks before discharged into the sewer system. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

6. Qiaobei WTP

Built in 2017 with a design capacity of 10000m^3/d and an actual capacity of around 600m^3/d, Qiandaohu Town Qiaobei WTP, currently in trial operation, has a surplus water supply capacity and Xin'anjiang Reservoir, as its water source, has abundant water reserve and excellent water quality. This project aims to increase its water supply scope through pipeline extension. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

This linked project has passed the environmental protection acceptance test and the sludge and domestic solid wastes generated from this linked project are removed by the sanitation teams with authorization. Domestic wastewater is treated in septic tanks before discharged into the municipal sewer network.

The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

7. Jiangjia Town WTP

Built in 2014 with a design capacity of 5000m^3/d and an actual capacity of around 1900m^3/d, Jiangjia Town WTP has a surplus water supply capacity and Xin'anjiang Reservoir, as its water source, has abundant water reserve and excellent water quality. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

This linked project has passed the environmental protection acceptance test and the sludge and domestic solid wastes generated from this linked project are removed by the sanitation teams with authorization. Domestic wastewater is treated in septic tanks before discharged into the municipal sewer network. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

8. Qiandao Lake WTP

Built in 2005 with a design capacity of 100,000m^3/d and an actual capacity of around 50,000m^3/d, Qiandao Lake WTP has a surplus water supply capacity and Xin'anjiang Reservoir, as its water source, has abundant water reserve and excellent water quality. Adopting the conventional water purification technology of "pre-chlorination + coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

This linked project has fulfilled the procedures of EIA and environmental protection acceptance and effluent containing sediments discharged from the coagulation and sedimentation processes is discharged via the pipelines into the nearby Nanshan WWTP for treatment. No sludge is generated. Domestic wastewater is treated in septic tanks before discharged into the municipal sewer network and finally into Nanshan WWTP for treatment. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.

9. Weiping Town WTP

Weiping Town WTP was built in 2006 with a design capacity of 100,000m^3/d and an actual capacity of around 2,500m^3/d. Xin'anjiang Reservoir, as its water source, has abundant water reserve and excellent water quality. Adopting the conventional water purification technology of "coagulation + sedimentation + filtering + disinfection", the WTP can achieve an effluent quality complying with the national hygienic standard for domestic drinking water.

This linked project has fulfilled the procedures of EIA and environmental protection acceptance and effluent containing sediments discharged from the coagulation and sedimentation processes is discharged into the municipal sewer network. No sludge is generated. Domestic wastewater is treated in septic tanks before discharged into the municipal sewer network. The audit showed that the plant is being operated in compliance with the applicable

WBG EHS guidelines.

Table 3.2-1: 8 WTPs involved in the Pipeline Extension Works

SN	WTP	Design capacity(t/d)	Treatment process	Water source	Actual water supply capacity(t/d)	Water supply capacity to be increased(t/d)	Environmental protection compliance analysis
1	Linqi Town WTP	3500	coagulation + sedimentation + filtering + disinfection	Jinxianxi River	2200	619	This linked project has passed the environmental protection acceptance test and the sludge generated from this linked project is stored in the sedimentation tanks and cleared on a periodical basis by the authorized sanitation teams. Domestic sewage is treated in septic tanks and then discharged into the sewers and finally into the WWTP of Linqi Town. The plant is being operated in compliance with the applicable WBG EHS guidelines.
2	Pingshan WTP	30000	coagulation + sedimentation + filtering + disinfection	Qiandao Lake	21000	1291	This linked project has passed the environmental protection acceptance test and the wastewater generated from this linked project is directly discharged into the sewer network and no sludge is generated. Domestic solid wastes are removed by the sanitation teams with authorization. The plant is being operated in compliance with the applicable WBG EHS guidelines.

Table 3.2-1: 8 WTPs involved in the Pipeline Extension Works

SN	WTP	Design capacity(t/d)	Treatment process	Water source	Actual water supply capacity(t/d)	Water supply capacity to be increased(t/d)	Environmental protection compliance analysis
3	Jieshou WTP	5000	coagulation + sedimentation + filtering + disinfection	Qiandao Lake	0	1346	The EIA procedures have been fulfilled for this linked project, which, however, has not been put into operation, and sludge and domestic solid wastes are removed by the sanitation teams with authorization. The plant is being operated in compliance with the applicable WBG EHS guidelines.
4	Langchuan Township WTP	6000	coagulation + sedimentation + filtering + disinfection	Linjiawu Reservoir	1000	938	This linked project has passed the environmental protection acceptance test and the sludge generated from this linked project is stored in the sedimentation tanks and cleared on a periodical basis by the authorized sanitation teams. Domestic sewage is treated in septic tanks and then discharged into the sewers and finally into nearby farmland for fertilization. The plant is being operated in compliance with the applicable WBG EHS guidelines.
5	Fenkou Town WTP	15000	coagulation + sedimentation +	Xiayuan Reservoir	12000	611	Built years ago, this plant was not required to fulfill any EA approval procedure upon the commencement of its

Table 3.2-1: 8 WTPs involved in the Pipeline Extension Works

SN	WTP	Design capacity(t/d)	Treatment process	Water source	Actual water supply capacity(t/d)	Water supply capacity to be increased(t/d)	Environmental protection compliance analysis
			filtering + disinfection				operation. According to the latest Catalog for Management of EIA Classification of Construction Projects and EIA review and approval requirements of China, it is not necessary for this linked project to develop EIA documents; and the plant has fulfilled the record filing and registration procedure at the local EPB per the requirements. Wastewater is discharged into the municipal sewage pipelines and no sludge is generated. Domestic sewage is treated in septic tanks before discharged into the sewer system. The audit showed that the plant is being operated in compliance with the applicable WBG EHS guidelines.
6	Jinxianwan Qiaobei WTP	10000	coagulation + sedimentation + filtering + disinfection	Qiandao Lake	600	651	This linked project has passed the environmental protection acceptance test and the sludge and domestic solid wastes generated from this linked project are removed by the sanitation teams with authorization. Domestic wastewater is treated in septic tanks before discharged into the municipal sewer

Table 3.2-1: 8 WTPs involved in the Pipeline Extension Works

SN	WTP	Design capacity(t/d)	Treatment process	Water source	Actual water supply capacity(t/d)	Water supply capacity to be increased(t/d)	Environmental protection compliance analysis
							network. The plant is being operated in compliance with the applicable WBG EHS guidelines.
7	Jiangjia Town WTP	5000	coagulation + sedimentation + filtering + disinfection	Qiandao Lake	1900	1573	This linked project has passed the environmental protection acceptance test and the sludge and domestic solid wastes generated from this linked project are removed by the sanitation teams with authorization. Domestic wastewater is treated in septic tanks before discharged into the municipal sewer network. The plant is being operated in compliance with the applicable WBG EHS guidelines.
8	Qiandao Lake WTP	100000	pre-chlorination + coagulation + sedimentation + filtering + disinfection	Qiandao Lake	50000	1003	This linked project has fulfilled the procedures of EIA and environmental protection acceptance and effluent containing sediments discharged from the coagulation and sedimentation processes is discharged via the pipelines into the nearby Nanshan WWTP for treatment. No sludge is generated. Domestic

Table 3.2-1: 8 WTPs involved in the Pipeline Extension Works

SN	WTP	Design capacity(t/d)	Treatment process	Water source	Actual water supply capacity(t/d)	Water supply capacity to be increased(t/d)	Environmental protection compliance analysis
							wastewater is treated in septic tanks before discharged into the municipal sewer network. The plant is being operated in compliance with the applicable WBG EHS guidelines.
9	Weiping Town WTP	2500	coagulation + sedimentation + filtering + disinfection	Qiandao Lake	2500	2500	This linked project has fulfilled the procedures of EIA and environmental protection acceptance and effluent containing sediments discharged from the coagulation and sedimentation processes is discharged into the municipal sewer network. No sludge is generated. Domestic wastewater is treated in septic tanks before discharged into the municipal sewer network. The plant is being operated in compliance with the applicable WBG EHS guidelines.

Note: Weiping Town WTP is an expansion work for the purpose of centralized water supply. The other WTPs are linked with the pipeline extension works and require no expansion thanks to their adequate capacity.

3.2.2 Hangzhou Lijia Environmental Service Co., Ltd.

1) Company overview

Survey shows that transportation and disposal of recovered waste pesticide packaging materials in Chun'an County is carried out by Hangzhou Lijia Environmental Service Co., Ltd. under authorization. Survey shows that, established on 28 February 2010, Hangzhou Lijia Environmental Service Co., Ltd. is a company specialized in transportation and disposal of hazardous wastes and is one of the key projects approved by the State Council in 2004 in the "National Plan for Construction of Facilities for Disposal of Hazardous Wastes and Medical Wastes". Owning two rotary kiln incineration systems respectively having a capacity of 1t/h and 2.4t/h, the Company is capable of treating 32,400 tons of hazardous wastes a year. In addition, it also has wastewater treatment facilities, stabilization and solidification treatment facilities and a 126,000m3 safety landfill. In Year 2016, the Company achieved an actual waste disposal of 31,000 tons.

The Company is capable of treating all hazardous wastes except HW10 and HW15, including medical wastes, waste drugs and medicines, pesticide wastes, organic solvent wastes, dyes, dye wastes, organic resin wastes, photosensitive material wastes, etc.

Analogical estimation based on the usage and recovery of pesticide bottles in Chun'an County shows that 70 tons of waste pesticide packaging materials will be recovered each year after the pesticide packaging waste harmless treatment project is implemented. It only takes 5% of the remaining treatment capacity of the company, which, therefore, can meet the demand of disposal under the Project.

According to the Notice on Printing the List of Key Enterprises for Monitoring and Control in Zhejiang Province in Year 2017 (ZheHuanHan Doc. No. [2017]180), Hangzhou Lijia Environmental Service Co., Ltd. is a company engaged in operation of provincially-controlled hazardous wastes and online monitoring systems are installed at both the exhaust gas and wastewater discharge outlets and interconnected with the EP authority. Zhejiang Provincial Department of Environmental Protection conducts a quarterly supervisory monitoring of this enterprise and discloses the results of monitoring on the official website of Zhejiang Provincial EPD. According to such results, the various pollutants discharged by the Company comply with the standard. In general, the company is being operated in compliance with the applicable WBG EHS guidelines.

2) Status of environmental protection approval

The predecessor of Hangzhou Lijia Environmental Service Co., Ltd. was Phase II Hangzhou Industrial Waste Disposal Project, which was approved on November 28, 2003 by Zhejiang Provincial EPB in its "Letter of Reply on the Review of the Environmental Impact Assessment Report of Phase II Hangzhou Industrial Waste Disposal Project" (ZheHuanJian Letter No. [2003]182 and approved on September 29, 2004 by the State Environmental Protection Administration in its "Letter of Reply to the Review of the Environmental Impact

Assessment Report of Phase II Hangzhou Industrial Waste Disposal Project" (HuanShen [2004]348) and received the environmental protection approval on June 7, 2010 (HuanYan [2010]128).

According to the "Letter of Approval on Variation of the Implementation Entity of Hangzhou Hazardous Waste and Medical Waste Disposal Project Implemented by Hangzhou Dadi Environmental Protection Co., Ltd. (formerly known as Phase II Hangzhou Industrial Solid Waste Disposal Project)" by Zhejiang Provincial Environmental Protection Department (ZheHuanJian Letter No. [2010]43 dated June 12, 2010), the implementation entity of Hangzhou Hazardous Waste and Medical Waste Disposal Project Implemented by Hangzhou Dadi Environmental Protection Co., Ltd. (formerly known as Phase II Hangzhou Industrial Solid Waste Disposal Project) is varied to Hangzhou Lijia Environmental Service Co., Ltd.

In July 2012, Hangzhou Lijia Environmental Service Co., Ltd. received the business license for hazardous waste operation issued by Zhejiang Province Environmental Protection Department and the scope of business operation includes collection, storage and disposal of medical wastes, pesticide wastes, phenolic wastes, surface treatment wastes and other hazardous wastes.

3.2.3 Hangzhou Qiandao Lake Wuxi Agriculture Development Co., Ltd.

1) Construction contents and scope

Breeding scope: 500 pigs for breeding stock, 700 pigs for slaughter quantity, 70 pigs for sows;

Breeding technology: dry collection process;

On-site environment: 1 feces storage tank, 1 liquid storage tank and 1 sedimentation tank; 200 mu land available for local digestion through land transfer;

Feces and wastewater generation per day: Commodity pigs produce dry feces in a unit capacity of 2kg/pig-day, wastewater (urine + pigsty washing wastewater) in a unit capacity of 8kg/pig-day;

Yearly dry feces production: 500×2×365/1000=365 tons/year and a yearly wastewater production of 500×8×365/1000=1460 tons/year.

2) Status of environmental protection approval

The EIA Report of Hangzhou Qiandao Lake Wuxi Agriculture Development Co., Ltd. was approved in 2016 by Chun'an County EPB in its letter No. ChunEPB Letter No. [2016]62 and passed the final environmental protection acceptance of "three simultaneousness" in 2017 in the Approval Letter No. ChunHuanYan 2017-003.

Feces and wastewater treatment methods: (1) Urine: treated through local digestion and used as fertilizer in the self-owned planting base; (2) feces are provided as organic fertilizers to local farmers and the self-owned planting base, complying with the requirements of environmental protection.

Plan of upgrading and improvement to be implemented under the Project: Liquid storage tanks will be constructed in its digestion tank and sprinkler

irrigation facilities and liquid fertilizer pumping and boosting facilities will be installed in the base to realize local digestion of liquid fertilizers of the breeding farm. In general, the company is being operated in compliance with the applicable WBG EHS guidelines.

3.2.4 Chun'an County Weizheng Family Farm

1) Construction contents and scope

Breeding scope: 700 pigs for breeding stock, 1000 pigs for slaughter quantity, and more than 70 pigs for sows;

Breeding technology: dry collection process;

On-site environment: 1 feces storage tank, 1 liquid storage tank; 500 mu land available for local digestion through land transfer;

Feces and wastewater generation per day: Commodity pigs produce dry feces in a unit capacity of 2kg/pig-day, wastewater (urine + pigsty washing wastewater) in a unit capacity of 8kg/pig-day

Yearly dry feces production: 700×2×365/1000=511 tons/year and a yearly wastewater production of 700×8×365/1000=2044 tons/year.

2) Status of environmental protection approval

The EIA Report of Chun'an County Weizheng Family Farm was approved in 2013 by Chun'an County EPB in its letter No. ChunEPB Letter No. [2013]47 and passed the final environmental protection acceptance of "three simultaneousness" in 2016 in the Approval Letter No. ChunHuanYan 2016-008. The technological reform and expansion project of the company was approved in 2017 by Chun'an County EPB in ChunEP Letter No. [2014]4. The reconstruction and expansion works are now completed and in trial operation. In general, the company is being operated in compliance with the applicable WBG EHS guidelines.

Feces and wastewater treatment methods: (1) Urine: treated through local digestion and stored in the liquid storage tanks after wastewater treatment, delivered by liquid fertilizer trucks to local fields for digestion; a part of the wastewater is delivered by liquid fertilizer trucks to the partnership tea garden; (2) feces are provided as organic fertilizers to local farmers, complying with the requirements of environmental protection.

Plan of upgrading and improvement to be implemented under the Project: Liquid storage tanks will be constructed in its digestion tank and sprinkler irrigation facilities and liquid fertilizer pumping and boosting facilities will be installed in the base to realize local digestion of liquid fertilizers of the breeding farm.

3.2.5 Hangzhou Qiandao Lake Tianping Agriculture Development Co., Ltd.

1) Construction contents and scope

Breeding scope: 2900 pigs for breeding stock, 5000 pigs for slaughter quantity, and more than 400 pigs for sows;

Breeding technology: dry collection process;

On-site environment: Large-scale wastewater treatment facility and feces storage tank and liquid storage tank; 700mu land is available for local digestion;

Feces and wastewater generation per day: Commodity pigs produce dry feces in a unit capacity of 2kg/pig-day, wastewater (urine + pigsty washing wastewater) in a unit capacity of 8kg/pig-day

Yearly dry feces production: 2900×2×365/1000=2117 tons/year and a yearly wastewater production of 2900×8×365/1000=8468 tons/year.

2) Status of environmental protection approval

The EIA Report of Hangzhou Qiandao Lake Tianping Agriculture Development Co., Ltd. was approved in 2016 by Chun'an County EPB in its letter No. ChunEPB Letter No. [2012]33 and is now in the process of final acceptance. In general, the company is being operated in compliance with the applicable WBG EHS guidelines.

Feces and wastewater treatment methods: (1) Urine: treated through local and non-local digestion and stored in the liquid storage tanks after wastewater treatment, delivered by liquid fertilizer trucks to local fields for digestion; a part of the wastewater is delivered by liquid fertilizer trucks to the partnership tea garden; (2) feces are sold or provided as organic fertilizers to local farmers and the self-owned planting base, complying with the requirements of environmental protection.

Plan of upgrading and improvement to be implemented under the Project: Liquid storage tanks will be constructed in its digestion tank and sprinkler irrigation facilities and liquid fertilizer pumping and boosting facilities will be installed in the base to realize local digestion of liquid fertilizers of the breeding farm.

3.2.6 Jiande City Domestic Waste Landfill

1. Construction contents and scope

Jiande City Domestic Waste Landfill is located at Fuyilong of Shouchang Town, Jiande City and involves a total land area of 228mu. Covering 9 towns / townships (communities) of Xin'anjiang, Genglou, Yangxi, Lianhua, Shouchang, Xiaya, Datong, Lijia, Hangtou and Daciyan, the Landfill has an average treatment capacity of 239t/d in its design service life and a total landfill capacity of up to 1,900,000m^3, capable of meeting the demand of domestic waste treatment for more than 23 years in Jiande City.

2. Status of environmental protection approval

Jiande City Domestic Waste Landfill received the letter of approval (ZheHuanJian Letter No. [2008]67) by the former Zhejiang Province EPB on the Environmental Impact Assessment Report of the Solid Waste Landfill Project At Fuyilong, Shouchang Town in Jiande City".

3. Construction & operation status

The Landfill is constructed in three phases.

Commenced in January 2008 and completed and put into service respectively in July and August the same year, Phase I of the Landfill Project involves a land occupation of 65 mu, a landfill capacity of 210,000m^3 and a design treatment capacity of 239 tons/day for a service life of 5 years. Phase I passed the acceptance on Jan. 21, 2010.

Located in the vicinity of a reservoir with a land occupation of 35mu, a landfill capacity of 251,700m^3 and a service life of 4 years, Phase II was completed in July 2011 and put into service in September 2013 and pass the acceptance on Dec. 29, 2016.

Phase III is an addition to Phase I of the landfill project and involves a total capacity of 152,500m^3. Commenced on Dec. 22, 2016 and completed in October 2017, Phase III project passed the acceptance on Oct. 13 the same year.

4. Environmental protection compliance status

Constructed according to the hygienic landfill standard, Jiande City Domestic Waste Landfill includes a leachate guide and discharge system, a groundwater guide and discharge system, a biogas guide and discharge system and horizontal seepage control facilities and an on-site leachate treatment station. The leachate is treated to meet the standard limits of water pollutant discharge concentration specified in Table 2 in the “Standard on Pollution Control on the Landfill Site of Municipal Solid Waste” (GB16889-2008) before discharged via the sewer pipelines into Shouchang Town WWTP. The project operation complies with the requirements of the EHS Guidelines of the World Bank.

5. Compatibility of treatment capacity

Landfill operations so far have used up approximately a storage capacity of 510,000m^3 and the remaining storage capacity of the landfill site is around 110,000m^3.

Sludge generated by Phase I expansion works of Shouchang WWTP under the Project will be compressed through the gravity concentration + deep dewatering process to a moisture content of ≤60% and the sludge cakes will be transported to Shouchang Landfill for disposal. With a grid residue and sludge volume of approximately 1350 t/a, equivalent to approximately 3.7 t/d, the average treatment capacity of Jiande City Domestic Waste Landfill within its designed service life is 239t/d. Therefore, the sludge landfill volume of the Project only accounts for 1.5% or so of the average treatment capacity of Jiande City Domestic Waste Landfill. In addition, the construction wastes and domestic solid wastes generated in the construction stage and by the construction workers of each subproject and to be transported to and treated by Jiande City Domestic Waste Landfill are of a very insignificant volume. Therefore, the remaining storage capacity of Jiande City Domestic Waste Landfill is capable of satisfying the landfill needs of the Project.

3.2.7 Jiande City Shouchang WWTP

1. Construction contents and scope

Jiande City Shouchang WWTP is located in Shanfeng Village, Shouchang Town of Jiande City with a total area of 30,000 square meters. The wastewater treatment capacity for Phase I was orginally designed as 10,000 m3/d and the WWTP mainly collects the industrial wastewater and domestic sewage from Jiangdong area and Jiangnan old urban area and the industrial zone of Shouchang for centralized treatment. However, during the actual operation, due to the gradual departure of some heavily polluting industries in the development zone, the volume of wastewater interception and sewer storage in the service area of Shouchang WWTP decreased significantly. Therefore, the designed daily treatment capacity of Phase I Project was changed from 10,000 tons to 5000 m3/d during construction.

Considering that the remaining treatment capacity is small at present, it is planned to expand the WWTP under the proposed project, details of which are shown in the relevant subproject descriptions about the expansion of Shouchang WWTP Phase 1.

2. Status of environmental protection approval

In 2007, Zhejiang Province Industrial Environmental Protection Design and Research Institute, authorized by Shouchang Town People’s Government, prepared the Environmental Impact Assessment Report of Jiande City Shouchang WWTP Construction Project, which was approved by the former Zhejiang Province Environmental Protection Bureau in its letter ZheHuanJian No. [2008]7.

With the construction commenced in 2009, the WWTP was completed and officially put into trial operation in 2010. Compared to the original EIA, adjustments were made to the scale of Zhejiang Province Jiande Economic Development Zone based on the needs of urban development. In addition,some heavily polluting industries were gradually moved out of the original development zone, which resulted in significant decrease of collected wastewater within the service area of the existing Shouchang WWTP. Based on the actual situation, Jiande City Shouchang WWTP Phase I was in fact constructed with a treatment capacity of 5,000 m3/d, smaller than the original design of 10,000 m3/d for Phase I as approved in the original EIA. According to the stipulations in the "Law of the People's Republic of China on Environmental Impact Assessment", the project was required to again go through the EIA approval process. In 2013, authorized by the IA, Hangzhou Lianqiang Environmental Engineering Technology Co., Ltd. prepared the Environmental Impact Report for the Construction of Jiande City Shouchang Wastewater Treatment Plant Phase I (with Capacity Adjustment to 5,000m3/d), which was already approved by the Environmental Protection Agency of Jiande City in a document numbered Jianhuanxupi [2013] A020.

3. Construction & operation status

The construction of Jiande City Shouchang WWTP was commenced in 2009, and the WWTP was completed and put into trial operation in 2010. It passed the completion acceptance organized by Jiande City Environmental Protection Bureau in 2017.

Sewer pipeline construction status: The constructed sewage collection pipelines involve a total length of 8.701km with a diameter range of DN300 to DN1000, collecting the domestic sewage from the Jiangnan old urban area and the industrial wastewater from the industrial park in Jiangnan District of Shouchang Town.

4. Treatment process and environmental protection compliance status

The Phase I Project of Jiande City Shouchang WWTP adopts the modified A^2O process and the treated wastewater is subject to UV disinfection to meet Class 1A standard as specified in GB18918-2002 “Pollutant discharge standard for municipal WWTPs” and then discharged via the pipelines into the center of Shouchang River.

According to the comments made upon the completion acceptance of the environmental protection facilities of the Project (Doc. No. Jianhuanjian [2017] 006), the WWTP sludge is dewatered by fiter press and transported to Jiande City Shouchang Landfill for disposal. Results of monitoring show that the concentrations of various pollutants contained in the sludge meet the requirements included in the "Sludge Quality for Mixed Landfill Disposal of Sludge Generated from Municipal Wastewater Treatment Plants" (CJ / T249-2007). The concentration of odor pollutants on the boundary of the WWTP meets the maximum allowable concentration limit of exhaust gas on the WWTP boundary specified in the Pollutant Discharge Standard for Municipal Wastewater Treatment Plants (GB18918-2002).

The monitoring data during operation for the months of January to October 2017 for Shouchang WWTP show that the effluent of Phase I Shouchang WWTP meets Class 1A standard specified in the Pollutant Discharge Standard for Municipal Wastewater Treatment Plants (GB18918-2002) and the tail water is discharged into Shouchang River.

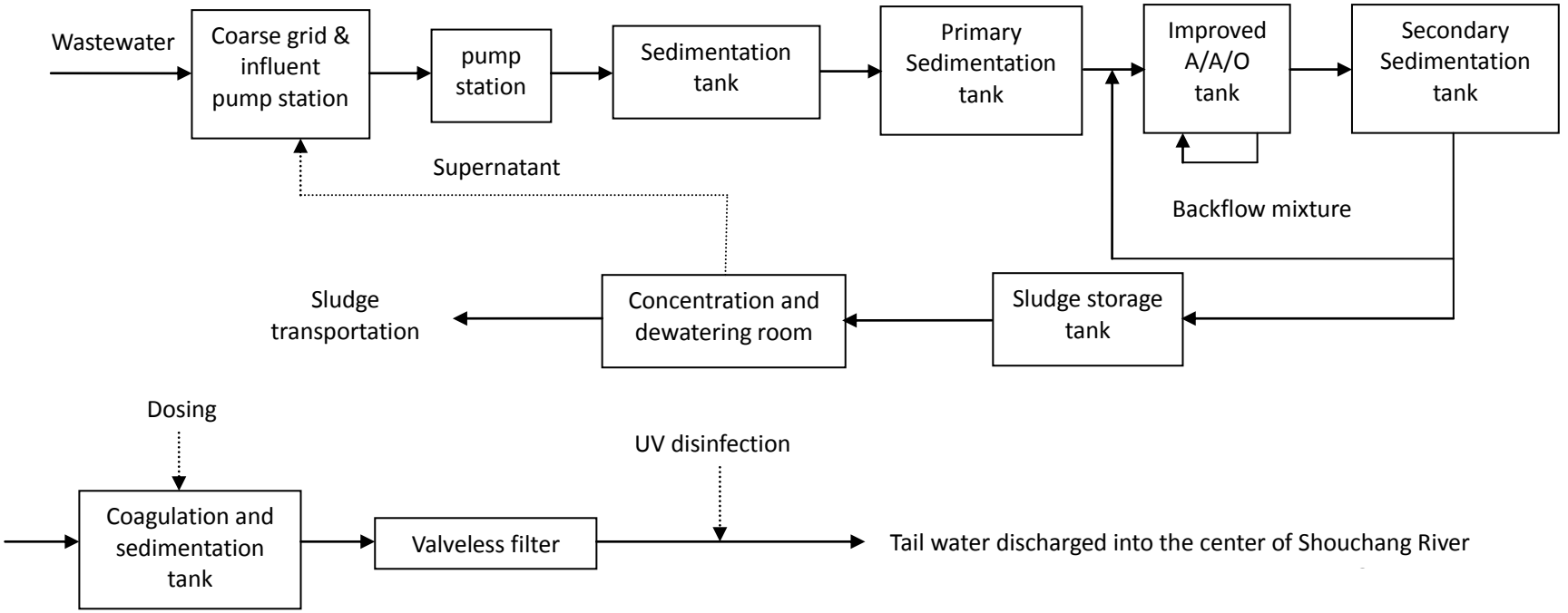


Figure3.2-1: WWTP Treatment Process

5. Summary

Due diligence of Jiande City Shouchang WWTP Phase I shows that Shouchang WWTP was built and put into trial operation in 2010 and Jiande City Water Supply Company is responsible for the operation and management of the WWTP. The WWTP received an average wastewater flow of about 2500 m3/day in 2016, which increased to about 3000 m3/day in 2017. The construction and operation of the WWTP complies with the relevant PRC laws and regulations and the WWTP has been operating under normal and stable conditions in compliance with the WB EHS Guidelines.

3.2.8 Jiande City Yitian Microbial Organic Fertilizer Co., Ltd.

1. Construction contents and scope

Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. was established on Dec.1, 2010 and is located in Dongcun Village, Hangtou Town of Jiande City. With a land occupation of approximately 35,600m^2, the Company utilizes livestock and poultry feces for production of organic fertilizers and produces 100,000 tons of microbial organic fertilizers and 5,000 tons of organic–inorganic compound fertilizer a year.

2. Status of environmental protection approval

The 100,000 t/a Microbial Organic Fertilizer Construction Project of Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. was approved by Jiande City Environmental Protection Bureau on May 4, 2011 in its Circular No. Jianhuanxupi [2011]B135. On Jan. 9, 2014, the 100,000 t/a Microbial Organic Fertilizer Construction Project of Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. passed the final environmental protection acceptance organized by Jiande City ERB. Comments of such acceptance are included in Jianhuanyan(Shou) Doc. No. [2014]001. The permit for pollutant discharge of Hangzhou City was granted on Jan. 17, 2014.

On March 10, 2015, the 5000t/a Organic-inorganic Compound Fertilizer Expansion Project of Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. was approved by Jiande City EPB in its Circular No. [2015]B031.

3. Construction & operation status

The Company’s 100,000t/a microbial organic fertilizer construction project was completed and put into operation in 2012. It has been verified with Jiande City EPB during the survey that no public complaints are received since Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. was put into production and the various measures have been properly implemented and the various pollutants discharged in compliance with the respective standards.

4. Treatment process

(1) Microbial agent fermentation workshop

Microbial agents are produced through three-stage fermentation. The medium is sterilized through autoclaving and the beetle strain is first cultivated and propagated in the shaker at the engineering center and then inoculated into the seed tank at a 10% inoculum concentration for fermentation. Each step of the production process is subject to pollution test and control and the fermented bacterial fluid is transferred to the tank for short-term storage or directly transferred to and used in fermentation production workshop and fertilizer production workshop.

(2) Microbial agent product workshop

Except directly applied in the fermentation and maturity workshop and the fertilizer production workshop, the fermented liquid bacteria is also used for production of microbial agent products using the production technologies of sterilization carrier adsorption, filtering and concentration, spraying and drying based on the different functional strains for fermentation and production.

(3) Pretreatment workshop

Stalk materials delivered into the workshops are cut into 10-15cm long sections in the knife crusher and then transported by the conveyor belt (lift) to the screening machine to remove impurities before transported to the mill and crushed into 0.5-1cm pieces, as the primary products. after natural drying, the moisture content of livestock and poultry feces delivered into the workshop is controlled at 70% to 80% and then forklifted onto the conveyor belt so that the impurities are removed by the screening machine to produce the primary products.

(4) Maturity and fermentation workshop

The maturity and fermentation workshop is a critical part of microbial organic fertilizer production. The primary products are unloaded on the conveyor belt at a certain percentage and then fully mixed in the mixer to adjust the C/N ratio of the primary products and control moisture content before they are further located into the fermentation tank or stacked with a forklift. In the process of agitation and turning, special devices installed on the mixer and the stack turning machine achieve the inoculation of maturity bacteria agent and the mixing and stack-turning cycle is controlled to achieve maturity fermentation.

(5) Fertilizer production and packaging workshop

Forklifts are used to place the mature products onto the conveyor belt at a preset percentage, which are adequately mixed in the mixer to produce powdery and granule fertilizer products. 3 granular microbial organic fertilizer production lines are constructed.

5. Compatibility of feces treatment capacity

To produce 100,000 tons of microbial organic fertilizer in a year requires

90,000 tons of livestock and poultry feces. The Company actually processes approximately 16,500 tons of livestock and poultry feces. It is estimated that the NPS pollution control for livestock and poultry breeding will generate 19,000 tons of livestock and poultry feces a year. Therefore, Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. has the capability of accepting and treating the feces generated under the Project. Organic fertilizers produced by the Company will mainly be sold via tendering by local government and also sold to planting bases on the other provinces.

6. Summary

It is therefore concluded from the due diligence of Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. that the construction and operation of this Company complies with the Chinese laws and regulations and the EIA approval requirements; the various pollutants are discharged according to the respective standard and the project has passed the environmental protection acceptance. The Company's treatment capacity as it is now is able to treat the livestock and poultry feces to be generated from the NPS pollution control for livestock and poultry breeding under the Project. In general, the company is being operated in compliance with the applicable WBG EHS guidelines.

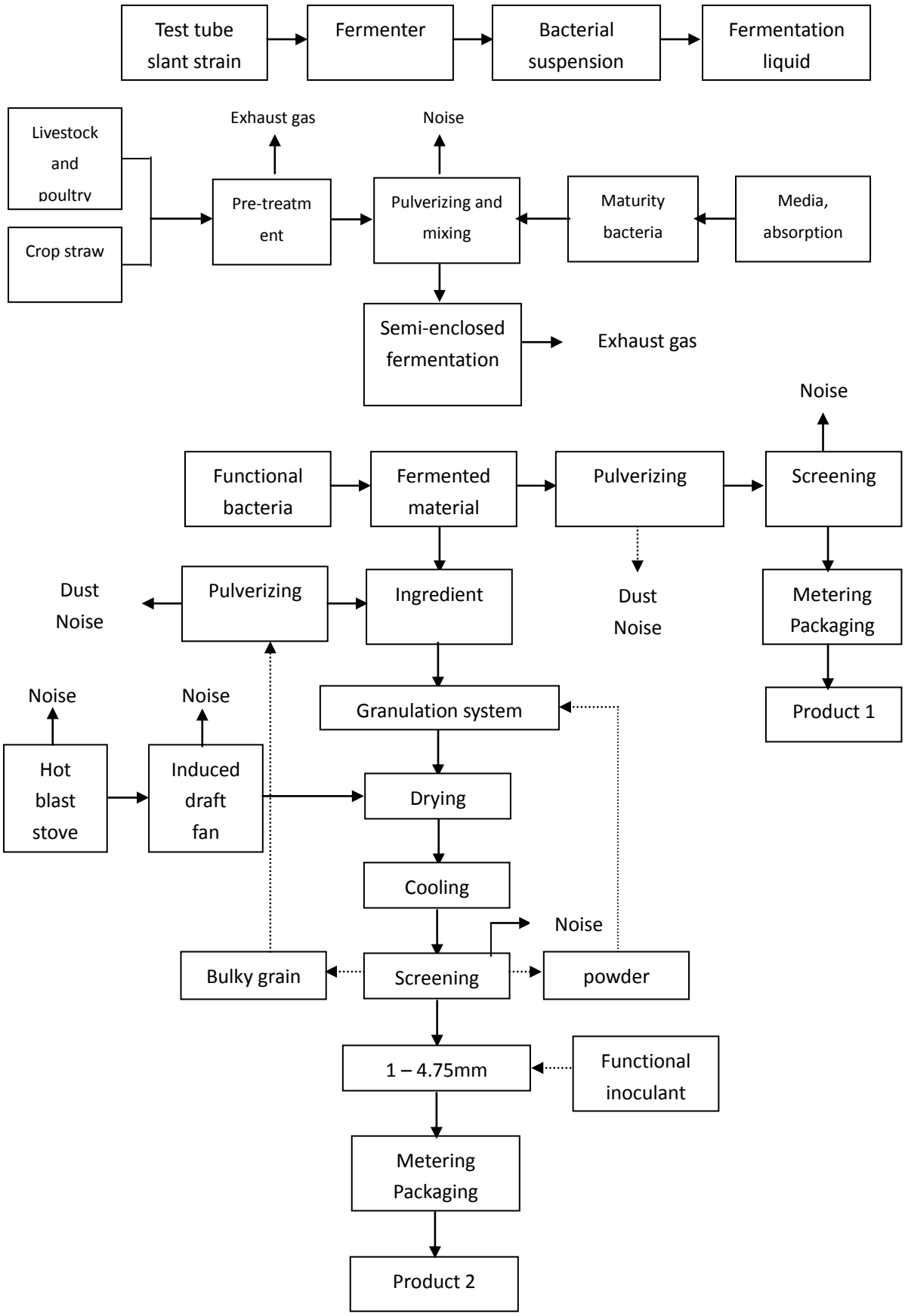


Figure 3.2-2 Production Process of Organic Fertilizers

3.2.9 Survey on livestock and poultry breeding farms to be improved under the Project in Jiande City

In this EIA, a survey on the status quo of the 19 livestock and poultry breeding farms involved in the NPS pollution control for livestock and poultry breeding was conducted. See Table 3.2-2 for the survey results. All the 19 livestock and poultry breeding farms are not located within the areas determined by Jiande City for prohibition of livestock and poultry breeding. The procedures for EIA approval and environmental protection acceptance have been fulfilled for the majority of such farms and are being implemented for a part of such farms (that are of smaller scale, insignificant environmental impacts and are required to get registered according to the EIA classification management requirements of China and no EIA report or statement is required). Corresponding wastewater and feces treatment facilities are constructed. The environmental protection requirements are substantially met. However, due to the continuous deterioration of equipment and upgrading of breeding scale, equipment failure, water leakage and gas leakage occur occasionally for the feces and wastewater treatment facilities, resulting in incomplete treatment of feces and aggravation of load and noncompliant discharge for the digestion site and digestion tanks. Therefore, it is proposed in the Project that the feces and wastewater treatment infrastructure, external fermentation beds and ancillary facilities of the 19 livestock and poultry breeding farms will be improved and upgraded to further enhance the feces treatment capacity.

Table 3.2-2 Status quo survey of the 20 livestock and poultry breeding farms to be improved in Jiande City

SN	Name of breeding farm	Location	Type	Number in stock	Status of EIA approval and acceptance	Land occupation	Existing feces removal method and feces and wastewater treatment facilities	Existing problems and proposed corrective measures
I	Datong Town large-scale livestock and poultry breeding farms							
1	Jiande City Datong Town Wanxing Ecological Breeding Farm	Wanxing Village Datong Town	egg chicken	40000	EIA approved and accepted	6500 ㎡	Artificial collection of chicken feces; having a 80m^2 chicken feces collection tank and a 60m^3 three-partition wastewater treatment tank; feces sold to farmland for digestion.	Chicken manure collection tank and wastewater treatment tank are too small and expansion of manure storage tank and sedimentation tank is planned; in addition, manure collection and transportation vehicles and sewage (fertilizer) tanker will be purchased for manure transportation.
2	Fang Jiangang	Fengban Village Datong Town	egg chicken	30000	Being filed	20 mu	Artificial collection of chicken feces; having a 50m^2 chicken feces collection tank; feces sold to farmland for digestion.	Chicken manure collection tank is too small and storage expansion is planned; construction of new wastewater sedimentation tanks is planned; in addition, sewage (fertilizer) tanker will be purchased for manure transportation.
3	Jiande City Datong Town Linhang	Chengshan Village	egg chicken	27000	Being filed	12 mu	Artificial collection of chicken feces; having a 30m^2 chicken feces	Chicken manure collection tank is too small and storage expansion is

Table 3.2-2 Status quo survey of the 20 livestock and poultry breeding farms to be improved in Jiande City

SN	Name of breeding farm	Location	Type	Number in stock	Status of EIA approval and acceptance	Land occupation	Existing feces removal method and feces and wastewater treatment facilities	Existing problems and proposed corrective measures
	Family Farm	Datong Town					collection tank; feces sold to farmland for digestion.	planned; construction of new wastewater sedimentation tanks is planned; in addition, sewage (fertilizer) tanker will be purchased for manure transportation.
4	Lin Shengxi	Jiangtou Village Datong Town	egg chicken	27000	Filed	6 mu	Artificial collection of chicken feces; having a 40m^2 chicken feces collection tank and a 100m^3 three-partition wastewater treatment tank; feces sold to farmland for digestion.	Chicken manure collection tank is too small and storage expansion is planned; construction of new wastewater sedimentation tanks is planned; in addition, sewage (fertilizer) tanker will be purchased for manure transportation.
5	Jiande City Datong Town Hongye Family Farm Co., Ltd.	Rubo Village Datong Town	egg chicken	25000	Filed	About 15 mu	Four-step cascade cage breeding; using conveyor belt for automatic feces collection; chicken feces directly transported out of site; having no wastewater treatment and temporary storage facilities; feces sold to orchards for digestion.	There are no manure storage, wastewater treatment and temporary storage facilities. New manure storage tank and sedimentation tank are to be constructed.
6	Rao Guoqiang	Xikou	egg	25000	EIA approved	70 mu	Artificial collection of chicken	Chicken manure collection tank is

Table 3.2-2 Status quo survey of the 20 livestock and poultry breeding farms to be improved in Jiande City

SN	Name of breeding farm	Location	Type	Number in stock	Status of EIA approval and acceptance	Land occupation	Existing feces removal method and feces and wastewater treatment facilities	Existing problems and proposed corrective measures
		Village Datong Town	chicken		and accepted		feces; having a 30m^2 chicken feces collection tank; feces directly transported out of site; feces and wastewater supplied to orchards and seedling bases for digestion.	too small and storage expansion is planned; construction of new wastewater sedimentation tanks is planned; in addition, conveyor belt manure removal system will be purchased for manure removal.
7	Huang Changlin	Fengban Village Datong Town	egg chicken	15000	Being filed	5000 ㎡	Artificial collection of chicken feces; having a 30m^2 chicken feces collection tank; feces and wastewater supplied to orchards and seedling bases for digestion.	Chicken manure collection tank is too small and storage expansion and construction of new wastewater sedimentation tanks is planned;
8	Tong Chungen	Fengban Village Datong Town	egg chicken	12000	Being filed	300 ㎡	Artificial collection of chicken feces; having a 20m^2 chicken feces collection tank; feces and wastewater supplied to orchards and seedling bases for digestion.	Chicken manure collection tank is too small and storage expansion and construction of new wastewater sedimentation tanks is planned;
9	Zheng Hongjun	Jiangtou Village Datong Town	egg chicken	12000	EIA approved and accepted	2600 ㎡	Artificial collection of chicken feces; having a 20m^2 chicken feces collection tank; feces and wastewater supplied to orchards and seedling bases for digestion.	Chicken manure collection tank is too small and storage expansion and construction of new wastewater sedimentation tanks is planned;

Table 3.2-2 Status quo survey of the 20 livestock and poultry breeding farms to be improved in Jiande City

SN	Name of breeding farm	Location	Type	Number in stock	Status of EIA approval and acceptance	Land occupation	Existing feces removal method and feces and wastewater treatment facilities	Existing problems and proposed corrective measures
10	Rao Jianzhong	Geling Village Datong Town	egg chicken	12000	Filed	4400 ㎡	Artificial collection of chicken feces; having a 70m^2 chicken feces collection tank; feces and wastewater supplied to orchards and seedling bases for digestion.	There is no wastewater sedimentation tank and new sedimentation tank is to be constructed.
11	He Jianguang	Chengshan Village Datong Town	egg chicken	10000	Filed	30 mu	Artificial collection of chicken feces; having no facilities for temporary storage and treatment of feces and wastewater, which are supplied to orchards and seedling bases for digestion.	There are no manure storage, wastewater treatment and temporary storage facilities. New manure storage tank and sedimentation tank are to be constructed.
12	Hangzhou Kuangye Agriculture Development Co., Ltd.	Panshan Village Datong Town	Sheep	1800	EIA approved and accepted	25 mu	Artificial and dry collection of feces; having an 80m^3 sedimentation tank; sheep feces supplied to farmland for digestion.	Sedimentation tank is too small and expansion is planned for sedimentation tank and discharge pipelines; new manure storage tanks are to be constructed; in addition, wastewater (fertilizer) tankers are to be purchased for manure fertilizer transportation.
II	Hangtou Town livestock and poultry breeding farms							
1	Jiande City Jianke	Shiping	egg	70000	EIA	100 mu	Conveyor belt for collection of	Sedimentation tank is too small

Table 3.2-2 Status quo survey of the 20 livestock and poultry breeding farms to be improved in Jiande City

SN	Name of breeding farm	Location	Type	Number in stock	Status of EIA approval and acceptance	Land occupation	Existing feces removal method and feces and wastewater treatment facilities	Existing problems and proposed corrective measures
	Livestock and Poultry Breeding Co., Ltd.	Village Hangtou Town	chicken		approved, but not accepted		chicken feces; having a 400m^3 sedimentation tank for wastewater treatment; feces directly transported out of site and digested in orchards;	and expansion is planned; There are no manure temporary storage and treatment facilities. New manure storage tank is to be constructed; in addition, manure collection and transportation vehicles, wastewater (fertilizer) tankers and conveyor belt manure removal system are to be purchased for dry manure and wastewater transportation.
2	Jiande City Hangtou Town Kaixiang Egg Chicken Farm	Pengjia Village Hangtou Town	egg chicken	60000	EIA approved and accepted	About 63 mu	Artificial collection of chicken feces; having a 300m^3 sedimentation tank and a 450m^2 feces storage shed (with canopy); feces supplied to orchards and seedling base for digestion.	Sedimentation tank is too small and a new sedimentation tank is to be added; in addition, conveyor belt manure removal system and wastewater (fertilizer) tankers are to be purchased for manure fertilizer transportation.
3	Jiande City Hangtou Town Paishan Egg	Dadiankou Village Hangtou	egg chicken	40000	Filed		Conveyor belt for collection of chicken feces; having a 400m^3 sedimentation tank for wastewater	There is no temporary manure storage and treatment facility. a new storage tank is to be added; in

Table 3.2-2 Status quo survey of the 20 livestock and poultry breeding farms to be improved in Jiande City

SN	Name of breeding farm	Location	Type	Number in stock	Status of EIA approval and acceptance	Land occupation	Existing feces removal method and feces and wastewater treatment facilities	Existing problems and proposed corrective measures
	Chicken Farm	Town					treatment; feces directly transported out of site and digested in orchards;	addition, manure and wastewater collection and transportation vehicles, wastewater (fertilizer) tankers are to be purchased for manure fertilizer transportation.
4	Jiande City Zhengpeng Pig Farm	Yutang Village Hangtou Town	pigs	2800	EIA approved and accepted	80 mu	Artificial collection of feces; having wastewater discharge pipelines, a 500m^3 biogas tank, a 1000m^3 storage tank; 12000m^3 external ectopic fermentation bed; biogas liquid and feces supplied to planting base for digestion.	The existing facilities are aged, out of repair and ineffective, resulting in incomplete treatment of manure and wastewater, External fermentation bed and supporting facilities are to be constructed.
5	Jiande City Zhengchuang Ecological Breeding Farm	Yutang Village Hangtou Town	pigs	2800	EIA approved and accepted	42 mu	Artificial collection of feces; having wastewater discharge pipelines, a 700m^3 biogas tank, a 1000m^3 storage tank; biogas liquid and feces supplied to planting base for digestion	The existing facilities are aged, out of repair and ineffective, resulting in incomplete treatment of manure and wastewater, External fermentation bed and supporting facilities are to be constructed.
6	Jiande City Hangtou Town Yongfeng Pig	Shiping Village Hangtou	pigs	500	EIA approved and accepted	About 10 mu	Artificial collection of feces; having a 100m^3 biogas tank; 300m^3 storage tank; biogas liquid and	The existing facilities are aged, out of repair and ineffective, resulting in incomplete treatment of manure

Table 3.2-2 Status quo survey of the 20 livestock and poultry breeding farms to be improved in Jiande City

SN	Name of breeding farm	Location	Type	Number in stock	Status of EIA approval and acceptance	Land occupation	Existing feces removal method and feces and wastewater treatment facilities	Existing problems and proposed corrective measures
	Farm	Town					feces supplied to tea garden for digestion	and wastewater, External fermentation bed and supporting facilities are to be constructed.
III	Shouchang Town livestock and poultry breeding farms							
1	Jiande City Shouchang Town Xiaoshunling Ecological Breeding Farm	Nanpu Village Shouchang Town	pigs	1000	EIA approved and accepted	/	Artificial collection of feces; having a 100m^2 feces storage shed (with canopy); 600m^3 biogas tank; 300m^3 storage tank; biogas liquid and feces supplied to orchards for digestion.	The existing facilities are aged, out of repair and ineffective, resulting in incomplete treatment of manure and wastewater, External fermentation bed and supporting facilities are to be constructed.

4. Status Quo Survey and Analysis

4.1 Overview of Zhejiang Province

Situated in the south wing of Yangzi River Delta on the southeast coast of China, Zhejiang Province faces the East China Sea on its east and neighbors Fujian Province on its south, and Jiangxi and Anhui provinces on its west and Shanghai and Jiangsu Province on its north. The largest river in the region is Qiantang River, also named Zhe River, a river of twists, giving birth to the name of Zhejiang Province, abbreviated as “Zhe”. The capital city of Zhejiang Province is Hangzhou City.

Known for its complex topography, Zhejiang Province is higher on the southwest and lower on the northeast. The mountain has three parallel ranges from southwest to northeast. The northwest mountain range starts at Huaiyu Mountain on the border of Zhejiang and Jiangxi Provinces and extends to Tianmu Mountain, Qianshangang Mountain, etc.; the middle range starts at Xianxialing Mountain at the border of Zhejiang and Fujian Provinces and extends to Siming Mountain, Kuaiji Mountain, Tiantai Mountain, and turns into Zhoushan Islands in the ocean; the southeast mountain range starts at Donggong Mountain on the border of Zhejiang and Fujian provinces and extends to Dayang Mountain, Kuocang Mountain and Yandang Mountain. Huangmao Peak with an altitude of 1,929 meters within the region of Longquan City is the highest peak in Zhejiang Province. The water bodies in Zhejiang Province mainly include 8 large rivers including Qiantang River, Oujiang River, Lingjiang River, Shaoxi Stream, Yongjiang River, Feiyunjiang River, Aojiang River and Caoejiang River and Beijing-Hangzhou Grand Canal Zhejiang Section. Qiantang River is the largest river in Zhejiang Province and has two headstreams in the north and in the south. The north headstream has a total length of 668 km starting from the source to river estuary, within which, 425 km is within Zhejiang Province; the south headstream has a total length of 612 km starting from the source to river estuary, with entire headstream within Zhejiang Province. Lakes within Zhejiang include 4 famous lakes: Hangzhou West Lake, Shaoxing East Lake, Jiaxing South Lake and Ningbo Dongqian Lake, as well as the largest artificial lake Qiandao Lake after Xin’an River Hydropower Station has been put in use. The terrain in Zhejiang Province can be divided into 6 topographical areas: Zhebei plain, Zhexi middle mountains and low hills, Zhedong low hill area, Jinqu Basin in the middle, Zhenan mountainous area, southeast coastal plain and coastal islands.

Zhejiang Province has 105,500 km^2 of land area, accounting for 1.1% of the national land area, and is one of the small provinces in China. The straight line distance from east to west and south to north is both approximately 450 km. Hilly areas account for 74.63%, water areas account for 5.05% and plain areas account for 20.32% of the land area in Zhejiang, giving birth to the saying of “70% mountains, 10% water and 20% farmland”. Zhejiang Province has a sea area of 260,000 km^2, with 2,878 sea islands larger than 500m^2 and 26 sea islands larger than 100,000 km^2. Zhejiang Province has the largest number of islands in the nation. Among these islands, Zhoushan Islands, with an area of 502.65km^2, is the fourth biggest island in China. Zhejiang Province has 21 sea islands listed into the “2015 China Marine Treasure Islands List”, accounting for 1/5 of all such sea islands.

The regional GDP of Zhejiang Province in 2015 was 4.2886 billion CNY, with an increase of 8% over the previous year. Within which, the added value of primary industry was 183.3 million CNY, the added value of secondary industry was 1.9707 billion CNY, the added value of tertiary industry was 2.1347 billion CNY, with an increase of 1.5%, 5.4% and 11.3% over the previous year, respectively. The added value of tertiary industries accounted for 65.7% of GDP. The ratio of the added value of primary, secondary and tertiary industries was adjusted from 4.4:47.7:47.9 to 4.3:45.9:49.8, with the weighted ratio of tertiary industry increased by 1.9 percent. The annual GDP per capita is CNY 77,644 (equivalent to 12,466 USD based on yearly average exchange rate), up by 7.6%.

According to the *Report on the State of Environment in Zhejiang Province* published by Zhejiang Province Environmental Protection Department (ZEPD) in June, 2016, the environmental condition has been largely improved in Zhejiang Province in the year of 2016. The surface water quality in the entire province is good, with some individual tributaries and urban river sections polluted to different degrees and some lakes having the problem of eutrophication to a certain degree, and reservoirs mainly mesotrophic. The water quality at the provincially-monitored water quality sections reaches or is better than Class III surface water quality standard, accounting for up to 77.4% of the rivers in the entire province. 91.1% of the drinking water sources in county levels meet or are above the specified standard.

Figure 4.1-1 Map of Zhejiang Province

4.2 Overview of Qiandao Lake and Xin'an River Watershed

4.2.1 Xin'an River Watershed

1. Overview

Xin'an River is originated from Wugujian Mountain on the border of Xiuning County in Anhui Province and Jiangxi Province (south part of Fengcun Township in Xiuning County, adjacent to Wuyuan County, with an elevation of 1,618.4 meters. Wugujian Mountain is one of the mountain peaks of Wulong Mountain Range which is the extension of Huaiyu Mountain Range to the northwest. Another name is Liugujian Peak: at the southeast of Fengcun Township, adjacent to Wuyuan County, with 1,629.8 meters elevation, which is also the highest peak in Xiuning County, its northeastern side is the source for Xin'an River, which is the first headstream of Qiantang River), including 2 tributaries, with the southern tributary named as Shuai Water (first headstream in modern hydrology) and the northern tributary named as Hengjiang River, the two tributaries joining each other under an old bridge nearby Tunxi District. The river section starting from this junction is named Xin'an River and traditionally the Hengjiang River south to Qian County is the headstream of Xin'an River. The main stream of Xin'an River passes Xiuning County, She County, and flows into Zhejiang Province Xin'anjiang Reservoir at Jiekou. Xin'an River main stream within Anhui province is 242.3 km long, with an area of 6,500 km^2, accounting for 11.9% of the entire watershed area of Qiantang River.

At Jiekou Township in She County, Xin'an River flows into Chun'an County in Zhejiang Province, and joins Lanjiang River at Meicheng Town in Jiande City, from there it is called Tongjiang River, which joins Fenshuijiang River at Tonglu Township in Tonglu County, from there it is called Fuchun River (the section in the region of Tonglu County is called Tongjiang River). Fuchun River flows passing Fuchun County and flows to Wenjianchuan River and joins with Qujiang River in Zhejiang Province, from there it is called Qiantang River. The old names of Xin'an River include Huigang, Qingxi, Shegang. The river has a watershed area of 11,047 km^2 and a main stream of 365 km in length. The river section in Hangzhou City has a watershed area of 5,718 km^2 and a total length of 128 km.

Within the region of Chun'an County in Zhejiang Province, Xin'an River is also named as Huigang. According

to the Year 1985 Zhejiang Province Qiantang River Headstream and Estuary Investigation, the total length of Xin'an River is 373 km, with 82.69 km in the region. The main river course is Xin'anjiang Reservoir and the major tributaries include Tongxi Stream, Liuduyuan River, Jiukengyuan River, Zitongyuan River, Yunyuangang River, Qingpingyuan River and Shangjiayuan River.

Within the region of Jiande City, the tributaries joining Xin'an River include Shouchang River and Lanjiang River. Xin'an River enters the region at Qinkengbu at the west of the city, and flows through Xin'anjiang City urban area from the west to the east, Yangxi Stream, Xixia, Mamu and Yangcun Bridge, and joins Lanjiang River at Meicheng and flows into Fuchun River; the length of river within the region is 41.4 km and the watershed area within the region is 1,291.44 km^2.

In normal years, the annual runoff of Xin'an River into Xin'anjiang Reservoir is 7.23 billion m^3, accounting for 15.4% of the total water volume of Qiantang River (46.799 billion m^3), and the total water production per unit area of 1.12 million m^3, ranked the first in Qiantang River watershed. Shuaishui River has the largest runoff among the various tributaries flowing into Xin'an River, which is 1.808 billion m^3 annually. The second largest is Lianjiang River, and Hengjiang River at the third. In the maximum water year, the runoff into the reservoir is as high as 10.652 billion m^3 (1954) and even in dry year the runoff into reservoir can get as high as 3.874 billion m^3 (1978). According to the monitoring data from Tunxi Station, the largest annual average runoff flow of Xin'an River is 19.9 billion m^3, with annual total runoff of 6.278 billion m^3 and a runoff depth of 2,351mm, appearing in the year of 1954; the smallest annual average runoff flow is 4.81 billion m^3, with annual total runoff of 1.359 billion m^3, and runoff depth of 509mm, appearing in the year of 1978; the variation ratio between years is 4.62, which is one of the smaller ones among all rivers in the whole province.

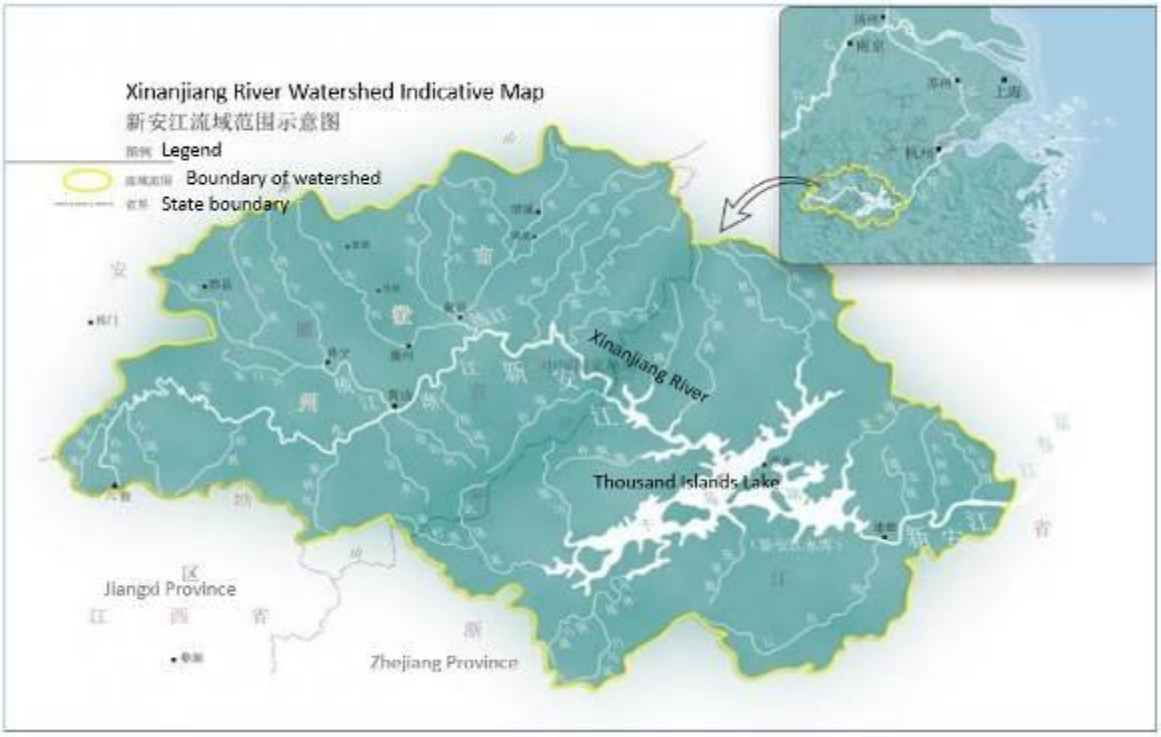


Figure 4.2-1 Xin'an River Watershed

2. Major Issues for Water Resources and Ecological Environment Protection

The socioeconomic development in the upstream watershed of Xin'an River and Qiandao Lake is relatively lagged behind, with unbalanced economic development between regions, prominent conflict between development and protection, water quality in rivers and lakes not in an optimistic state, and agriculture NPS pollution remaining a prominent issue, and infrastructure construction relatively delayed and institutional mechanism requiring stronger efforts of innovation.

3. Measures and Effectiveness of Water Resources and Ecological Environment Protection

The national government and Zhejiang and Anhui Provinces pays highly attention to comprehensive improvement and ecological protection in the Qiandao Lake and Xinjiang River upstream watershed and have taken certain measures in recent years and achieved some good outcomes.

① Increasing financial input and policy supports

Chun'an County has established the first county-level environmental protection fund in the whole province. In September 2011, the Ministry of Finance (MOF) and Ministry of Environmental Protection (MoEP) jointly issued the implementation plan for the pilot project of water environment compensation in the Xin'an River Watershed. In the provincial policy documents successively issued by Zhejiang Province, such as the *Management and Appraisal Methods for Protection of Water Quality at the River Cross Sections on the Border of Different Administrative Regions in Zhejiang Province* and the *Opinions on Strengthening Water Environment Protection of Lakes and Reservoirs*, explicit requirements are raised concerning the protection of key lakes and reservoirs including Qiandao Lake. In Anhui Province, the "Three Red Lines" policy has been enforced for water resource management and the relevant policies have been issued regarding the pollutant receiving capacity of and restrictions on total pollutants discharged into rivers and water bodies in addition to the implementation of the water pollution incident reporting system among others.

② Promoting industrial restructuring

Local government at various levels in the watershed should implement the national and industrial policies, strictly execute the environmental protection access system, prohibit any new energy consuming and high pollution projects, close and eliminate a large number of polluting enterprises. Currently, there is not a single heavy pollution enterprise of papermaking, pesticide and fertilizer production, printing, leather making and medicine production in the area of Qiandao Lake Reservoir in Chun'an County; Huangshan City has been making efforts to protect the water resource and water environment at the source of Xin'an River by raising the access threshold of investment projects.

Local governments have been actively developing the ecological and special industries relying on their own advantages. Chun'an County, for example, has been promoting scientific fishing and ecological culture tourism; Huangshan City has been accelerating its development of special industries including tea, bamboo, silkworm breeding and mulberry growing, fruits, Chinese medicine and aquaculture, etc., and the construction of Huizhou Cultural and Ecological Protection Experiment Zone and Wannan International Tourism and Culture Demonstration Zone and actively promoting the implementation of the National Pilot Project for Comprehensive Reform of the Service Industry, with its hi-tech industry taking an initial shape.

③ Controlling discharge of pollutants

Local governments in the watershed have strengthened pollution control and successfully decreased the COD discharge per capita and per 10,000 GDP. In Chun'an County, 4 centralized WWTPs have been constructed in the urban area; centralized wastewater treatment stations have been constructed in 23 townships; harmless disposal have been generally achieved for domestic solid waste in the urban area with a total treatment capacity of 160 tons/day while a rural solid waste collection system covering the whole county has been constructed. In Huangshan City, 6 WWTPs have been constructed with a total treatment capacity of 145,000 tons/day and a coverage rate of 85%; 3 solid waste harmless treatment facilities have been constructed with a total treatment capacity of 490 tons/day. In the watershed as a whole, all the local governments have strengthened the management and control of industrial pollution and have been promoting the soil testing and formulated fertilizer and comprehensive straw utilization technologies and successively carried out the net box aquaculture retrieving.

④ Implementing ecological protection and construction activities

Thanks to the implementation of Grain-to-Green Project and the Yangzi River Shelter Forest Project, the forest area has been increased; In the reservoir area, efforts of water body conservation have been made by means of seasonal moratorium of fishing, closure of and prohibition of fishing in key water areas, planting silver carp and bighead carps to achieve water conservancy through fishery. Chun'an County has been honored as the National Ecological County and possesses 8 national ecological townships; Jiande City has been honored as the National Model City of Greening and the national ecological demonstration area; Huangshan City has successfully created 13 national ecological townships.

4.2.2 Qiandao Lake[1]

The Qiandao Lake, i.e. the Xin'anjiang Reservoir, is an artificial lake formed by water retained by the water dam constructed as a part of the Xin'an River Hydropower Station, the first large-scale hydropower station independently designed and using equipment independently made by China in 1959. The reservoir dam is 105 m high and 462m long; the reservoir has a length of 150 km, with a maximum width of more than 10 km and a maximum depth of more than 100 m. In normal condition, the reservoir area is approximately 580 km^2, with a water storage of up to 17.8 billion m^3.

The Qiandao Lake is in the shape of tree branches and has an area of 567.50 km^2, containing more than a thousand of islands; the reservoir dam is 108 m high and 462 m long; the watershed area is 10,480 km^2; and the total storage volume of the reservoir is 17.84 billion m^3. The reservoir, 150 km long from south to north and 10km wide from east to west, has a surface water area of up to 580 km^2 and a bank length of 1,406 km. The water depth in front of the big dam of Qiandao Lake reaches 90 meters and the average water depth of the lake is 34 m. The lake bottom mainly comprises of yellow clay; with surface runoff flowing from 25 different streams and rivers into the lake, the Xin'an River is the largest and the longest one of them with the most abundant reserve of water resources, accounting for 57% of the Lake's total influent. The other rivers such as Wuqiangxi Stream, Zhongzhouxi Stream, Jinxianxi Stream and Baimuban Stream, etc. in Zhejiang Province share the remaining 43% of the influent of the Qiandao Lake[2].

4.3 Overview of Regional Environment of Chun'an County

4.3.1 Overview of Natural Environment

1. Geological Location

Chun'an County, affiliated to Hangzhou City in Zhejiang Province, is located in the west part of Zhejiang Province, west to Jiande and Tonglu, north to Quzhou, Changshan, east to Xiuning County in Huizhou and She County, south to Linan. The county is located between north latitude 29°11′ to 30°02′, east longitude 118°20′ to 119°20′. 96.80 km long from east to west and 94.40 km wide from south to north, Chun'an County has a total area of 4,427 km^2, accounting for 4.35% of Zhejiang Province as a whole and is the largest county of Zhejiang Province. Qiandaohu, the county town of Chun'an County, is located in the middle east part of the county 150 km away from Hangzhou City and Huangshan City, respectively.

2. Terrain and Topography

The terrain of Chun'an County is elevated on the periphery and lower area in the center, forming a landform where the low and medium-height hills on the periphery transit toward the low hills in the center. The mountain range belongs to Yuling Mountain, Baiji Mountain and Qianligang Mountain, which are distributed at northeast, northwest and south boundary, with an elevation of about 1,000m. The highest peak is Moxin Peak in Baima Township with an elevation of 1,523m. In the extensive low hill area, the elevation is generally below 400m and Fenkou is lowest region with an average elevation of 110m. Under lasting erosion of external forces in the tectonic movement, a northeast–southeast compact fold and fault line has been developed, which is represented topographically as a series of belt-shaped mountainous and hilly areas from the north to the east.

Wuqiangxi Stream is a mountainous river and the main stream and its tributaries respectively have a gradient of 11.8‰ and 33.3‰~73.9‰ featuring in river courses of twists and curves and with turbulent flow. The runoff is controlled by rainfall and the densely-distributed water systems on both banks are distributed in a shape of tree branches while the river bed bedrock in the valley is mostly exposed directly to the surface; the area below 200m in elevation are mostly supporting river valley terrace, which gradually widens from Shuizhuige Village and reaches a width of about 2km at Zhongzhou and Fenkou. The intercanal terrace has a relatively thick coverage.

Yuchuanxi Stream is a mountainous river and the main stream and its tributaries respectively have a gradient of 13.4‰ and 30.0‰~219‰ featuring in river courses of twists and curves and with turbulent flow. The runoff is controlled by rainfall and the densely-distributed water systems on both banks are distributed in a shape of tree branches while the river bed bedrock in the valley is mostly exposed directly to the surface; the area below 200m in elevation are mostly supporting river valley terrace, which gradually widens from Zhangcun Village and reaches a width of about 2km at Fulin and Yinfeng. The intercanal terrace, with a width of 300m to 500m in

[1] Chun'an County Government website: http://www.qdh.gov.cn/col/col61/index.html;

[2] Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences, *Key Points and Strategies for Thousand Island Lake Pollution Control*, Li Hengpeng, Zhu Guangwei, Chen Weimin, 2016.11.5.

general, has a relatively thick coverage and is mostly developed into arable land and paddy field.

Liuduyuan Stream is a mountainous river and the main stream and its tributaries respectively have a gradient of 8.9‰ and 16.2‰~46.0‰ featuring in river courses of twists and curves and with turbulent flow. The runoff is controlled by rainfall and the densely-distributed water systems on both banks are distributed in a shape of tree branches while the river bed bedrock in the valley is mostly exposed directly to the surface; the area below 200m in elevation are mostly supporting river valley terrace. The intercanal terrace, with a width of 300m to 500m in general from Yejia Village to Weiping Town, has a relatively thick coverage and is mostly developed into arable land and paddy field.

Shangwuxi Stream is originated from Sanjing Peak on the border of Chun'an County and Qujiang District, and the highest peak at the river source has an elevation of 1,281m, with an inclined terrain from southeast to northwest. This area is the canyon terrain formed by the rise of the crust and the cutting of the river valley. As a part of the middle-to-low hill area, the mountain range is deeply affected by tectonic control and extends generally in the direction of northeast.

Zitongyuan Stream is originated from Fuban Peak on the border of Guocun Village in Jiangjia Town and Xintong Township with a terrain inclining from west to east. This area is the canyon terrain formed by the rise of the crust and the cutting of the river valley and belongs to the middle-to-low hill area. Since the mountain range is deeply affected by tectonic control, it extends in general in the direction of northeast.

3. Meteorological and climatic characteristics

Chun'an County is located at the north edge of subtropical monsoon climate zone, characterized by warm and wet weather, rich rainfall, four distinctive seasons, abundant sunlight, relatively more natural disaster weather, distinct regional differences in sunlight, temperature and precipitation. The multiyear average temperature is 17^0C, with the lowest monthly average at 5.8^0C (in January), and the highest monthly average at 28.9^0C (in July) and the lowest historical temperature and the highest historical temperature are respectively is -7.6^0C and 41.8^0C. The annual average frost-free season is 263 days while the average frost season is 23.4 days. The average precipitation is 1,430mm, with 155 rainy days. The average relative humidity is 76% while the average sunshine time is 1,952 hours and the average evaporation is 1,381.5mm. With an annual average wind speed of 2.1 m/s and a static wind frequency of 18%, the wind direction varies with season, with northeast wind prevailing in winter half year, and southeast wind prevailing in summer half year, and northeast wind prevailing in most of the year.

4. Soil characteristics

Soil in Chun'an County is divided into 4 types including red soil, yellow soil, endodynamorphic soil and paddy soil, and 9 subtypes and 30 soil genus. The thickness of soil is generally between 50 - 120 cm; the soil thickness on mountain slope is generally 20 - 30 cm or even thinner. The organic content in soil is 3.11%, nitrogen content is 0.152%, rapidly available potassium is 118.9 mg/kg, phosphorous content is 0.042%, rapidly available phosphorous is 6.6 mg/kg. Soil is mainly subacidic and acid soil; acidity soil accounts for 28.7% and subacidity soil accounts for 56.5% and neutral soil and other types respectively account for accounts for 14.4% and 0.4%.

5. Forest resources

The county's overall forest coverage rate is as high as 75.1%. If the Qiandao Lake's surface area is excluded in the calculation, the forest coverage rate will reach 87.12%, among the highest in China. The total land area for forestry is 5,368,123 mu, including 4,465,820 mu or 81.6% for woodland, 11,508 mu or 1.8% for thin-forest land, 2,696 mu or 0.08% for nursery land, 135,203 mu or 2.1% for no-standing-wood land, 61,602 mu or 1.4% for suitable forest land, and 883 mu or 0.02% for auxiliary forestry production land. The whole county has a planned area of 22,362,585 mu for ecological public interest forest, with 1,938,425 mu, 172,620 mu, and 251540 mu respectively as ecological public interest forest at the national, provincial and municipal levels.

The total storage volume of standing-wood in the county amounts to 19,032,858 m^3, mainly distributed in Chundong, Chunnan and areas surrounding the Qiandao Lake, accounting for approximately 68% of total volume, with the northwestern part relatively less distributed. The whole county has a cash forest area of 664,986 mu, including 201,436 mu hickory, 226,738 mu bamboo and 18,899 mu dogwood. Bamboos are mainly concentrated in Chunnan, accounting for 50% of total bamboo resource in the county. Special economic forests such as hickory, dogwood, and seedless persimmon are mainly distributed in Chunbei area, accounting for approximately 85% of the total resource of these economic plants in the county.

4.3.2 Overview of Social Environment

1. Socioeconomic Development

In 2015, Chun'an County achieved a GDP of CNY 20.742 billion and a per capita GDP of CNY 45,170 based on the registered population. Total agricultural output value was CNY 4.556 billion, including 83,300 tons of grain, 4,523 tons of tea, 3718 tons of cocoon, and 12.29 tons of fruits, and 12,500 tons of freshwater fish. The total industrial output value was CNY 31.38 billion; the output value of industrial sales amounts to CNY 31.284 billion and the production and marketing rate of industrial products is 99.4%. The County achieved a total fiscal revenue of CNY 2.590 billion (including CNY 1.714 billion as local budgetary revenue) and the local budgetary fiscal expense was CNY 5.061 billion. The per capita disposable income for urban residents was CNY 33,432 and the per capita disposable income for rural residents was CNY 14,632. The total number of tourist was 11.22 million person-times and the total tourism revenue was CNY 10.488 billion.

At the end of 2015, the county had a registered population of 459,400 persons, up by 4,000 over the previous year. Included in the registered population are an agricultural population of 376,400 persons and a non-agricultural population of 83,000 persons.

2. Chun'an Underwater City (the Lion City)

Lion City is the county town of the former Sui'an County (merged with Chun'an in 1958). It is located between the Sui'an Islands and Wutoujian along the navigation channel route from Qiandao Lake to Jiangjia in the western part of Zhejiang Province approximately 5 km away from Jiangjia.
In October 1955, the former Ministry of Electric Power Industry developed the Xin'an River Hydropower Station sited at Tongguan at the boundary between Chun'an and Jiande. Later on April 30, 1959, Chun'an and Sui'an merged and became to the current Chun'an County. Later on September 21, the Xin'an River was closed to store water in the reservoir. The two ancient cities with more than a thousand years history, the Lion City and the Hecheng City, settled down to the bottom of the reservoir, and became the current Lion City Underwater City.
The Lion City is not within the scope of the project construction. It is approximately 30 meters below the water surface. The project construction will not have direct impacts on the ancient city.
According to field investigations, there are no other cultural relics and historic sites involved in the scope of project construction.

Figure 4.3-1 Location of Wenyuan Lion City

4.3.3 Ecological Environment Quality Status

In general, the project activities mainly comprise of river rehabilitation, afforestation and WTP and water supply pipeline construction and mainly involve areas surrounding towns and villages. All such project areas are areas with long and high interference of human activities. There are neither rare and endangered animals and plants and their natural habitats nor endangered and critically endangered animals and plants included in the IUCN Red List in the project scope and the EIA scope.

1. Aquatic ecological environment

According to the *13th Five-Year Plan of Fishery Development of Chun'an County*, the current status of the aquatic ecological environment in Qiandao Lake Basin is as follows:

① Phytoplankton

There are 8 phylum of phytoplankton, including Chlorophyta, Bacillariophyta, Cyanophyta, Cryptococcosis, Euglenophyta, Xanthophylls, Dinoflagellates and Chrysophyta, under which there are 87 genus and 241 species. Among them there are 110 species of Chlorophyta, accounting for 45.6% of total species; 73 species of Bacillariophyta, accounting for 30.3%; 37 species of Cyanophyta, accounting for 15.4%; 6 species of Euglena, accounting for 2.5%; 4 species of Cryptococcosis, accounting for 1.7%; 5 species of Dinoflagellates, accounting for 2.1%; 2 species of Xanthophyll, accounting for 0.85%; and 4 species of Chrysophyta, accounting for 1.7%. The concentration of phytoplankton in the lake area is in the range 3.45 - 4.27 * 10^6 per liter with the average at 3.86 * 10^6 per liter. The biomass concentration is in the range 1.47 - 1.61 mg/L, with the average at 1.55 mg/L. The phytoplankton community biodiversity index is in the range 1.86 - 2.15 with average at 1.99; the evenness index is in the range 0.24 - 0.67 with the average at 0.66. Assuming that the dominance species has a dominance index Y larger than 0.02, then the dominant phytoplankton community in the lake include Mesocystis algae, Oocysts, and Scenedesmus under Chlorophyta phylum; Corynebacterium aculeatus, Granuloplane, Microcystis pluvialis, Penicillium, and Trichoderma longicornis under Bacillariophyta plylum; Anabaena flos-aquae, lacustrine chlorella, Pseudanabaena limnetica, Merismopedia sinica, Agassiz Oscillatoria, Aphanizomenon flos-aquae under the Cyanophyta phylum; Polychaete under the Dinoflagellates phylum; and Chroomonas acuta under the Cryptococcosis phylum.

② Zooplankton

There is a total of 82 species of zooplankton in three phylum including rotifers, cladocerans and copepods. Rotifers account for 43 species, or 56.1% of the total number of zooplankton; copepods account for 26 species, or 31.7%; and Cladocera account for 13 Species, or 15.9%. There are 31 dominant zooplankton species in the three phylum, including 14 rotifers, 11 cladocerans and 6 copepods. The concentration of phytoplankton in the lake area is in the range 107.03 - 141.88 per liter with the average at 123.77 per liter. The biomass concentration is in the range 0.49-0.81 mg/L, with the average at 0.62 mg/L. The zooplankton community biodiversity index is in the range 0.45 – 1.87 with average at 1.32; the evenness index is in the range 0.24 - 0.76 with the average at 0.53.

③ Zoobenthos

There are 40 species of Zoobenthos, including 17 species of mollusk, 14 species of arthropods, 8 species of annelids and 1 species of linear animals. The dominant species of Zoobenthos include bellamya purificata under the Gastropoda family and unio douglasiae under the Bivalvia family of mullusc phylum; Limnodriu hoffmeisteri and Branchiura sowerbyi annelids phylum; and Macrobrachium nipponensis under the arthropods phylum. Shallow water benthic animals such as mussels, snails and shrimp are mainly distributed in the growth area of aquatic vascular plant in the convergence area of tributary river and reservoir, or in the shallow water of reservoir bay, or even in the shallow silt region originally used for farmland and vegetable field. They are the most abundant in the aquatic vascular plant growth area. In areas with various forms of shoreline, mountain edge, rocks edge, snail and shrimp are dominant. The deep-water Zoobenthos are mainly the species in the Oligochaeta family of annelids phylum. The annual average concentration of Zoobenthos in Qiandao Lake is 607.5 ± 122.7 per m2, and the biomass concentration is 0.55 ± 0.1 g/m2.

④ Aquatic vascular plant

There are 15 aquatic vascular plants species in 11 families, including 2 emergent plants, 2 floating leaf plants, 5 floating plants, and the rest are submerged plants. Aquatic vascular plants are mainly distributed in the downstream of the river-reservoir junction where the tributaries flow into the reservoir area. Therefore they

have a limited distribution and low coverage, and are mainly distributed irregularly and discontinuously along the shoreline of the reservoir. As Qiandao Lake is an artificial lake with short history, the water depth and water level varies significantly. Therefore it is difficult for aquatic vascular plants to grow.

⑤ Periphyton

There are a total of 74 species (genera), including 36 algae species in four phylum, 7 protozoan species, 12 rotifer species, 2 cladocera species, 1 copepoda species, 3 crustacean species, 1 oligochaetes species, 5 aquatic insects species, 5 molluscs species and 2 other species. The periphyton biomass in the Qiandao Lake are: 613.64 kg/mu annual yield (wet weight) on the surface (0.4-1.6 m), 430.02 kg/mu at 5 m depths and 303.06 kg/mu at 10 m depth. The average biomass (wet weight) is 448.91 kg/mu. The average annual production (wet weight) is 448.91 kg/mu. The water area with periphyton biomass accounts for 80% of the total area. The overall periphyton annual production along the shore is 7,570,200 kg/year.

⑥ Fish species

There are 102 fish species in Qiandao Lake, belonging to 9 orders and 21 families. These include 88 wild fish species, 14 species of tamed fish that escape from cages or boxes. For the whole lake there are 114 fish species of fish, which belongs to 10 orders and 23 families. These include 96 wild fish species, 18 species of tamed fish that escape from cages or boxes. Main economic fish species include Silver carp, Bighead carp, Carp, Crucian carp, Herring, Grass carp, Bream, Elopichthys bambusa, Culter and Xenocypris.

Qiandao Lake is a freshwater fish base for Zhejiang Province and an important part of Chun'an County's economic development. In 2000, there were 10 fish species certified as organic fish by the State Environmental Protection Administration, including Silver carp, Bighead carp, Herring, Grass carp, Xenocypris, Crucian carp, Culter mongolicus, Culter alburnus, Elopichthys bambusa and Silverfish.

In addition, according to the “Ecological and Fishery Functions of the Key Tributaries of Qiandao Lake” (Chen Makang, He Xiguang, and Chen Laisheng), in the Wuqiangxi Stream, Yuchuanxi Stream, Liuduyuan Stream, Shangwuxi Stream, and Zitongxi Stream involved in the project construction, the fish species are mostly in the cyprinid family, mainly Xenocypris, Hemibarbus and Spanish mackerel. The species include carp, Crucian carp, white carp and loach. No rare and migratory fish or spawning site or feeding site are identified in the project area. Most of the local fish are economic fish species that mainly live in the river-reservoir junction and the shoreline areas.

2. Terrestrial Ecological Environment

Chun'an County is in the Northern Subtropical Evergreen Broad-leaved Forest sub-zone, and is located on the border of Zhejiang and Anhui Province with complex terrain forms and superior climatic conditions. The vegetation in Chun’an County is within the Zhejiang/Anhui Cyclobalanopsis glauca and Suanlin forest vegetation zone in the national vegetation zoning. Within the area Pinus massoniana (Pinus massoniana) forest is the most widely distributed, followed by coniferous and broad-leaved mixed forests, with the least being broad-leaved forests. Under the trees the vegetation type includes shrubs and grasslands with height in the range 0.7- 4.0 m. Shrubs are most heavily distributed followed by grasslands. Although in the forest there are various type of ecosystems it is dominated by warm coniferous forest - pinus massoniana forests, with simple structure and low biodiversity.

The ecological systems in the project-related watersheds are mainly agricultural eco-system or forest eco-system. The vegetation resources in the basin are mainly natural secondary vegetation and some artificial vegetation, mostly evergreen broad-leaved, broad-leaved, and coniferous mixed forest.

3. Status quo of soil erosion

Based on the national soil erosion zoning, the project area belongs to the red soil hilly areas in southern China and the soil erosion type is mainly hydraulic erosion. The project area is within the key control area of soil erosion control. According to field investigation results, the main soil erosion type in the project area is hydraulic erosion. The soil disturbance in the project area are for cultivated land use and gardening use. The soil erosion intensity is at minor level. The background value of soil erosion modulus is 300t / (km^2.a).

4.3.4 Environmental Quality Survey and Assessment

4.3.4.1 Water Quality Condition of Qiandao Lake Reservoir

1. Water Quality of Qiandao Lake

The water quality monitoring results from 2011 to 2013 at Jiekou (cross-sections at boundary of Zhejiang and Anhui Provinces), Santan Island, Reservoir dam and Maotoujian were collected and assessed. The target water quality is the Class II standard of the *Surface Water Environmental Quality Standard* (GB3838- 2002).

From Tables 4.3-1 to 4.3-5, for the cross-sections at Santan Island, Reservoir dam and Maotoujian, all indicators except TN (total nitrogen) can meet the Class I standard requirements of the *Surface Water Environmental Quality Standard* (GB3838-2002). At the Jiekou cross-section, all indicators except TN and TP (total phosphorus) can meet the Class II standard requirements of the *Surface Water Environmental Quality Standard* (GB3838-2002) while the TP is between the Class III and Class IV standards. It should be pointed out that usually TP requirements for lakes are different from those for rivers as the TP requirement for lakes are more stringent. If the TP standards for rivers are applied, the TP concentration at Jiekou cross-section can meet the Class II standard of the *Surface Water Environmental Quality Standard* (GB3838-2002). TN is a key indicator used to indicate the eutrophication levels in a lake. The TN is the Qiandao Lake is between Class III and Class IV standards.

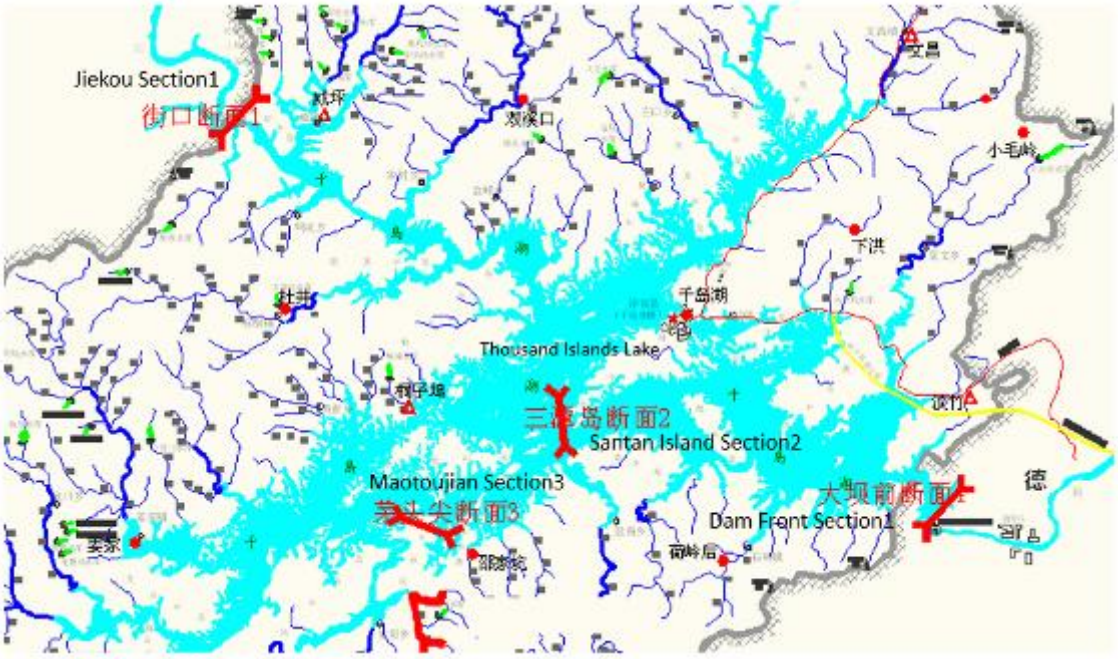


Figure 4.3-2 Thousands Island Lake Reservoir Water Quality Monitoring Sections Indicative Map

2. Eutrophication Trend Analysis

Using comprehensive nutrition state index method, the calculation formula is:

$$TLI(\sum) = \sum_{j=1}^{m} W_j . TLI(j)$$

In the formula: TLI(∑)——comprehensive nutrition state index.

Wj——relevant weight the nutrition state index for the jth parameter.

TLI(j)——nutrition state index representing the jth parameter.

Using ch1a as the basic parameter, the calculation formula for the relevant weight of normalization of jth parameter is:

$$Wj = \frac{r_{ij}^2}{\sum_{j=1}^{m} r_{ij}^2}$$

In the formula：rij——the correlation coefficient for jth parameter with basic parameter ch1a.

M——number of evaluation parameters.

The correlation coefficient rij and rij2 of ch1a of lakes (reservoir) in China with other parameters are listed in Table 2.2-6.

Table 4.3-1 Correlation coefficient rij and $rij^{2※}$ of partial parameters of lakes (reservoir) in China with ch1a.

Parameter	ch1a	TP	TN	SD	COD_{Mn}
r_{ij}	1	0.84	0.82	-0.83	0.83
r_{ij}^2	1	0.7056	0.6724	0.6889	0.6889

※: Quoted from *Environment of Lakes in China* by Jin Xiangcan, rij in the table is from the calculation results of investigation data of 26 major lakes in China.

The calculation formulas for nutrition state index are:

TLI(ch1a) = 10(2.5 + 1.086Lnch1a)

TLI(TP) = 10(9.436 + 1.624LnTP)

TLI(TN) = 10(5.453 + 1.694LnTN)

TLI(SD) = 10(5.118 - 1.94LnSD)

$TLI(COD_{Mn}) = 10(0.109 + 2.661LnCOD_{Mn})$

In the formula：the unit of chlorophyll a(ch1a) is mg/m^3, the unit of transparency (SD) is m, and units for other indexes are mg/L.

Evaluation indexes are: chlorophyll a(ch1a), total phosphate (TP), total nitrogen (TN), transparency (SD) and permanganate index (COD_{Mn}).

Nutrition state grading are:

A series of continuous numbers from 0~100 are used for the grading for the nutrition state of lakes (reservoir):

TLI(∑)<30 (Oligotropher)

30≤TLI(∑)≤50 (Mesotropher)

TLI(∑)>50 (Eutropher)

50<TLI(∑)≤60 (Light eutropher)

60<TLI(∑)≤70 (Middle eutropher)

TLI(∑)>70 (Hyper eutropher)

Under the same nutrition station, the higher the index number, the higher degree of eutrophication.

Eutrophication index value in 2008 is the highest for the years from 2004 to 2013; in the years from 2009 to 2013, the index has been declining slowly; the average eutrophication index for the years from 2004 to 2013 is in the range of 27.9~40.9.

4.3.4.2 Water Quality Condition in Rivers flowing into the Reservoir

The Year 2015 conventional monitoring data (Table 4.3-2) of 23 junction sections in townships in Chun'an County was provided by Chun'an County Environment Monitoring Station. It can be seen from the monitoring results that the water quality in the inflow rivers are good and the monitoring indexes such as pH, CODMn, NH3-N, TP and TN generally meet Class II water quality standard for rivers specified in the *Environmental Quality Standard of Surface Water.*

Table 4.3-2 Surface Water Quality Monitoring Data in Project Area (2015)

Unit: mg/L, except for pH

Administrative District	Name of Section	River	pH	COD_{Mn}	NH_3-N	TP	TN	Water Quality Class
Zhongzhou Town	Xianju Village	Wuqiangxi Stream	7.74	1	0.019	0.015	0.76	Class I
Fenkou Town	Songqi Village	Wuqiangxi Stream	7.64	1.4	0.034	0.016	1.18	Class I
Langchuan Township	Shazhong Village	Langchuanxi Stream	7.7	1.12	0.037	0.026	1.36	Class II
Jiangjia Town	Xishecun Bridge	Yuchuanxi Stream	7.7	1.16	0.02	0.024	1.26	Class II
Jieshou Township	Yaojia	Jinkeng Stream	7.69	1.03	0.071	0.038	2.51	Class II
Zuokou Township	Xianhou Village	Shibaduyuan	7.76	1.12	0.015	0.029	0.96	Class II
Fuwen Township	Zhu Village	Qingpingyuan	7.73	1.29	0.023	0.016	1.16	Class I
Qiandao Lake Town	Taoyuan Village	Wangjiayuan	7.65	1.67	0.04	0.053	1.25	Class II
Wenchang Town	Wenchang Village	Tantou Stream	7.68	1.19	0.016	0.023	1.36	Class II
Yaoshan Township	Yanghan Village	Jinxianxi Stream	7.7	1.06	0.014	0.006	1.21	Class I
Pingmen Township	Fan Village	Jinxianxi Stream	7.69	1.07	0.016	0.007	1.16	Class I
Linzhi Town	Linzhi Qiao	Jinxianxi Stream	7.74	1.1	0.021	0.011	1.21	Class I
Fengshulin Town	Shangjiang Village	Fengjiayuan Stream	7.7	1.04	0.019	0.019	0.86	Class I
Dashu Town	Shanhou Village	Shangfangxi Stream	7.68	1.16	0.018	0.017	0.89	Class I
Anyang Township	Shanxia Village	Shangwuxi Stream	7.71	0.98	0.021	0.028	1.25	Class II
Lishang Township	Yujia Village	Shangjiayuan Stream	7.71	1.05	0.012	0.017	1.33	Class I
Shilin Town	Shilin Town	Fudeyuan Stream	7.66	0.96	0.012	0.018	1.37	Class I
Jinfeng Township	Wulong Village	Zhufengyuan Stream	7.72	1.66	0.014	0.033	1.16	Class II
Songcun Township	Miaoban Village	Yunyuangang	7.66	0.97	0.023	0.012	0.92	Class I
Wangfu Township	Yeyanggu	Yunyuangang	7.71	0.82	0.012	0.006	0.54	Class I
Weiping Town	Qingchun Village	Tongxi Stream	7.68	1	0.014	0.018	1.42	Class I
Jiukeng Township	Bainianmu Village	Jiukengxi Stream	7.73	1.02	0.012	0.02	1.3	Class I
Xintong Town	Bingfeng Village	Zitongyuan	7.71	1.09	0.022	0.021	2	Class II
Average Value			**--**	**1.13**	**0.022**	**0.021**	**1.24**	

4.3.4.3 Water Quality Survey of Drinking Water Sources for the Project

In order to identify the water quality condition of the drinking water source for the proposed water treatment plant, Zhejiang Ruiqi Testing Technology Ltd Company took samples and tested the samples from water source for the proposed WTP in the project. The testing results are listed in Table 4.3-3.

According to the monitoring results, the water quality of drinking water source for the proposed WTP is good, except that the TN index meet Class IV in Yanjia Reservoir, Yejiayuan Reservoir and Xin'anjiang Reservoir and

bacteria meet Class III at Xiashan Village, all the other indexes meet Class I standard specified in the *Environmental Quality Standard of Surface Water (*GB3838-2002), indicating that the water source is suitable for centralized domestic use.

Table 4.3-3 Water Quality Monitoring Results of WTP water sources

Monitoring Item	Yanjia Reservoir			Yejiayuan Reservoir		Xiashan Village	Qiuyuan Village	Tongshan Reservoir			Baima Guanchuan Power Station Front Water Pond	Xintong Town Xin'anjiang Reservoir	Weiping Town Xin'anjiang Reservoir
	Surface Layer	Mid-Layer	Bottom Layer	Surface Layer	Bottom Layer			Surface Layer	Mid-Layer	Bottom Layer			
pH	7.94	7.73	7.98	7.02	7.17	7.49	8.05	7.83	7.59	7.75	7.86	7.12	7.23
DO(mg/L)	9.7	9.4	9.3	10.8	10.8	10.4	11.1	9	9	8.8	8.5	11.4	10.6
COD_{Mn}(mg/L)	1	1.1	1.1	0.9	1.2	0.7	0.6	0.8	0.6	0.7	0.6	1.1	1.2
COD(mg/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
BOD_5(mg/L)	0.5	<0.5	<0.5	2.2	2.6	0.7	0.5	<0.5	<0.5	0.6	<0.5	2.8	1.6
NH_3-N(mg/L)	<0.025	<0.025	<0.025	0.088	0.055	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.041	<0.025
Turbidity(UTN)	3.3	3.3	3.3	3.4	4.3	1.3	3	0.8	0.8	0.8	4.4	1.7	0.9
TP(mg/L)	0.013	0.021	0.021	<0.010	<0.010	0.011	0.018	0.011	<0.01	<0.01	0.011	0.015	0.022
TN(mg/L)	**1.39**	0.652	**1.25**	0.972	**1.09**	0.828	0.819	0.74	0.672	0.613	0.868	**1.25**	**1.13**
Copper(mg/L)	<0.02	<0.02	<0.02	<0.01	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01
Zinc(mg/L)	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
Fluoride(mg/L)	0.35	0.35	0.35	0.16	0.18	0.38	0.37	0.41	0.39	0.46	0.34	0.16	0.17
Arsenic (μg/L)	<0.05	<0.05	<0.05	1.7	1.8	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	3.5	2.4
Mercury(μg/L)	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.01
Cadmium(μg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead(μg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Petroleum(mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fecal Coliform(MPN/L)	110	20	<20	50	80	5.40×10^3	20	20	<20	<20	50	20	20
Chloride(mg/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Iron(mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese(mg/L)	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Water Quality Classification	Ⅳ	Ⅲ	Ⅳ	Ⅲ	Ⅳ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅲ	Ⅳ	Ⅳ

4.3.4.4 Status Monitoring and Evaluation of Noise Environment

In order to identify the status of noise environment quality in the project area, from Feb 15th to Feb 17th, 2017, site monitoring was conducted for the noise environment in the project area. The noise level is between 36.0~53.8dB in daytime and 36.0~42.4dB in night time, which meet Class I standard *Environmental Quality Standard for Noise* (GB3096-2008), implying that the noise environment quality in the project area is good.

4.3.4.5 Status Monitoring and Evaluation of Air Environment

According to 2015 conventional monitoring data of air environment provided by Chun'an County Environmental Monitoring Station, which are listed in Table 4.3-4, SO_2 and NO_2 meet annual average concentration limit requirement in Class I standard specified in the *Ambient Air Quality Standard* (GB3095-2012) while PM_{10} meet the annual average concentration limit requirement in Class II standard specified in the *Ambient Air Quality Standard* (GB3095-2012).

Table 4.3-4 Air Quality Monitoring Results

Unit: mg/m^3

Items		SO_2	NO_2	inhalable particles (PM_{10})	API	Classification
Quarter 1	January	0.035	0.055	0.058	54	Class II, good
	February	0.018	0.032	0.039	39	Class I, excellent
	March	0.021	0.035	0.034	34	Class I, excellent
	Quarterly Average	0.025	0.041	0.044	44	Class I, excellent
Quarter 2	April	0.022	0.036	0.074	61	Class II, good
	May	0.016	0.020	0.077	63	Class II, good
	June	0.014	0.016	0.063	56	Class II, good
	Quarterly Average	0.017	0.024	0.071	60	Class II, good
Quarter 3	July	0.012	0.014	0.040	40	Class I, excellent
	August	0.019	0.014	0.046	46	Class I, excellent
	September	0.014	0.014	0.047	47	Class I, excellent
	Quarterly Average	0.015	0.014	0.044	44	Class I, excellent
Quarter 4	October	0.016	0.020	0.067	58	Class II, good
	November	0.030	0.036	0.108	79	Class II, good
	December	0.027	0.037	0.079	64	Class II, good
	Quarterly Average	0.024	0.031	0.085	67	Class II, good
Annual Average		0.020	0.028	0.061	55	Class II, good
Class I Standard (Annual Average)		0.02	0.04	0.04	/	/
Class II Standard (Daily Average)		0.15	0.08	0.15	100	/

4.3.4.6 Status Survey and Evaluation of River Sediments

In order to identify the status of the sediment environment of the river dredging section, a survey was conducted to determine whether there are or were any industrial pollution sources in areas upstream of the project area and the level resident concentration in the project area.

The monitoring sites are mainly at places which has or previously had industrial pollution source, residential areas in the vicinity of the project and concentrated farmland, as well as spots where sediments are easily accumulated such as river junctions and curves based on the principle of even distribution at upstream, midstream and downstream of river and also based on the characteristics of project and consideration of length of river dredging section and impact area. Monitoring was conducted for sediments at all dredging sections and 38 monitoring sites are placed. Hangzhou Guangce Testing Technology Limited Company was authorized with the sampling during May 16th to May 18th, 2017 for sediments in project area. Monitoring methods used include electrode method, flame atomic absorption spectrometry, graphite furnace atomic absorption spectrometry, cold atomic fluorescence spectrometry and the tested indexes are pH, copper, total chromium, zinc, nickel, lead, mercury and organics. Detailed monitoring results are listed in Table 4.3-5 as attached.

Based on the monitoring results, copper, Total Chromium, Zink, Nickel, Lead and Mercury at 2 monitoring sites, namely, No. 34 monitoring site (Zitongyuan Stream 1) and No. 35 monitoring site (Zitongyuan Stream 2), generally meet Class III Standard specified in the *Soil Environment Quality Standard* (GB 15618-1995), which indicates that they are suitable for forestry use; the other 36 monitoring sites can meet Class II and Class I standards, which are suitable for use in ordinary farms, vegetable farms, tea farms, fruits garden, etc. The sediments from river dredging section in this project do not belonging to hazardous waste and disposal or comprehensive utilization can be carried out accordance with *Standard for Pollution Control of General Industrial Solid Waste Storage and Disposal* (GB18599-2001).

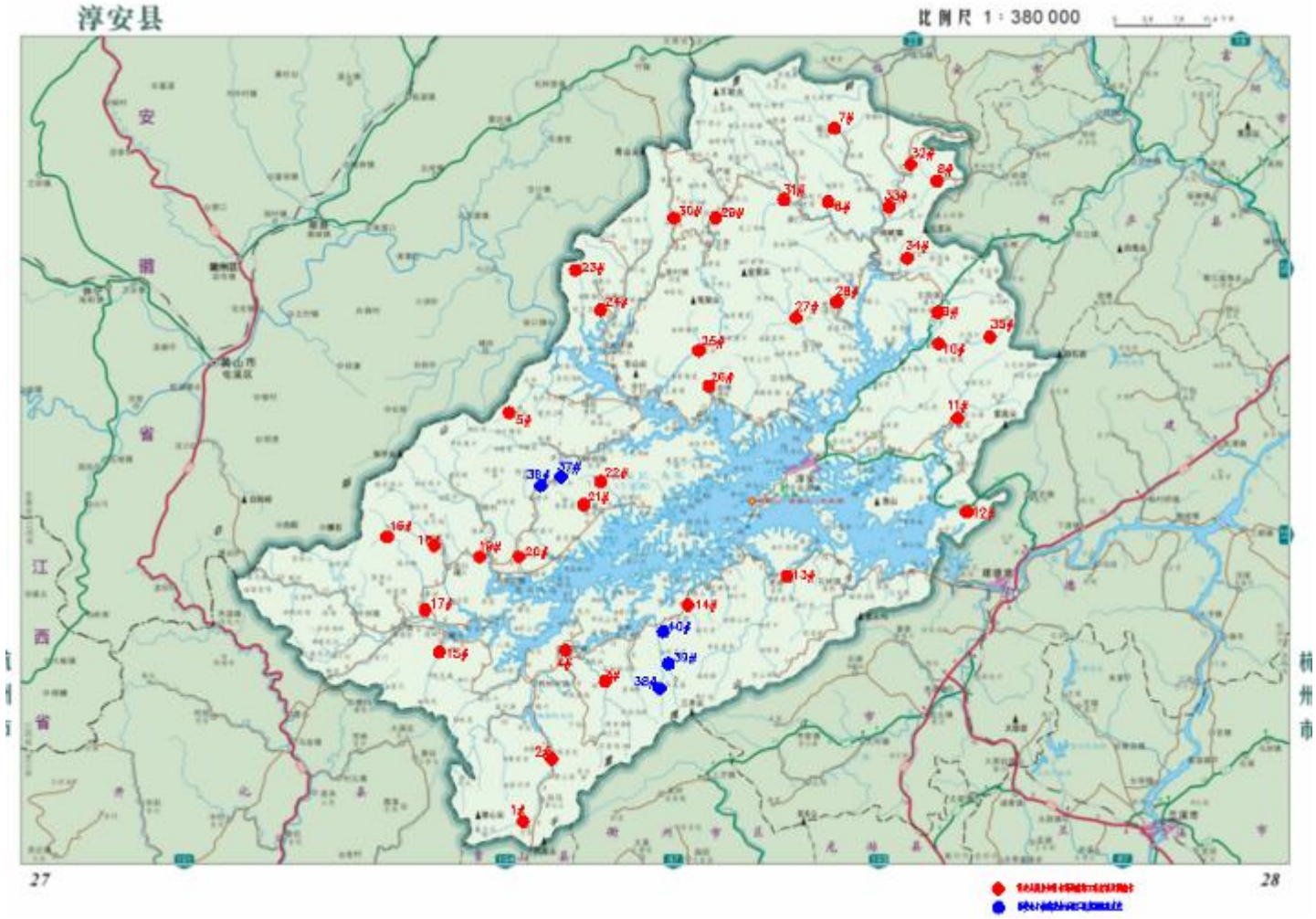


Figure 4.3-3 Location Map of Sediment Monitoring Sites in Chun'an County

4.4 Overview of Regional Environment of Jiande City

4.4.1 Overview of Natural Environment

1. Geographic Location

Situated in the west part of Zhejiang Province, Jiande City is affiliated to Hangzhou City, which is located at 108km to the northeast of Hangzhou City covering the area from 118°53′46″E to 119°45′51″E and from 29°12′20″N to 29°46′27″N. Jiande City is west to Pujiang County, north to Lanxi City, southwest to Tonglu County, northeast to Longyou County and Qu County, southeast to Chun'an County. 47km long from south to north and 90km wide from east to west, the City has a total area of 2,314.65km^2, accounting for 2.28% of the entire province.

2. Terrain and topography

Influenced by the complex inclined geological structure of South Mountain parageosyncline in Hangzhou, the geomorphology in the region is mainly composed of hilly area and mountains, which accounts for 88.6% of the entire city area. The terrain has higher elevation in the northwest and lower elevation in the southeast, higher on two sides and lower in the central axis. If using Xin'an River and Fuchun River as the axis, areas on both sides of the axis are higher while that in the middle is lower and the entire area is inclined from northwest to southeast.

The mountain ranges are affiliated to Tianmu Mountain, Qianligang and Longman Mountain System, with a major direction from northeast to southwest. There are 12 mountain peaks with an elevation higher than 1,000m, which are distributed in the northwest and southeast parts of the region. The low hill area is distributed in the west part and north part. Due to strong geological cutting effect, the relevant elevation difference is as large as 400m - 600m, with a slope of generally 30^0 - 40^0. The low hills with an elevation below 200m are mainly distributed in the southern part where the terrain is in a gentle and rounded slope with a gradient of generally smaller than 15^0. The area of plain is relatively small and plains with an elevation below 50m only has an area of 215km^2, mainly distributed on the two banks of rivers or creek valleys, mostly used for agricultural farming.

3. Climate

Jiande City belongs to the subtropical central humid monsoon climate, which is hot and rainy in summer and cold and dry in winter, with wet and hot weather in the same season and four distinct seasons. The annual average temperature is 16.9^{0}C and the total accumulated annual average temperature is 6,180^{0}C. There are 254 frost-free days and sufficient heat in a year. The annual average sunshine time is 1,760 days and there is abundant sunlight. The annual average total precipitation is 1,545mm and distribution of rain is uneven in a year. Affected by the summer monsoon, precipitation is concentrated in mid-May to mid-July and the average humidity is 78%. Due to undulating terrain and the uneven distribution of precipitation, the area of Dakengyuan in Lijia Town is the center of rainstorm while Tongjia and Xin'an River are located in rainy area and Meicheng, Sanhe and Mache in the Lanjiang River basin are in dry areas.

4. Water System and Hydrology

Jiande City is abundant in rivers, which belongs to Qiantang River system. The total water area of the city is 64.66km^2, accounting for 2.78% of the total land area.

There are 4 major rivers including Xin'an River, Fuchun River, Lanjiang River and Shouchang River, and 38 middle and small streams. The rivers belong to rain sourced river in the city and the flow rate is obviously controlled by rainfall. In particular, the medium-sized and small rivers have turbulent flow and sudden rises and drops, with big difference between dry season and flood season. Therefore there are frequent flood disasters. The river bed has large slope drops and the water power resource is abundant.

The water body with large water surface area include Fuchun River Reservoir and Qiandao Lake. Fuchun River Reservoir is a river-type reservoir with a total area of 31,485 km^2 and a storage volume of 440 million m^3. The normal water level is at 23 m and the elevation difference is no larger than 2m. The total water surface area is 88,000 mu, within which, the area of water system in the region of Jiande City is 61,000 mu, out of which, 42,286 mu can be used for fishery. The water surface area of Qiandao Lake in the region of Jiande City is 20,000 mu.

5. Soil

There are many types of soil in the city, including 5 soil groups, paddy soil, red soil, yellow soil, endodynamorphic soil and moisture soil, and 11 subgroups, 8 soil genus and 44 soil species, among which, red soil, purple soil and skeleton soil are the major soil groups in the city.

Affected by terrain and climate, the soil groups show the apparent law of vertical distribution and geographical distribution. In the vertical direction, the low hills and medium-height mountains with an elevation of 650 - 700m and above are mainly covered by mountain yellow soil and mountain yellow sandy soil; the low mountain and high hill areas with an elevation of 200 - 650m are mainly yellow clay, stone sandy soil, sandy clay soil, pink clay and oil yellow soil and red yellow soil which are derived from limestone and argillaceous limestone; in the low hill areas with an elevation of 200m and below, the main soil types includes yellow clay, yellow red clay, quaternary red clay, red sandy soil, acidic purple sandy soil, purple sandy soil, red purple sandy soil, paddy soil and improved clay sandy soil on river banks. In horizontal direction, soil distribution from the bank side of the four major rivers to inner land area is in the pattern of clean water sand – improved clay sand field – clay field – yellow clay sand field – yellow clay field.

6. Forest resources

There are many forest species in the region of Jiande City and the main forest vegetation types include warm coniferous forest, evergreen broad-leaf forest, deciduous broadleaf forest, evergreen deciduous and broadleaf mixed forest, mixed broadleaf-conifer forest, bamboo forest, economic forest and shrubbery, etc.. The coverage of forest stabilizes at 75% and above. The various types of public welfare forest have a total area of 994,170mu, which are mainly distributed at the forest land extending from the edge of Xin'anjiang Reservoir, Fuchunjiang Reservoir and Lanjiang River to the first ridge line, Fuchunjiang National Forest Park, Xin'an River Provincial Forest Park, Lvhe Forest Park and natural protection zones, the forests inside ecological sensitive area on both sides of main roads including highways, national highways and state highways, as well as mountain slopes steeper than 36 degree, which involves townships and towns including Xin'anjiang, Yangxi, Genglou, Lianhua, Qiantan, Qingtang, Meicheng, Yancunqiao, Xiaya, Dayang and Sandu, etc. Large forest coverage provides a basis for the good ecological environment of Jiande City.

4.4.2 Overview of Social Environment

GDP of Jiande City in 2015 is CNY 32.036 billion, increased by 8.9% over the previous year. Among which, the added value of the primary industry is CNY 3.048 billion, increased by 2.4% over the previous year; the added value of secondary industry is CNY 16.773 billion, increased by 7.9% over the previous year; the added value of tertiary industry is CNY 12.214 billion, increased by 12% over the previous year. The tertiary industry structure is adjusted from 9.6 : 54.0 : 36.4 in previous year to 9.5 : 52.4 :38.1. The GDP per capita is CNY 62,980 calculated based on residential population, which is increased by 8.9% over the previous year.

The registered population of the entire city at year end is 508,673, dropped by 1,046 than the end of the previous year. In the full year, 3,549 people were born, with a birth rate of 6.97‰ (population that is born in the year/yearly average population); the death population is 3,661 and the death rate is 7.19‰ (death population in the year/yearly average population); the natural growth rate (population that is born in the year- death population in the year)/total population at year end) is -0.2‰. Permanent population of the entire city at year end is 446,500.

The financial revenue of the year is CNY 3646.99 million, increased by CNY 206.52 million or 6.0% from a year ago, including local financial revenue of CNY 2119.44 million, which is 141.36 million or 7.1% higher from a year ago.

The total agricultural output value reached CNY 4.881 billion in the entire year, increased by 6.3%. The grain sowing area reached 207,800 mu, increased by 11.5%. Rice production was 86,000 tons, increased by 17.1%. Meat production reached 29,700 tons, increased by 1.0% over the previous year, including 18,800 tons for pork, increased by 6.2%, 78,000 tons for eggs, dropped by 17.5%. The number of pig in stock at year end was 106,000, dropped by 17.3%. The number of poultry in stock at year end was 4.404 million, dropped by 33.3%. The annual aquatic production was 112.90 million tons, increased by 6.4% over the previous year. Woods production was 64,800 m^3, dropped by 1.2% over the previous year.

In the whole year, CNY 338 million was invested in water conservancy construction. At the end of the year, the County as a whole owns a total power of 289,000kWh for agriculture machinery. The area of farmland with effective irrigation was 15,580 ha at year end. The city has 141 various types of reservoirs, 4 reinforced reservoirs and 11 hilly ponds.

Total water supply in the urban area is 13.821 million m^3, including 8.4633 m^3 for domestic water. Greening

coverage ratio in constructed area is 36.79% and the year-end forest coverage in the entire city reached 76%. At the end of the year, the number of pipeline gas users was 20,112 households. The centralized wastewater treatment ratio in the city was 88.09%. The total area of gardens and greening belts in the urban area was 377.5 ha. Public greening space in urban area was 157 ha at the year end, with a per capita public greening space of 11.43 m^2.

4.4.3 Status Quo of Ecological Environment Quality

1. Status Quo of Aquatic Ecological Environment

Project construction mainly involves Shouchang River, Datongxi Stream and Wulongxi Stream, etc., According to the survey, 40 Phytoplankton were monitored in the river courses, which include 4 Cyanophyta, 1 Cryptophyta, 1 Euglenophyta, 1 Pyrrophyta, 10 Bacillariophyta and 23 Chlorophyta. The total density of algae cells is between 5.54×10^5~1.16×10^7cells/L. The majority of the fish species is Capriniae, mainly including carp fish, Crucian, white carp and loach, No rare and migratory fish or spawning site or feeding site are identified in the project area, generally all the local fishes are common local fish.

2. Status Quo of Territorial Ecological Environment

Chun'an County is in the northern subzone of the middle subtropical evergreen broadleaved forests, where Pinus massoniana (Pinus massoniana) is the most widely distributed forest, followed by coniferous and broad-leaved mixed forests, with the least being broad-leaved forests; underbush vegetation includes shrubs and grasslands with a height in the range of 0.7- 4.0 m; Shrubs are most widely distributed followed by grass shrubs and brushwood. Although the forest ecosystem is diversified, it is dominated by warm coniferous forest - pinus massoniana forests and of a simple structure and low biodiversity.

The ecological systems in the watersheds involved in the construction of the Project are mainly agricultural eco-system and forest eco-system. The vegetation resources in the basin are mainly natural secondary vegetation and some artificial vegetation, mostly evergreen broad-leaved, deciduous broad-leaved, and coniferous mixed forest.

3. Status Quo of Soil Erosion

Based on the national soil erosion zoning, the project area belongs to the red soil hilly areas in southern China and the soil erosion type is mainly hydraulic erosion. The project area is within the key area of soil erosion control. According to field investigation results, the main soil erosion type in the project area is hydraulic erosion. The land parcels where the original landform is disturbed in the project area are mainly arable land and garden land. The soil erosion intensity is at minor level. The background value of soil erosion modulus is 300t / (km^2.a).

4.4.4 Environmental Quality Survey and Assessment

4.4.4.1 Surface Water Environment Quality Survey and Assessment

Monitoring was conducted at Datongxi Stream, Zhenyuanxi Stream, Qingtanxi Stream, Fengjiaxi Stream, Wulongxi Stream, Shouchang River, Xiaoxiyuan, Zhuyuanxi Stream, Shangmaxi Stream, Laocunxi Stream, Tongjiaxi Stream and Xiaojiangxi Stream in the project. Details are included in Table 4.4-1, Appendix Table 4.4-1~4.4-3.

Based on the monitoring results:

Laocunxi Stream: The monitoring indicator of DO at the upstream of Laocunxi Stream exceeded the standard. Monitoring indexes including pH, COD, BOD_5, NH_3-N, TP and Petroleum, etc. meet Class II standard specified in the *Surface Water Environment Quality Standard* (GB3838-2002).

Zhenyuanxi Stream: BOD_5 at upstream section of Zhenyuanxi Stream (Wansheng Village) exceeded Class II standard specified in the *Surface Water Environmental Quality Standard* (GB3838-2002) while the other monitoring indexes including DO, pH, COD, NH_3-N, TP and Petroleum, etc. meet Class II standard limitation.

Qingtanxi Stream: COD and BOD_5 at conjunction of Qingtanxi Stream and Datongxi Stream exceeded Class II standard specified in the *Surface Water Environmental Quality Standard* (GB3838-2002) while the other monitoring indexes including DO, pH, NH_3-N, TP and Petroleum, etc. meet Class II standard limitation.

Fengjiaxi Stream: COD and BOD_5 at conjunction of Fengjiaxi Stream and Datongxi Stream exceeded Class II standard specified in the *Surface Water Environmental Quality Standard* (GB3838-2002) while the other

monitoring indexes including DO, pH, NH_3-N, TP and Petroleum, etc. meet Class II standard limitation.

Datongxi Stream: COD and BOD_5 at upstream section of Datongxi Stream (Guancunqiao Village) exceeded Class II standard specified in the *Surface Water Environmental Quality Standard* (GB3838-2002) while the other monitoring indexes including DO, pH, NH_3-N, TP and Petroleum, etc. meet Class II standard.

Wulongxi Stream: petroleum at upstream section of Wulongxi Stream exceeded Class II standard specified in the *Surface Water Environmental Quality Standard* (GB3838-2002) while the other monitoring indexes including DO, pH, BOD_5, COD, NH_3-N, TP, etc. meet Class III standard limitation.

Shouchang River: monitoring indexes including DO, pH, COD, BOD_5, NH_3-N, TP and Petroleum, etc. at all monitoring section at Shouchang River meet Class III standard specified in the *Surface Water Environmental Quality Standard* (GB3838-2002).

Xiaoxiyuan, Zhuyuanxi Stream, Shangmaxi Stream, Tongjiaxi Stream, Xiaojiangxi Stream: DO, pH, COD, BOD_5, NH_3-N, TP and Petroleum, etc. at all monitoring section at Xiaoxiyuan, Zhuyuanxi Stream, Shangmaxi Stream, Tongjiaxi Stream, Xiaojiangxi Stream meet Class II standard specified in the *Surface Water Environmental Quality Standard* (GB3838-2002).

Table 4.4-1 Monitoring Data for Surface Water in Project Area

Monitoring Section	Monitoring Items	Sampling Frequency	Monitoring Time
1# Upstream of Datongxi Stream (Shangma Village); 2# Upstream of Zhenyuanxi Stream (Wansheng Village); 3# Conjunction of Zhenyuanxi Stream and Datongxi Stream; 4# Upstream of Qingtanxi Stream (Maojia); 5# Conjunction of Qingtanxi Stream and Datongxi Stream; 6# Upstream of Fengjiaxi Stream; 7# Conjunction of Fengjiaxi Stream and Datongxi Stream; 8# Conjunction of Datongxi Stream and Shouchang River; 9# Upstream of Wulongxi Stream; 10# Conjunction of Wulongxi Stream and Shouchang River; 11# Upstream of Shouchang River; 12# Shouchang River (East Community in the City); 13# Upstream of Datongxi Stream (Guancunqiao Village); 14# Upstream of Xiaoxiyuan Stream; 15# Conjunction of Xiaoxiyuan Stream and Datongxi Stream; 16# Upstream of Zhuyuanxi Stream (Jiangtou Village); 17# Conjunction of Zhuyuanxi Stream and Datongxi Stream; 18# Upstream of Shangmaxi Stream; 19# Conjunction of Shangmaxi Stream and Datongxi Stream; 20# Upstream of Laocunxi Stream; 21# Conjunction of Laocunxi Stream and Shouchang River; 22# Xin'anjiang Reservoir; 23# Upstream of Tongjiaxi Stream; 24# Conjunction of Tongjiaxi Stream and Shouchang River; 25# Upstream of Xiaojiangxi Stream; 26# Conjunction of Xiaojiangxi Stream and	pH, DO, COD, BOD_5, NH_3-N, TP, Petroleum	2 times in a day	August 7th to August 8th, 2017

Shouchang River			

4.4.4.2 Air Quality Survey and Assessment

According to monitoring statistics data for air quality in January 2017 for Jiande City, daily average concentration of NO_2, PM_{10}, $PM_{2.5}$ at regular Monitoring sites exceed the standard limitation while SO_2, CO, O_3 all meet Class II standard specified in the *Ambient Air Quality Standard* (GB3095-2012).

Table 4.4-2 Air Environment Monitoring Results in Project Area

Monitoring Point	Monitoring Items	Sampling Frequency	Monitoring Time	Assessment Results
Conventional Environmental Monitoring Sites for Jiande City	SO_2, NO_2, PM_{10}, CO, O_3, $PM_{2.5}$	SO_2, NO_2, CO, O_3, 4 times a day, continuous sampling for PM_{10}、$PM_{2.5}$	January 2017	According to monitoring statistics data for air quality in January 2017 for Jiande City, daily average concentration of NO_2, PM_{10}, $PM_{2.5}$ at regular monitoring sites exceed the standard limitation while SO_2, CO, O_3 all meet *Ambient Air Quality Standards* (GB3095-2012) Class II standard.

4.4.4.3 Status Monitoring and Evaluation of Noise Environment

In order to identify the status for noise environment in the project area, site monitoring was conducted during August 7th to August 8th, 2017 of the noise environment in the project area. Results show that the noise value in the region is 51.8 - 53.5dB in daytime 41.8 - 43.7dB in nighttime, which meet Class I standard specified in the *Environmental Quality Standard for Noise* (GB3096-2008), implying that the noise environment quality is good in the project area.

Table 4.4-3 Noise Monitoring Results in the Project Area

Monitoring Point	Monitoring Items	Sampling Frequency	Monitoring Time	Assessment Results
Futang Village, Zhenyuan Village, Panshan Village, Qingtan Village, Chaoyang Village and Xin'anjiang Forest Surrounding Area	LAeq	1 day, 1 time at day and 1 time at night	August 7th to August 8th, 2017	According to the monitoring results, the noise level was between 51.8 - 53.5dB at days, and between 41.8 - 43.7dB at nights, which meet *Environmental Quality Standard for Noise* (GB3096-2008) Class I standard, the noise environment quality is good in the project area

4.4.4.4 Status Survey and Evaluation of River Sediments

In order to identify the status of sediments in river dredging section in this project, based on the project construction characteristics, dredging length and its impact area, sediments of all river dredging sections were monitored and 9 sediment monitoring sites are placed. Results of monitoring are listed in Table 4.4-4 and Table 4.4-5.

According to the monitoring results, Nickel at monitoring sections at Zhenyuanxi Stream, Shimulingxi Stream and Wulongxi Stream meets Class III standard specified in the *Soil Environment Quality Standard* (GB15618-1995) while the other items including pH, Cadmium, Mercury, Arsenic, Copper, Lead, Chromium, Zinc meet Class II standard, which indicates that the soil is suitable for forestry use.

All monitoring results of pH, Cadmium, Mercury, Arsenic, Copper, Lead, Chromium, Zinc and Nickel at Qingtanxi Stream, Fengjiaxi Stream, Shouchang River Main Stream (Hangchuan), Qingtianban Canal and Shouchang West Lake meet Class II standard specified in *Soil Environment Quality Standard* (GB15618-1995), which indicates that the soil is suitable for ordinary agricultural use, vegetable farmland, tea farm and fruit

gardens uses.

The sediments from river dredging section in this project were identified as not belonging to hazardous wastes and the disposal or comprehensive utilization can be carried out accordance with *Standard for Pollution Control of General Industrial Solid Waste Storage and Disposal* (GB18599-2001).

Table 4.4-4 Sediment Monitoring Results for Rivers in the Project Area

Monitoring Point	Monitoring Item	Sampling Frequency	Monitoring Time	Monitoring Evaluation Results
2 points are chosen for sludge at Zhenyuanxi Stream, Qingtanxi Stream, Fengjiaxi Stream, Shouchang River Main Stream (Hangchuan), Wulongxi Stream and Shimulingxi Stream, respectively. (vertical column sample was taken at 1 point (20cm at surface layer, 60cm at mid-layer, 100cm at lower-layer samples), and surface layer sample was taken for another point).	pH, Cadmium, Mercury, Arsenic, Copper, Lead, Chromium, Zinc, Nickel	Monitored for 1 day and one time in a day.	August 7th – August 8th, 2017	Nickel at monitoring sections at Zhenyuanxi Stream, Shimulingxi Stream and Wulongxi Stream meet *Soil Environment Quality Standard*(GB15618-1995) Class III standard, other items all meet Class II standard, disposal or comprehensive utilization can be carried out as regular solid waste for sludge accordance with *Standard for Pollution Control of General Industrial Solid Waste Storage and Disposal* (GB18599-2001)

Table 4.4-5: Sediment Monitoring Results

Location	Depth at section	pH	Copper	Cr	Ca	Lead	Zinc	Nickel	Mercury	Arsenic
Qingtanxi Stream	0-20cm	6.88	36.6	46.8	0.28	37.8	52.2	42.8	0.166	13.8
	0-100cm	7.02	38.7	49.2	0.26	36.5	53.6	40.3	0.154	15.4
Zhenyuanxi Stream	0-20cm	6.94	35.5	51.4	0.28	38.4	55.2	**52.9**	0.169	15.9
	0-100cm	7.11	41.2	52.3	0.26	39.6	52.4	**50.4**	0.143	17.3
Shimulingxi Stream	0-20cm	6.68	43.4	56.7	0.26	42.2	48.6	**52.6**	0.152	18.6
	0-100cm	6.96	48.7	54.2	0.28	43.7	47.7	**55.8**	0.138	16.5
Wulongxi Stream	0-20cm	7.08	46.3	57.7	0.28	46.3	49.2	**56.4**	0.145	17.9
	0-100cm	7.24	42.9	49.6	0.26	45.2	43.6	47.3	0.159	19.2
Shouchang River Main Stream	0-20cm	6.79	43.5	52.5	0.26	47.7	45.2	49.2	0.172	18.2
	0-100cm	6.85	39.6	58.7	0.26	42.3	41.8	46.8	0.134	17.4
Fengjiaxi Stream	0-20cm	7.07	41.2	61.1	0.28	41.1	44.3	45.5	0.151	17.7
	0-100cm	7.12	40.5	60.4	0.28	39.4	42.9	43.7	0.158	16.3
	0-100cm	7.07	39.8	58.6	0.28	45.6	48.7	45.1	0.154	14.9

Figure 4.4-1 Location Map of Surface Water Monitoring Sites No. 1

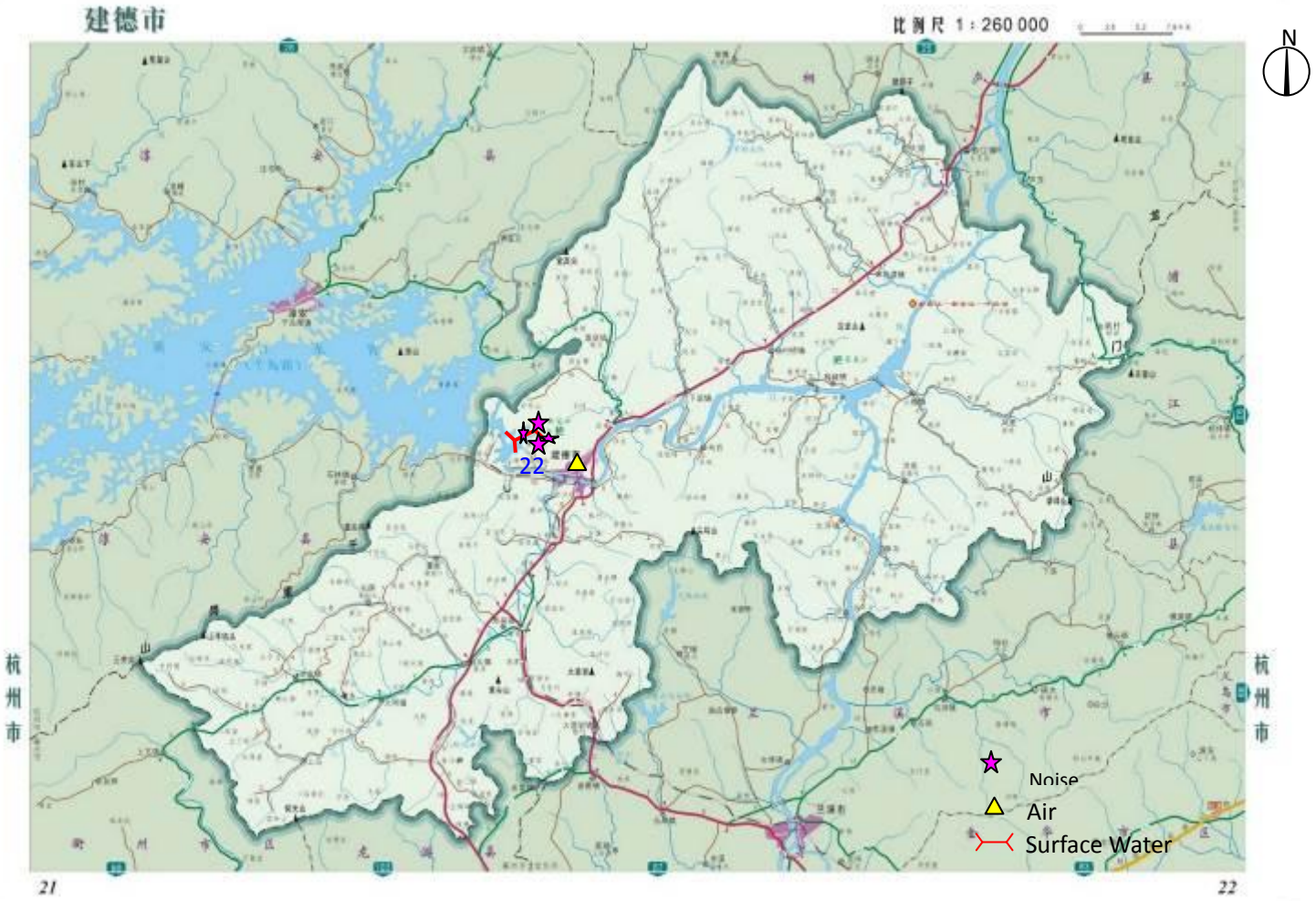


Figure 4.4-2 Location Map of Monitoring Sites No. 2

5. Environmental Impact Assessment and Mitigation Measures

5.1 Environmental Impacts and Mitigation Measures during Construction

Based on the contents of the project activities, environmental impacts for the construction stage and operation stage are identified respectively. Construction activities that will generate environmental impacts include earth excavation, earth and construction material transportation, dike & embankment construction, dredging, construction of WTP and associated pipeline networks, forest rehabilitation, road construction, and WWTP construction. Therefore, major environmental impacts in the construction stage include soil erosion caused by excavation, exhaust emission and noise from transportation of earth and construction material on construction site and construction access roads, wastewater discharge from construction camp and construction site, and construction spoil. Additionally, social impacts include disturbance to local traffic by construction vehicles and road-crossing pipelines, impact of tomb relocation, and impact of dike and embankment construction on farmland irrigation. Environmental impacts in the construction stage will be assessed in these aspects. Common environmental impacts of road construction, river rehabilitation and small-sized civil works could be mitigated through implementation of relevant ECOP, with impacts on sensitive environmental receptors being assessed particularly.

5.1.1 Soil Erosion Analysis and Mitigation Measures

5.1.1.1 Analysis of Soil Erosion Impact

1. Causes of Soil Erosion

Vegetation will be removed in the process of construction site clearing, leveling, embankment construction, road construction and pipeline construction. Excavation of drainage foundation trench will lead to temporary earth storage; excavation or backfilling associated with watercourse and pipeline construction will change original landform and generate new unstable slope without vegetation. Affected by the aforesaid construction activities, surface erosion and gully erosion will be caused by rain in the project area.

2. Environment Impact of Soil Erosion

(1) Increased Turbidity and Impact on Water Quality

Soil erosion will occur and soil will directly enter the river in the process of watercourse excavation and lead to high turbidity of river water and deteriorated water quality, if construction is not under good management. Spoil generated from dike construction, site excavation or road construction will flow into the river through stormwater runoff and affect water quality especially in

strong wind and heavy rain, if the soil is not cleaned in a timely manner or not properly covered.

(2) Watercourse Blockage, Polluted Water Quality and Impact on Flood Discharge

There are many rivers around project area, which may be affected by excavation and transportation of large quantity earth during construction. If the earth is not disposed of in a timely manner and stored in an uncontrolled way, the earth will enter nearby rivers through heavy stormwater and lead to watercourse blockage, narrowed cross-section and lifted river bed and as a result will weaken flood discharge capacity and put pressure on downstream flood control.

(3) Decreased Soil Fertility and Land Resources

As original landform and vegetation are damaged by earth and rock excavation, filling and disposal, soil erosion will possibly arise under the scouring effect of rainfall and surface runoff and nutrients in surface soil will be carried away, resulting in decrease of soil fertility and adverse impacts on forest and crop growth and utilization of land resources. Without effective soil conservation measures being taken during construction, soil may enter farmland along the embankment, block farmland channels, occupy farmland, and lead to adverse impact on farming activities.

5.1.1.2 Impact of Jiande City Water Conservancy Facility Rehabilitation on Water and Soil Conservation

1. Earth and Stone Balance

The Subproject will involve a total excavation volume of 567,800m^3 (including 292,000m^3 for dike construction and 275,800m^3 for road construction), which includes an earthwork excavation of 512,800m^3 (with 106,800m^3 for dike construction, 130,200m^3 for river dredging and 375,800m^3 for road construction), a stonework and concrete demolition volume of 55,000m^3 (for dike construction) and a river dredging volume of 130,200m^3.

The Subproject will involve a total fill of 318,200m^3, including 55,000m^3 for ordinary earth and stone fill and 386,600m^3 for landscaping topping soil.

The balance volume will be 327,300m^3, including 246,600m^3 for ordinary earth and stonework, 37,500m^3 for demolition of damaged flood dikes and 43,200m^3 for sediments.

2. Soil Erosion Prediction Results

The subproject will involve a disturbed surface area of 118.83hm^2 and a land area of 118.83hm^2 entitled to compensation for land acquired for water and soil conservation facilities. The Subproject may involve a total soil loss of 16355t and an additional soil loss of 16013t. The construction stage of the project is the key time period of soil erosion while the construction sites of dike

reinforcement, river rehabilitation and road construction as well as the sites for stockpiling of earth are the key areas of soil erosion. .

3. General Layout of the Soil Erosion Control Zones and Mitigation Measures

Based on the construction time and sequence, layout and characteristics of soil erosion possibly caused by the construction works, the subproject is divided into 4 soil erosion control zones: Zone I (control zone for flood dike construction), Zone II (control zone for municipal road construction), Zone III (Control zone for earth stockpiling sites) and Zone IV (control zone for temporary construction facilities). The detailed quantities are summarized as follows:

1) Zone I (Control zone for flood dike construction) : The area of this control zone is 86.67hm^2, including 2.57hm^2 for dike construction and river rehabilitation works and 84.10hm^2 for the directly affected area.

Structural measures: (1) Topping soil: 9,800m^3.

Temporary measures: (1) Covering the side slope temporarily with colored plastic cloth and preparing plastic cloth for a total area of 5600m².

2) Zone Ⅱ (Control zone for municipal roads)

The area of this control zone is 17.80hm^2, including 9.43 hm^2 for construction of new roads and 8.37hm^2 for the directly affected area.
Structural measures: (1) Topping soil with a volume of 41,800m^3; (2) C20 concrete rectangular drainage ditches on one side of the roads as a part of the drainage facilities with a length of 20.90km and a volume of 2,700m^3.

Planting measures: (1) Vegetated slope within a distance of 0.5m on both sides of the road with a total area of 2.09hm^2; (2) tending area: 2.09hm^2·a.

Temporary measures: (1) covering the side slope temporarily with colored strip plastic cloth with a total area of 4200m².

3) Zone III (control zone for earth stockpiling sites)
Control area: 11.88hm^2, including 9.99hm^2 for stockpiling sites and 1.90hm^2 for directly affected area.
Structural measures: 9.99 hm^2 for site leveling.
Temporary measures: C20 concrete rectangular interception ditches with a length of 2.52km and a volume of 300m^3.

4) Zone IV (Control zone for temporary construction facilities)

Control area: 3.38hm^2, including 1.16hm^2 for construction sites, 1.32hm^2 for construction access roads and 0.90hm^2 for directly affected area.
Structural measures: 2.48 hm^2 for site leveling; 1200m^3 for C20 concrete rectangular drainage ditches with a length of 9.04km.
Temporary measures: covering temporarily with colored strip plastic cloth with a total area of 3000m².

4. Investment estimation for water and soil conservation

Total investment for water and soil conservation of this subproject is estimated CNY 6.594 million.

5.1.1.3 Soil Erosion Impact of Chun'an County Rural Drinking Water Safety Improvement

1. Earth Balance

Earth excavation totals 3,983,200 m^3, including 996,500 m^3 surface soil and 2,986,700 m^3 ordinary soil. Earth backfill totals 3,983,200 m^3, including reuse of 996,500 m^3 surface soil and backfill of 2,986,700 m^3 ordinary soil.

2. Result of Soil Erosion Prediction

Construction of this Project will disturb land area of 957.4868hm^2, and no compensation for soil erosion will be charged.

Potential soil loss will be 732,648 tons during soil erosion prediction period including 727,874 tons in construction stage and 4,774 tons in natural restoration period, with 715,447 tons being contributed by this project (713,537 tons in construction stage and 1,910 tons in natural restoration period). Soil loss concentrates in construction stage, and major area of significant soil erosion is water supply pipeline construction area.

3. Water and Soil Conservation Zoning and General layout of Measures

Water and soil conservation of this subproject has four zones, namely, WTP construction zone, water supply pipeline construction zone, water intake structure construction zone and temporary facility construction zone.

(1) Zone I (WTP Construction Zone)

Soil erosion prevention area is 4.1876 hm^2 including 3.7246 hm^2 construction area and 0.463 hm^2 land directly affected by construction activities.

Structural measures: removal of 2.833 hm^2 surface soil and 5,700 m^3 surface soil backfill.

Greening measures: 1.1332 hm^2 plant area greening and tending (one year).

Temporary measures: construction of 3,600 m drainage channel and seven sedimentation tanks.

(2) Zone II (water supply pipeline construction zone)

Soil erosion prevention area is 1206.3172 hm^2 including 953.6722 hm^2 construction area and 252.645 hm^2 land directly affected by construction activities.

Structural measures: removal of 498.2704 hm^2 surface soil, 996,500 m^3 soil backfill, 953.6722 hm^2 ground leveling, and 247.9548 hm^2 land reclamation.

Greening measures: planting of 228,881 trees, 347.1367 hm^2 of grass sowing and tending (one year).

Temporary measures: 20,000 m^2 colored strip plastic cloth.

(3) Zone III (water intake structure construction zone)

Soil erosion prevention area is 0.12 hm^2 including 0.09 hm^2 construction area and 0.03 hm^2 land directly affected by construction activities.

Temporary measures: construction of 300 m drainage channel and four sedimentation tanks.

(4) Zone IV (temporary facility construction zone)

Soil erosion prevention area is 0.9 hm^2 land occupied by temporary facilities.

Structural measures: 0.9 hm^2 ground leveling.

Temporary measures: 1,090 m drainage channel, 6,000 m^2 colored strip plastic cloth, and 550 m^3 straw bag stuffed with soil.

4.Cost Estimate for Water and Soil Conservation

Total investment for water and soil conservation of this subproject is estimated CNY 5.21 million.

5.1.1.4 Soil Erosion Impact of Chun'an County Embankment Improvement and River Rehabilitation

1. Earth Balance

Earth excavation totals 1,186,600 m^3 and includes (a) 472,200 m^3 from ordinary earth excavation of embankment improvement and 28,400 m^3 from demolition of destroyed embankment; and (b) 247,100 m^3 from ordinary earth excavation of river rehabilitation and 9,100 m^3 from demolition of destroyed embankment, 386,600 m^3 from surface soil removing, and 43,200 m^3 from dredging.

Earth backfill will total 859,300 m^3 including backfill of 472,700 m^3 ordinary earth and 386,600 m^3 for greening purpose.

Spoil to be disposed of totals 327,300 m^3 including 246,600 m^3 ordinary earth, 37,500 m^3 demolished embankment material, and 43,200 m^3 dredged sediment.

2. Result of Soil Erosion Prediction

Construction of this subproject will disturb land area of 352.4 hm^2 including 73.84 hm^2 river water area, and compensation for soil erosion will be charged on 278.56 hm^2.

Potential soil loss will be 293,669 tons in total with 289,256 tons being contributed by this subproject. Soil loss concentrates in construction stage, and major areas of significant soil erosion include embankment improvement site, river rehabilitation site, and temporary storage site.

3. Water and Soil Conservation Zoning and General layout of Measures

This subproject has two zones for water and soil conservation based on construction scheduling, construction distribution and nature of potential soil erosion, and they are Zone I (Main Works Zone) and Zone II (temporary facility zone). Quantities of particular mitigation measures are summarized as below.

(1) Zone I (Main Works Zone)

Soil erosion prevention area is 137.1 hm^2 including 100.3 hm^2 embankment improvement and river rehabilitation area and 36.8 hm^2 land directly affected by construction activities.

Structural measures: removal of 24,600 m^3 surface soil and 1,000 m^3 surface soil backfill for greening.

Greening measures: 0.1945 hm^2 grass planting on embankment and tending.

Temporary measures: construction of 66.86 km drainage channel and 76 sedimentation tanks

(2) Zone II (Temporary Facility Zone)

Soil erosion prevention area is 312.3 hm^2 including 15.2 hm^2 spoil disposal site, 164.76hm^2 construction site, 33.2hm^2 construction access road, 33.4hm^2 temporary material storage site, 5.54hm^2 surface soil storage site, and 60.2 hm^2 land directly affected by construction activities.

Structural measures: removal of 362,000 m^3 surface soil, 38.56 hm^2 soil backfill, 252.1 hm^2 land reclamation, and 252.1 hm^2 ground leveling.

Temporary measures: 3,000 m^3 rock masonry retaining wall, 95.746 km drainage channel, 8,556 m^3 soil bag, and grass planting of 55,981 m^2.

4. Investment estimation for water and soil conservation

Total investment for water and soil conservation of this subproject is estimated CNY 5.779 million.

5.1.1.5 Soil Erosion Impact of Chun'an County Small River Basin Rehabilitation

1. Earth Balance

Earth excavation totals 1,003,600 m^3, including 154,800 m^3 surface soil, 783,100 m^3 ordinary soil, 55,400 m^3 rocks demolished, and 10,300 m^3 dredged sediment.

Earth backfill totals 564,400 m^3, including reuse of 154,800 m^3 surface soil and backfill of 409,600 m^3 ordinary soil.

Backfill earth is all contributed by excavation of this subproject, and no borrow earth is needed.

Spoil to be disposed of will be 439,200 m^3 including 373,500 m^3 ordinary soil,

55,400 m^3 waste rocks and 10,300 m^3 dredged sediment. Spoil will be hauled to disposal sites located along the site and appropriate protective measures will be taken.

2. Result of Soil Erosion Prediction

Construction of this subproject will disturb land area of 136.95 hm^2 and compensation for soil erosion will be charged on 136.95 hm^2.

Potential soil loss will be 143,800 tons in total (142,900 tons in construction stage and 900 tons in natural restoration period), with 142,400 tons being contributed by this subproject (141,900 tons in construction stage and 500 tons in natural restoration period). Soil loss concentrates in construction stage and in temporary facility area.

3. Water and Soil Conservation Zoning and General layout of Measures

This subproject has three zones for water and soil conservation and they are Zone I (main works zone), Zone II (spoil disposal site), and Zone III (temporary facility zone). Quantities of particular mitigation measures are summarized as below.

(1) Zone I (main works zone)

Soil erosion prevention area is 144.14 hm^2 including land occupation by flood control embankment, bank protection, river rehabilitation, weir/dike and landscaping, and land directly affected by construction activities.

Structural measures: removal of 67,600 m^3 surface soil and 67,600 m^3 surface soil backfill for greening.

Greening measures: 23.01 hm^2 greening and tending.

Temporary measures: construction of 66.61 km temporary drainage channel outside embankment and 220 temporary sedimentation tanks

(2) Zone II (spoil disposal site),

Soil erosion prevention area is 39.13 hm^2 including land area of disposal site and affected land area within 10 m of upper slope and 20 m within down slope.

Structural measures: removal of 36,700 m^3 surface soil, 16 km drainage channel, 10 sedimentation tanks, and12,080 m stone mortar masonry retaining wall.

Greening measures: 25.02 hm^2 grass planting on top of the disposal site.

(3) Zone III (temporary facility zone).

Soil erosion prevention area is 71.42 hm^2 including construction access road, construction site, temporary earth storage site and affected area.

Structural measures: removal of 50,500 m^3 surface soil, 20.2 hm^2 ground

leveling, 87,200 m^3 earth backfill, and 32.58 hm^2 land reclamation.

Temporary measures: 4,120 m temporary drainage channel and 50 sedimentation tanks for construction site; 20,020 m temporary drainage channel and 57 sedimentation tanks for construction access road; 10,560 m^3 soil bag, 10,560 m temporary drainage channel, and 9.07 hm^2 colored strip plastic cloth for temporary earth storage site; 17,750 m^3 soil bag for containment of surface soil storage site and 22.07 hm^2 grass planting.

4. Cost Estimate and Benefit Analysis

Total investment for water and soil conservation of this subproject is estimated CNY 12.57 million.

5.1.2 Social Environment Impacts and Mitigation Measures

5.1.2.1 Impact of Land Acquisition and Resettlement and Mitigation Measures

Land acquisition and resettlement will inevitably affect daily life of residents in the project area in certain period of time. The IAs will provide resettlement compensation in cash and will work with local governments to make proper arrangements in accordance with concerned policies to avoid social issues caused by improper resettlement. Details of social impacts and mitigation measures associated with land acquisition and resettlement are given in Section 7 of this report and Resettlement Action Plan of this Project.

5.1.2.2 Impact on Public Traffic and Mitigation Measures

Soil, construction material (sand, cement) and spoil storage and transportation during construction will increase local traffic flow, occupy existing road, and cause traffic congestion and access difficulty. Pipeline construction has significant impact on local road traffic. Temporary earth storage associated with pipeline construction during construction will have significant traffic impact. Open excavation for laying road-crossing pipelines will interrupt road traffic and cause significant traffic impact. Construction activities that affect daily life of the residents include foundation excavation, excavation and pipeline laying, backfilling, and road excavation and occupation, which will reduce urban road surface, decrease traffic capacity, lead to road blockage and congestion, and traffic inconvenience of local residents.

Pipelines to be laid under the Project crossing the provincial highway shall be routed via the existing culvert with priority. If there is no culvert to utilize, non-excavation construction technology (pipe jacking) may be used to accommodate traffic impacts. Therefore, the Project will involve substantially no impacts on the major roads such as the provincial highway.

Where other roads of lower classification are to be crossed by the project pipelines, large-opening excavation technology should be adopted and the construction site should be restored in time. Temporary impacts will be

generated on local traffic during construction, but such impacts can be mitigated by constructing temporary bypass roads since the project area is in the rural area of Chun'an County and the low-class roads involve relatively smaller traffic flow.

A county road (X704) and a provincial highway (S06) will be involved in the pipeline extension works of Pingshan WTP in Pingshan Township in Chun'an County. These two roads are to be overhauled recently. Timely communication between the IA and the transportation authority is recommended so that the water supply pipelines under the project can be buried before the overhaul to avoid multiple excavations.

Along the section of Qiuyuanxi Stream in Chun'an County from the cofferdam to be constructed to the raw water pipeline of Pingmen WTP, there is the Jiupaojie Scenic Area, which requires that the road traffic can be maintained where possible during the construction stage. This requirement can be met if half-width excavation is adopted to keep the other half-width open to traffic and assure the accessibility of the scenic area.

The water supply pipelines of Baima WTP in Chun'an County are to be laid along Da-Guan Highway, for which an overhaul is planned for the few years to come. Timely communication with the transportation authority is recommended so as to minimize repetitive excavation of pavement while maintaining the construction progress.

For the reconstruction of the 12 bridges in Jiande City, the existing bridges need to be demolished and local villagers will be affected during the construction period. Therefore, it is recommended that temporary access bridges are erected by the contractor for villagers in the construction period.

The fire protection emergency response access road for the forest zone in Jiande City will extend from Zhengfa Road of Xin'anjiang Community to Fangcun Village of Gaoling Natural Village in Yangxi Community and then further extends from Shibahu to Tongguan Forest Zone (the Lovers' Valley Scenic Area). The construction process will affect tourist accessibility to the Lovers' Valley Scenic Area while construction dust and noise will have impacts on visitors. It is required that the construction contractor will make reasonable arrangement of construction time to avoid construction in the peak hours of the scenic area and temporary access roads are constructed to assure smooth accessibility of the Scenic Area. Therefore, the following measures should be taken to avoid traffic impacts in the construction stage:

1. Temporary bypass roads should be constructed before massive excavation of existing roads to assure road traffic during the construction period. Bulletin boards should be erected along the roads and special personnel assigned to guide traffic and assure smooth traffic flow.

2. The county highway (X727) is the only access road to Jiupaojie Scenic

Area and is required to allow the passage of large tourist buses in the high tourist season. The construction plan should be scheduled in such a way that the high season is avoided where possible and bypass road wide enough to allow passage of large buses should be preserved during the construction process. Where such bypass cannot be assured, timely communication is required with the scenic area authority and plans should be developed for temporary commutation of tourists. In addition, the construction progress of this highway should be accelerated to minimize traffic impacts.

3. Timely communication with the transportation authority is recommended. In order to minimize repetitive pavement excavation, it is recommended that the pipeline construction is implemented in association with the road overhauls to be implemented for the county highway (X704) and the provincial highway (S06) in Pingshan Township and Da-Guan Highway in Baima Village.

4. For construction activities that will affect public traffic, construction program should be provided to public traffic authority in advance for arrangements for adjusting public traffic route, and construction cannot commence until permission is obtained.

5. Signs should be set on construction site before construction indicating construction description and schedule, requesting public understanding of inconvenience caused by construction activities, and disclosing contact information and complaint hotline. This information could be disclosed in advance through media, micro-blog and wechat,, if possible,.

6. Excavation and backfilling should be done by zone and as soon as possible.

7. Pipeline construction along road should be done on half of the road to ensure normal transport on the other half. Temporary hoardings and traffic instruction and warning signs should be posted on construction site to ensure traffic safety.

8. As construction will occupy existing road and affect road traffic, traffic management should be enhanced by suspending or reducing vehicle transportation in traffic peak hours to mitigate traffic congestion. Local roads that are significantly damaged during construction should be restored immediately or compensation should be paid to local highway

9. Pipeline construction should avoid peak hours or traffic diversion and adjustment should be done by traffic police in peak hours to mitigate traffic congestion and ensure convenience of pedestrians to minimize traffic impact to local residents.

10. Training on construction management and environmental protection

should be strengthened.

5.1.2.3 Social Impact of Tomb Relocation and Mitigation Measures

13 tombs will be relocated due to WTP construction. Tomb relocation will not have significant impact through negotiation with the tomb owners and reasonable compensation. In order to mitigate social impact caused by tomb relocation, following measures should be taken.

1. Full consultation with the tomb owners should be done and agreement should be obtained before relocation.

2. Compensation should be provided to affected households directly by town government and relocation should be done by the affected households.

3. Village leaders need to coordinate with tomb owners to select appropriate places for relocation.

4. Local custom for tomb relocation should be respected.

5. Cash compensation for tomb relocation ceremony should be considered besides in-kind compensation.

5.1.2.4 Impact on Irrigation Channel and Mitigation Measures

Survey indicates that the river rehabilitation and cofferdam construction works of the Project will affect 40 irrigation channels (as detailed in Table 5.1-1), which are located next to the river course and divert river water to nearby farmland. Irrigation area of individual channel ranges from 7 to 115 mu and the farmland irrigated is mostly dry land. Major crops on the farmland include mulberry, corn, green soy bean, peanut, and vegetables. Embankment, dike improvement and channel rehabilitation will destroy water intakes or decrease water level, and will affect irrigation in a short period and have slight impact. Irrigation channels will be restored once construction is over and the irrigation function will be restored or improved to eliminate impact on irrigation of surrounding farmland.

The following management requirements or measures should be taken to mitigate impact on irrigation channels:

(1) Construction should avoid crop irrigation period where possible;

(2) Cofferdam should be built and construction should be done by stage and by section for wide river, in order to ensure water level at intake and meet irrigation demand;

(3) In case water intake cannot be used due to impact of construction activities, temporary cofferdam should be set upstream to ensure water intake. Flexible pipes will be used at 40 locations (100 m in length for each location) to convey water downstream to irrigation channels to meet irrigation demand.

Table 5.1-1 Irrigation ditches to be affected in the construction stage

Village	Construction works	Type of land use	Area of irrigation (mu)	Water consumption (m^3/year)	Impact factor
Chun'an County					
Xinhe Village, Wangfu Township	rehabilitation of ditches	dry land	50	2300	Rehabilitation of irrigation channels will affect farmland.
Longyao Village, Fenkou Town	restoration of ditches	dry land	10	500	
Longquan Village, Fenkou Town	restoration of ditches	dry land	35	1700	
Huiyuan Village, Langchuan Township	rehabilitation of ditches	dry land	19	900	
Baojia Village, Langchuan Township	restoration of ditches	dry land	85	3900	
Duchuan Village, Weiping Town	restoration of diches170m	dry land	47	2200	
Wenchang Village, Wenchang Town	rehabilitation of diches450m	dry land	32	1500	
Sunjiawu, Jiangjia Town	restoration of diches107m	dry land	8	400	
Sunjiawu, Jiangjia Town	restoration of diches205m	dry land	12	600	
Shangwangquan, Jiangjia Town	restoration of ditches	dry land	20	1000	
Aiguo Village, Yaoshan Township	rehabilitation of ditches 145m	dry land	76	3500	
Kantou Village, Pingmen Township	rehabilitation of ditches 20m	dry land	17	800	
Banxia Village, Linqi Town	Drainage ditch: 78m	dry land	21	1000	
Yecunxi, Zhongzhou Town	rehabilitation of ditches	dry land	16	700	
Changgeng Village, Zhongzhou Town	restoration of ditches	dry land	115	5200	
Weishan Village, Fenkou Town	restoration of ditches	dry land	96	4300	
Sixia Village, Fenkou Town	restoration of ditches	dry land	94	4200	
Zhangcun, Jiangjia Town	rehabilitation of ditches	dry land	43	2000	
Guocun, Jiangjia Town	restoration of ditches	dry land	38	1700	
Yingfeng, Jiangjia Town	restoration of ditches	dry land	38	1700	
Yingjiawu, Jiangjia Town	restoration of ditches	dry land	20	900	
Muwang Village, Jiangjia Town	rehabilitation of ditches	dry land	38	1700	
Huangqiao Village, Jiangjia Town	restoration of ditches	dry land	116	5200	
Fulin Village, Jiangjia Town	restoration of ditches	dry land	32	1400	
Chicheng Village, Jiangjia Town	restoration of ditches	dry land	27	1200	
Sanzhou (Guojia) , Weiping Town	restoration of ditches	dry land	22	1000	
Yejia Village, Weiping Town	restoration of ditches	dry land	67	3000	
Yangjiaban Village	restoration of ditches	dry land	143	6400	

Table 5.1-1 Irrigation ditches to be affected in the construction stage

Village	Construction works	Type of land use	Area of irrigation (mu)	Water consumption (m^3/year)	Impact factor
Hongyin Village	restoration of ditches	dry land	55	2400	
Jiande City					
Hangtou Village, Hangtou Town	Cofferdam construction	Dry land	50	2400	Farmland irrigation will be affected during cofferdam construction.
Wulong Village, Hangtou Town	Cofferdam construction	Dry land	80	4000	
Dadiankou Village, Hangtou Town	Cofferdam construction	Dry land	60	2900	
Hangchuan Village, Hangtou Town	Cofferdam construction	Dry land	100	5000	
Shimulingxi Village, Hangtou Town	Cofferdam rehabilitation	Dry land	20	1000	
Wenjia, Shangma Village, Datong Town	Cofferdam construction	Dry land	30	1400	
Zhenyuan Village, Datong Town	Cofferdam construction	Dry land	100	4800	
Songxi Village, Datong Town	Cofferdam rehabilitation	Dry land	20	1000	
Chaoyang Village, Datong Town	Cofferdam construction	Dry land	60	3000	
Qingtan Village, Datong Town	Cofferdam construction	Dry land	50	2400	
Panshan Village, Datong Town	Cofferdam construction	Dry land	60	2900	

5.1.2.5 Impacts on Underground Pipelines

Foundation excavation may interfere with existing underground pipelines and damage of existing pipelines will affect daily life of the residents. Based on existing underground pipeline survey and design excavation depth, existing petroleum oil and gas transmission pipeline, optical cable for national defense, underground optical cable in construction area will not be interfered.

The underground fuel gas pipelines of Hangzhou Fuel Gas Co., Ltd. will be involved in the pipeline extension works of Fenkou and Jiangjia WTPs in Chun'an County. If no adequate preparations are made, adverse impacts will be generated on the safe operation of the fuel gas pipeline.

The water transmission and distribution pipelines of the Project will probably cross the other underground infrastructures, which will probably be affected during construction if the relevant information is not identified in advance.

The following mitigation measures should be required to avoid impact of pipeline interruption to daily life of residents caused by excavation for pipeline construction.

1. The contractor and the designer need to communicate with the local planning and municipal engineering authorities and other infrastructure

administration authorities during the design stage and prior to construction to identify the layout of underground facilities and works in the construction sites and the adjacent areas, disclose to the local public and carry out further survey of the layout of underground infrastructures, negotiate and develop a solution, conscientiously design the construction program and finish the reinforcement and rehabilitation of affected underground facilities and works before the construction of the Project and communicate with the local authorities about the construction program. Reinforcement and rehabilitation of such underground facilities should be covered in a special fund planned under the Project.

2. Construction plan and emergency response plan should be developed based on pipeline alignment and depth to avoid interference with existing underground pipelines where possible.

3. Construction works at sites involving crossing of fuel gas pipelines should be designed and constructed according to the “Law on Protection of Natural Gas Pipelines” and other regulations and specifications. The contractor shall consult the fuel gas companies and develop a pipeline protection program, carry out a survey of the terrain and topography on site and make sure that the water supply pipelines are kept as far away from the fuel gas pipelines as possible. Prior to ground excavation, detailed information on the safety and technological aspects of the fuel gas pipelines shall be delivered. The locations of the underground pipelines shall be identified before any construction works proceed. A safety separation belt shall be provided on sites involving interfering operations to separate such sites from the construction areas and access should be strictly controlled to keep non-operators away from site. Excavation activities in areas with a distance of less than 10m from the pipeline centerline shall be carried out artificially instead of using large plants. Drainage and waterproofing measures should be properly implemented on the construction sites. In the process of excavation, pipe knocking of any nature is prohibited. Prior to duct backfill, used tires can be placed on top of the new pipelines to separate the two crossing pipelines. Duct backfill shall be carried out manually by filling soft soil around the pipelines and artificially compacted. The backfill shall not cause any impacts and compression of the pipelines. Backfill soil shall be artificially pushed into the duct from one side and compacted. Warning signs should be provided on site. Safety training for construction workers should be organized prior to construction and an emergency response plan should be developed for natural gas leakage during construction.

4. In the event of interference with existing pipelines, the concerned authority should be informed of particular construction location and schedule of excavation activities to be prepared for emergency responses.

5.1.3 Impact on Water Environment and Mitigation Measures

1. Common Impacts on Water Environment

Construction wastewater includes mostly domestic sewage from construction workers, wastewater from concrete batching system cleaning, wastewater from vehicle and equipment maintenance and cleaning, slurry during construction, and wastewater from foundation trenches.

Domestic sewage is from daily life activities of construction workers, which contains pollutants like COD_{Cr}, BOD_5 and SS. Given large number of subprojects and scattered construction sites, individual construction camp will have limited construction workers and generation of domestic sewage. Domestic sewage can be either adequately treated on site and then used for farmland irrigation or hauled out by sanitation utility and will have insignificant environmental impact.

Concrete batching plant will generate small amount of discharge from facility cleaning, which contains high SS content and has high pH level and uncontrolled discharge may destroy soil structure. Cleaning water discharged should be treated through sedimentation to meet Integrated Wastewater Discharge Standard (GB8978-1996) Class 1 for reuse for construction or dust control watering, and will have insignificant environmental impact.

Vehicle and construction equipment maintenance will involve sewage discharge from maintenance and cleaning, which contains petroleum oil and suspended solids. Given the large number of subprojects and construction sites located in a decentralized way, individual vehicle and equipment maintenance site will generate wastewater at a rate of about $2m^3$ per day. After being treated in sedimentation and oil separation tanks, the effluent will be reused for equipment cleaning and site watering, and will have insignificant environmental impact.

Bridge and embankment foundation construction will generate small quantity of slurry. Temporary sedimentation tank should be set near construction site for sedimentation and drying. Treated effluent will be reused for construction and will have insignificant environmental impact.

Construction of cofferdam is required during embankment and dike construction associated with river rehabilitation. Foundation trench discharge includes water penetrating into the cofferdam, groundwater from excavation and stormwater, which contains suspended solid content around 2,000 mg/L. After sedimentation, effluent will meet Integrated Wastewater Discharge Standard (GB8978-1996) Class 1 for reuse to construction or dust control watering, and will have insignificant environmental impact.

The EMP includes codes for management of construction activities to mitigate impact on water environment, and major measures to be taken include the following:

(1) Wastewater collection and sedimentation facility should be set on concrete batching plant. Horizontal concrete and brick masonry sedimentation tank should be built on site. Wastewater will be collected and treated in sedimentation tank with chemical dosing and effluent will be reused for concrete making, vehicle cleaning and site watering for dust control.

(2) Wastewater collection ditches should be built on construction equipment maintenance site to collect oily wastewater from cleaning and maintenance. Oil separation and sedimentation tank should be set on construction site and oil and sediment should be cleaned on a regular basis. The effluent will be reused for vehicle cleaning and site watering for dust control. Oil collected should be hauled to qualified facility for disposal.

(3) Sedimentation tanks should be built on construction sites for treatment of foundation trench discharge, the retention time of which should be more than 2 hours. The effluent will be pumped out for construction or road watering.

(4) Containment structure should be built around temporary cofferdam to prevent water pollution by suspended solids.

(5) Residential buildings should be used as construction worker camps where possible for utilization of existing municipal facilities for domestic sewage treatment. Where there are no wastewater collection and treatment facilities, domestic sewage collection and treatment facilities should be built by the contractor prior to construction. Septic tank should be built for toilet, and septic tank discharge could be collected by local sanitation utility. When construction site is located in remote area where service of sanitation utility is not available, underground and powered wastewater treatment facility should be provided and domestic sewage should be treated to meet Integrated Wastewater Discharge Standard (GB8978-1996) Class 1 and reused for nearby farmland and forest irrigation.

(6) Siting of construction site should fully accommodate need for drainage and should be located as far away from water bodies as possible. Construction site, warehouse, and diesel storage site should not be located within 500 m of the river. Necessary measures should be taken to prevent discharge of pollutants into the river, especially through stormwater runoff or surface runoff in rainy season.

(7) Drilling debris should be hauled to designated site for disposal, and drilling slurry should be pumped to sedimentation tank for treatment and then transported to designated site for disposal.

(8) Construction wastewater should be adequately treated in sedimentation tank and effluent should be reused for road and vehicle tire cleaning.

(9) 50 cm high brick masonry retaining wall can be built around temporary construction material storage site to prevent stormwater erosion. Construction debris should be stored on designated site, covered and transported for disposal in a timely manner to prevent entering watercourse through surface runoff in raining days.

(10) Construction site should be cleaned. Construction equipment should be maintained and repaired in a timely manner to avoid oil leakage and spill. Measures should be taken in the event of oil leakage immediately by collecting oil in special container and appropriate disposal.

(11) Management of wastewater treatment facilities should be enhanced by sedimentation tank and drainage channel cleaning on a regular basis and off-site disposal of oil and grease from oil separation tank. Uncontrolled dumping is not allowed.

(12) Water-related construction should be done in dry season where possible, and construction stage should be shortened, if possible, to reduce disturbance to water body.

5.1.4 Impact on Ambient Air and Mitigation Measures

Air pollution during construction is mostly associated with dust suspension caused by construction vehicles, storage site and concrete making, vehicle exhaust, and odor from dredging.

Affected by dust from transportation vehicles on construction site, ambient air quality in areas 80 to 120 m downwind from the site will not meet Ambient Air Quality Standard (GB3095-2012) Class 2. TSP level in area 30 to 60 m downwind from the spoil transportation road will violate this applicable standard, and this is the same for area 100 to 150 m downwind from spoil disposal site. Analogy analysis indicates that hourly average TSP concentration is 8.10mg/m^3 5 m away from the concrete batching station and decreases to 1.65mg/m^3 at 100 m away, and GB3095-1996 Class 2 could be met at 150 m away from the batching plant in terms of daily average value. Construction dust will have certain impact on ambient air surrounding construction site and construction workers. Dust impact is temporary and will be significantly mitigated through covering and watering measures and will be minimal when construction activities have been finished.

Exhaust of construction machines and vehicles contains NOx, CO and hydrocarbon, but will not have significant impact on ambient air due to very limited intensity of exhaust emission and favorable dilution and diffusion condition benefited from the flat landform.

Dredged sediment contains high level of organic contents and decomposition of organics during disturbance and storage will generate odor pollutants such as ammonia and hydrogen sulfide. Uncontrolled odor diffusion will not only pollute ambient air but also will harm public health when concentration reaches a certain level. Analogy analysis predicts that sediment dredging will have significant odor impact along the river. The scope of odor impact is in general less than 30 meters and the impact will be lowered to Level 2 beyond the 30m scope and be insignificant and better than standard limits (level 2.5 to level 3.5). Odor from sediment dredging will have certain impact on sensitive

receptors within a distance of 30 meters from the site especially on densely-populated Shouchang Town. However, dredging impact will last for a very short time and will be mitigated by strengthened construction management, and will disappear when river dredging comes to the end.

Although there are many environmental sensitive receptors near construction sites of embankment and drinking water supply pipelines, a single construction site has very limited quantities of civil works and short construction period and the impact of construction dust will be mitigated through implementation of ECOP specified in the EMP for earth excavation, construction material and earth transportation and building/structure construction. The key mitigation measures include：

1. Construction site management should be strengthened. Transportation vehicle should be in good condition and should not be overloaded for cement and lime transportation, and covering and enclosing measures should be taken to avoid spill and reduce dust generation. Reasonable locations should be selected for material and spoil storage, and material such as cement and lime should be stored at the same area and wind protection and covering measures should be taken. Sand screening and cement bag opening should be done in the lee, and site that has significant dust generation should be installed with windbreak facilities.

2. Clean-up and water spraying can be done for dust control on construction sites and access roads. Spraying water 4 to 5 times each day on construction site is suggested. Practice in China concluded that Integrated Air Pollutant Emission Standard (GB16298-1996) can be met by adopting these mitigation measures, in terms of concentration of uncontrolled emission of particulates. Damaged vegetation should be restored in a timely manner.

3. Transportation vehicles should be cleaned and washed in a timely manner before leaving the construction site. Wheel washing equipment should be provided on site to clean dirt on the wheels.

4. Onsite fume control should be enhanced. Toxic fume and gas emission is prohibited on construction site to mitigate waste gas pollution to sensitive receptors.

5. Stringent site management measures should be taken, which include installation of hoarding not lower than 2 m along both sides of construction site, enclosed construction, containment structure installed at hoarding bottom with no space between hoardings and between hoarding and containment structure, and setting of No-entry signs for banning non-construction workers to enter the site.

6.Loading/unloading and transportation process should be strictly managed. Transportation of sand, cement and waste soil should be covered, and construction material should be loaded and unloaded with due care.

7.Temporary storage of earth and sand during construction should be covered and watered, and spoil should be hauled out of the site as early as possible.

8. Transportation vehicle and construction equipment should be properly maintained to keep normal operation and avoid more exhaust emission caused by improper maintenance. Use of equipment that significantly violates applicable emission standard should be banned.

9. The contractor should improve planning and management of construction sites. Locations of construction material (sand and stone) storage sites and concrete batching plants should be fixed and regular watering and proper covering measures should be taken. Centralized concrete batching should be selected where possible and should be located more than 200 m away downwind of the sensitive receptors.

11. Regular watering should be done for residential communities near construction site and operation area that generates much dust, and dust generating temporary facilities (like concrete batching plant) and construction material storage site should be set far away from residential communities and temporary material storage site should be covered with color strip cloth.

12. Temporary and scattered concrete batching facilities should be located far away from residential area.

13. Full-time staff should be designated by contractor for storage, transportation and disposal of spoil, construction solid waste and construction material. Storage site should be covered or watered to prevent secondary dust suspension.

5.1.5 Impact of Noise and Mitigation Measures

Construction noise is generated by construction machine and transportation vehicle. Construction noise occurs in a certain period, temporarily and not in fixed locations. Noise varies with construction machine. Intensity of major noise sources is projected in **Table 5.1-2**.

Table 5.1-2 Noise Level of Major Construction Machines

No.	Construction Machine	Noise Level/dB (A) (5 m away from the machine)
1	Loader	90
2	Truck	87
3	Pump	80
4	Vibrator	79
5	Bulldozer	90
6	Excavator	83

As shown in Table 5.1-2, operation of multiple machines at the same time will

lead to superposition of noise level. According to the prediction, it is estimated that the superimposed noise level will increase by no more than 3 dB (A). As shown in **Table 5.1-3**, noise level of construction machine decreases with distance.

Table 5.1-3 Projected Noise Level by Distance

Construction Machine	Noise Source Intensity (Distance: 5 m) dB(A)	Distance (m)								
		15	30	50	80	100	150	200	300	500
Loader	85	75.5	69.4	65.0	60.9	59.0	55.5	53.0	49.4	45.0
Truck	87	77.5	71.4	67.0	62.9	61.0	57.5	55.0	51.4	47.0
Pump	80	70.5	64.4	60.0	55.9	54.0	50.5	48.0	44.4	40.0
Vibrator	79	69.5	63.4	59.0	54.9	53.0	49.5	47.0	43.4	39.0
Bulldozer	85	75.5	69.4	65.0	60.9	59.0	55.5	53.0	49.4	45.0
Excavator	83	80.2	74.2	69.7	65.6	63.7	60.2	57.7	54.2	49.7

Major construction machines include excavator, bulldozer, loader, vibrator and dump truck with an operation noise level ranging from 80 to 90 dB (A). Prediction results in Table 5.1-2 show that impact of machine noise is within 150 m in daytime and 500 m in nighttime at places there is no any sound barrier between noise source and receptors. Noise level can be reduced by 15-25 dB (A) when temporary hoarding and sound barriers are installed, and noise level at environmental sensitive receptors caused by construction equipment will range from 54 to 60 dB(A) after mitigation measures are taken, which meets Environmental Quality Standard for Noise (GB3096-2008) Class 2. Benefiting from noise buffering by the first row of residential buildings, the second row of residential buildings are hardly affected by construction noise. Noise impact during construction concentrates in area within 30 m of the construction site. Given small civil work quantities on individual construction site, impact of noise on residents during construction will last short time and insignificant.

Construction noise level will be 60 dB at the nearest Yanjiaping Village that is 80 m away from Wangfu WTP and can meet applicable standard. Meanwhile, noise at the nearest Wangjia Village that is 30 m away from Xiashan WTP will be 70 dB and cannot meet applicable standard. Noise at the nearest Hepu Village that is 100 m away from Pingmen WTP will be 57 dB and can meet applicable standard. Noise at the nearest Guanchuan Village that is 200 m away from Baima WTP will be 52 dB and can meet applicable standard. Noise at the nearest Hehuaping Village that is 110 m away from Wangfu WTP booster pump chamber will be 56 dB and can meet applicable standard. Noise at the nearest Lianhe Village that is 60 m away from Weiping WTP booster pump chamber will be 62 dB and cannot meet applicable standard. As long-time WTP construction will have significant noise impact, installation of

temporary sound barriers around WTP and pump station is required to minimize impact of construction noise, and construction in nighttime should be prohibited.

The EMP includes common practices to mitigate noise impact by better management of construction activities such as earth excavation, earth and material transportation and construction of buildings and structures. Major mitigation measures include:

(1) Construction machines and transportation vehicles should meet applicable national standards. Advanced low-noise construction method and equipment should be selected to minimize noise from the source.

(2) Construction time is from 8:00 a.m. to 20:00 p.m., with construction activities being suspended from 12:00 to 14:00 for noon break. Construction activity in nighttime is allowed only when permission is obtained from construction authority and approved by local EPB and disclosed to nearby residents.

(3) Construction activities should be reasonably scheduled to avoid operation of multiple high-noise machines at the same time and on the same construction site. Construction stage should be shortened, if possible, to minimize noise impact on construction workers.

(4) Vibration damping foundation or support should be used for machines that generate high noise, including use of damping material.

(5) The contractor should have reasonable construction site layout and distribution of construction machines to reduce noise from operation of multiple machines. Construction site should be located as far away from residential area as possible and construction machines should be located at the side of construction site that is far from temporary construction worker camp and nearby sensitive receptors.

(6) The contractor should consult the nearby agencies, residents and schools, and arrange construction activities with high noise in summer and winter vacations and holidays where possible. Meanwhile, construction should be accelerated to shorten construction stage. High-noise construction activities should be concentrated in weekends to minimize impact on nearby sensitive receptors.

(7) Route and time of transportation vehicles should be well arranged. Speed limit and limit of horn use should be required to minimize traffic noise. Transportation during 20:00 to 6:00 should be minimized and densely populated residential areas and acoustic sensitive receptors should be avoided. Transportation plan should be carefully developed for vehicle transportation that have to cross residential area and consultation and communication with nearby residents should be strengthened.

(8) High-noise construction equipment should be located on the construction

site far away from resident area. 1.8m high hoarding for noise reduction should be installed on construction site located within 5 m of residential area.

(9) The contractor should have reasonable construction staffing to shorten working time of high-noise machine operators. Earmuff should be provided to construction workers to reduce noise impact.

(10) All the construction equipment should be maintained on a regular basis to keep them in good condition, reduce noise and prolong service life.

(11) Stringent requirements should be made for construction scheduling, machine and vehicle operator and operation practice.

(12) The IA should require the contractor to disclose information of complaint channel on construction site. Once complaints are received, the IA should contact local environmental authority for settlement of various disputes in a timely manner. It is stipulated in PRC Environmental Noise Pollution Prevention Regulation Article 43 that entity and individual that causes environmental noise pollution will be obliged to eliminate the impact and provide compensation to directly affected organizations or individuals. In the event applicable noise control standard cannot be met although noise mitigation measures are taken, affected individuals should be compensated by the contractor, especially for noise impact in nighttime.

5.1.6 Solid Waste Impacts and Mitigation Measures

Solid wastes in the construction stage include dredged sediment from river dredging and construction debris from construction of new buildings and structures (sand and stone, lime, concrete, timber, and waste brick) as well as domestic solid waste generated by construction workers. Solid waste generated by this Project is classified as ordinary waste and will be hauled to construction solid waste landfill for disposal. Domestic solid waste will be collected and transported out by local sanitation entity and will not have adverse environmental impact.

According to the earthwork balance, the subproject will involve a total excavation of 567,800m^3 (including 292,000 m^3 for dike rehabilitation and 275,800 m^3 for road construction), a total fill of 318,200 m^3 and a balance of 327,300 m^3, including 246,000 m^3 for ordinary earthwork, 37,500 m^3 for removal of damaged flood dike and 43,200 m^3 for sediments. Waste soil generated in the construction works will be fully reused, including 39,600 m^3 in Hangtou Town to be reused for site leveling of Hangtou Town Dadiankou Industrial Park and the remaining 210,100 m^3 to be used for site leveling in Datong Town Industrial Park. According to the site survey, the available areas in Datong Town Industrial Park and Hangtou Town Dadiankou Industrial Park are respectively 0.71km^2 and 0.65km^2 and these areas are currently open space requiring a fill height of around 2m on average, capable of fully digesting the waste soil to be generated in the project. The waste soil should be properly covered in the process of transportation to prevent spillage and leakage. Results of monitoring of sediment samples show that the sediments sampled and monitored at Zhenyuanxi Stream, Shimulingxi Stream and Wulongxi

Stream satisfy the Class III standard specified in the Soil Environment Quality Standard (GB15618-1995) and are usable as forest land soil. All the sediments from dredging under the Project will be delivered to the industrial parks in Datong Town and Hangtou Town in Jiande City for site leveling and such disposal method satisfies the relevant requirements of GB18599-2001 "Standard for controlling pollution on the storage and disposal sites for general industrial solid wastes".

All the earth from Chun'an County river dredging subproject will be transported out of the site. The total earth excavation involved in this Subproject will be 810,000 m^3, including 56,200 m^3 from river dredging. Earth backfill totals 475,300 m^3 and 334,700 m^3 will be hauled out of the site (including 56,200 m^3 from river dredging).

Disposal of 314,700 m^3 spoil from Chun'an County Small Watershed Rehabilitation Subproject is required. Wuqiangxi Stream basin involves an earth excavation of 184,440 m^3 in total including reuse of 76,730 m^3 and disposal of 107,610 m^3 (equivalent to excavated incompact earth 128,070 m^3). Yuchuanxi Stream basin involves an earth excavation of 225,000 m^3 in total including reuse of 116, 800 m^3 and disposal of 108,200 m^3 (equivalent to excavated incompact earth 129,500 m^3). Liuduyuan River basin has 217,370 m^3 earth to be excavated and 55,390 m^3 stone masonry retaining wall to be demolished in total including reuse of 104,540 m^3 and disposal of 168,200 m^3 (equivalent to excavated incompact earth 201,900 m^3). Shangwuxi Stream basin has 66,900 m^3 earth to be excavated in total including 3,500 m^3 from river dredging, 31,300 m^3 for backfill and 35,600 m^3 for disposal (including 3,500 m^3 from river dredging). Zitongyuan River basin has 69,200 m^3 earth to be excavated in total including 6,800 m^3 from river dredging, backfill of 60,300 m^3 and disposal of 8,900 m^3 including 6,800 m^3 from river dredging.

The design of mitigation measures for disposal sites should be carried out following such a principle that retaining walls are constructed first before any disposal operations proceed and both permanent and temporary measures should be incorporated in order to prevent soil erosion in the process of disposal site use due to absence of protective measures. Mitigation measures include construction of stone masonry retaining wall and farming restoration on disposal site surface. Details of the disposal sites are listed in Tables 5.1-3 to 5.1-6. Details of soil conservation and restoration measures are shown in Section 5.1.1.

Results of monitoring of river sediments in Chun'an County show that the sediments sampled and monitored at Zitongyuan River satisfy the Class III standard specified in the Soil Environment Quality Standard (GB15618-1995) and are only usable as forest land soil. The sediments will be delivered to Changning Village Construction Waste Landfill Site for disposal and such disposal method satisfies the relevant requirements of GB18599-2001 "Standard for controlling pollution on the storage and disposal sites for general industrial solid wastes".

Monitoring results of sediments and soil status reveal that Class 2 or Class 3 standards specified in the Soil Environment Quality Standard can be met in terms of concerned heavy metals, concentrations of which are close to baseline values. Sediment is classified as ordinary solid waste, and disposal of construction spoil will not pollute nearby soil.

Chinese silver grass, shrub and grass chopped down during forest land improvement can be stored or buried in the forest for natural decay or hauled to organic fertilizer plant for reuse. Timber attacked by pests should be disposed of or destroyed under supervision and guidance of forest and plant quarantine authority.

Table 5.1-3 Locations of Disposal Sites and Bill of Quantities of Mitigation Measures of Chun'an County Small Watershed Rehabilitation

Basin	Town	Location of Disposal Site	Area, mu	Capacity 10,000 m^3	Removal of Surface Soil 10,000 m^3	Length of Interception Ditch (m)	Number of Sedimentation Tanks	Length of Retaining Wall (m)
Liuduyuan River	Weiping Town	Maojiaojian Xiafanli Disposal Site 1	10	15	0.48	2114	2	1596
		Maojiaojian Xiafanli Disposal Site 2	20	30	0.79	3436	2	2594
Yuchuanxi Stream	Jiangjia Town	Zhushi	7	7	0.27	1164	2	879
		Zhangcun	6	5	0.29	1267	2	956
		Fulin	1	0.18	0.24	1029	2	777
		Yinfeng	2	0.3	0.1	420	2	317
		Huangcunqiao	15	10	0.27	1188	2	897
Wuqiangxi Stream	Fenkou Town	Fenkou Town Construction Solid Waste Landfill	60	30				
	Zhongzhou Town	Zhangcun	3	0.5	0.17	752	2	568
		Xujia	30	15	0.42	1821	2	1375
Shangwuxi Stream	Anyang Township	Wulong Village Shanlingjiao Village	1.31	0.24	1037	2	783	
		Huangjiayuan, area changed from farmland	1.12	0.2	887	2	669	
		Shanlingjiao Village	0.97	0.18	768	2	580	
		Shanxia Village	0.15	0.03	119	2	90	
Zitongyuan River	Zitong Town	Changning Village Construction Solid Waste Landfill	0.25					

Table 5.1-4 Spoil Disposal and Mitigation Measures of Chun'an County Dike Improvement

No.	Town	Responsible Party	River	Disposal Location	Type	Land Area mu	Capacity 10,000 m^3	Drainage Channel, m	Number of Sedimentation Tanks
1	Dashu	Dongwu Village	Fenglingang River	Wulangwu	open	2.3	0.66	145	1
2		Sunjiafan Village		Yaopengwu	open	2.1	0.68	124	1
3		Dawu Village	Shangfang Stream	Niuanling	open	4.5	1.34	183	1
4	Anyang	Waifan and Tongchuan Villages	Tongchuan Stream	Xielin Bridge in Tongchuan Village	open	2.96	0.59	145	1
5	Lishang	Daye Village	Shangjiayuan River	Zixuwukou	open	3.2	0.61	154	1
6		Yuquan Village		Kaokeng	open	2.9	0.58	180	1
7	Linqi	Yejiafan Village	Jinxianxi Stream	Songkeng	open	0.9	0.24	84	1
8		Linqi Village		Jinkeng	open	8.5	2.74	244	2
9		Xikou Village	Fengchuan Stream	Greenhouse in Zhongxin Village	open	2.5	0.70	160	2
10	Jiangjia	Xiayuquan Village	Yuquan Stream	Disposal site of Xiayuquan Village	open	2.8	0.73	170	2
11		Sunjiawu	Longquan Stream	Disposal site of Chishuitang	open	1.9	0.51	110	1
12	Pingmen	Jiangkeng Village	Jinxianxi Stream	Next to inner side of 2# embankment of Jiangkeng Village	open	1.1	0.30	96	1
13		Pingmen Village		Disposal site of Pingmen Village	open	5	1.54	197	2

Table 5.1-4 Spoil Disposal and Mitigation Measures of Chun'an County Dike Improvement

No.	Town	Responsible Party	River	Disposal Location	Type	Land Area mu	Capacity 10,000 m^3	Drainage Channel, m	Number of Sedimentation Tanks
14	Weiping	Tang and Kengxia Villages	Qiduyuan River	Construction solid waste landfill in Tang and Kengxia villages	open	1.22	0.50	108	1
15		Duchuan		Construction solid waste landfill in Duchuan Village	open	1.55	0.57	121	1
16	Zuokou	Zuokou Village	Shibaduyuan River	Houwu	open	1.8	0.59	168	2
17		Xianhou Village		Next to Piaoliu Bridge	open	2	0.66	120	1
18	Fengshuling	Shangjiang Village	Fengjiayuan River	Bare land of Shangjiang Village	open	7.2	2.15	300	2
19	Wenchang	Wenchang Village	Wangjiayuan River	High-speed railway disposal site of Wenchang Village	open	1.8	0.51	168	2
20	Yaoshan	Aiguo Village	Jinxianxi Stream	Disposal site of Aiguo Village	open	1.5	0.39	150	2
21	Songcun	Qingshankou and Hujiafan Villages	Yunyuangang River	Qingshankou Village	open	0.41	0.11	41	1
	Total					58.14	16.71	3168	29

Table 5.1-5 Spoil Disposal and Mitigation Measures of Chun'an County River Rehabilitation

No.	Town	Responsible Party	River	Disposal Location	Type	Land Area mu	Capacity 10,000 m^3	Drainage Channel, m	Number of Sedimentation Tanks
1	Jiajiang	Shankou and Xiashe Villages	Qinchuan Stream	Disposal site in Xiashe Village	Open	1	0.37	95	1
2		Shangyuquan Village	Yuquan Stream	Disposal site in Longlingshang Village	Open	1.5	0.59	150	2
3	Langchuan	Yuanfeng Village	Langchuan Stream	300 m downstream from Chayuan Village	Open	0.6	0.14	48	1
4		Hongqi Village	Longquan Stream	Confluence of Longyaunxi and Hongqi Branch	Open	1.8	0.45	168	2
5	Fengshuling	Muhuakeng Village	Fenglingang River	Landfill in Muhuakeng	Open	3.1	0.94	150	2
6		Tongshan Village	Fenglingang River	Abandoned Tongshan Iron Mine	Open	0.8	0.22	80	1
7		Xiacun Village	Fengjiayuan River	Xiacun landfill	Open	1	0.28	100	1
8	Dashu	Taolin Village	Shangfang Stream	Miaodi	Open	0.87	0.31	80	1
9		Linggan Village	Shangfang Stream	Changlingjiao	Open	0.43	0.20	40	1
10		Taoyuanlingjia Village	Fenglingang River	Yaopengwu	Open	0.45	0.22	40	1
11		Sunjiafan Village	Fenglingang River	Yaopengwu	Open	0.48	0.20	40	1
12		Ruhong Village	Shangfang Stream	Yaopengwu	Open	0.86	0.26	80	1
13		Laoling Village	Shangfang Stream	Banwukeng	Open	1.7	0.44	165	2

Table 5.1-5 Spoil Disposal and Mitigation Measures of Chun'an County River Rehabilitation

No.	Town	Responsible Party	River	Disposal Location	Type	Land Area mu	Capacity 10,000 m^3	Drainage Channel, m	Number of Sedimentation Tanks
14	Lishang	Shiwan Village	Shangjiayuan River	Miaohouwu	Open	1.9	0.76	170	2
15		Jiang Village	Jiangcunyuan River	Tongshanling	Open	1	0.31	95	1
16	Wenchang	Langdong Village	Langdongyuan River	Disposal site in Langdong Village	Open	1.5	0.36	150	2
17		Shifan Village	Langdongyuan River	H-speed railway disposal site in Wenchang Village	Open	0.5	0.11	45	1
18		Wangjiayuan Village	Wangjiayuan River	Disposal site in Wangjiayuan Village	Open	1	0.15	95	1
19		Tantou Village	Wangjiayuan River	Shalingtou disposal site in Tantou Village	Open	1.5	0.27	150	2
20		Wenchang Village	Langdongyuan River	H-speed railway disposal site in Wenchang Village	Open	0.6	0.17	48	1
21	Linqi	Xiazhong Village	Jinxianxi Stream	Xiazhong construction solid waste landfill	Open	2.5	0.80	245	2
22		Zuoyuan Village	Fengchuan Stream	Fengcun construction solid waste landfill	Open	3.5	1.04	340	2
23		Youyuan Village	Fengchuan Stream	Kantou construction solid waste landfill	Open	2	0.59	200	2
24		Shenlingjiao Village	Jinxianxi Stream	Zicaoling construction solid waste landfill	Open	2	0.57	200	2

Table 5.1-5 Spoil Disposal and Mitigation Measures of Chun'an County River Rehabilitation

No.	Town	Responsible Party	River	Disposal Location	Type	Land Area mu	Capacity 10,000 m^3	Drainage Channel, m	Number of Sedimentation Tanks
25		Likou Village	Jinxianxi Stream	Zhujiawu	Open	3	0.85	300	2
26		Xinxi Village	Jinxianxi Stream	Huitong sandpit	Open	1	0.22	95	1
27		Banxia Village	Jinxianxi Stream	Meilingtou construction solid waste landfill	Open	5	1.50	500	2
28	Weiping	Ping Village	Qiduyuan River	Ping Village construction solid waste landfill	Open	0.56	0.26	45	1
29		Duchuan Village	Qiduyuan River	Duchuan Village construction solid waste landfill	Open	0.44	0.31	40	1
30		Hefu Village	Qiduyuan River	Hefu Village construction solid waste landfill	Open	0.39	0.20	30	1
31		Xinmao Village	Qiduyuan River	Xinmao Village construction solid waste landfill	Open	0.4	0.22	40	1
32	Wangfu	Mashan Village	Yunyuangang River	Dukeng Village	Open	0.48	0.15	40	1
33		Huaping Village	Yunyuangang River	Huaping Village	Open	0.51	0.25	50	1
34	Zuokou	Cilongyuan Village	Cilongyuan River	Next to Niyuxing	Open	1.2	0.39	120	1
35		Fangjia Village	Shibaduyuan River	Pengkanwu	Open	0.5	0.14	50	1
36		Longyuanzhuang	Shibaduyuan River	Zhongwuli	Open	1	0.27	95	1

Table 5.1-5 Spoil Disposal and Mitigation Measures of Chun'an County River Rehabilitation

No.	**Town**	**Responsible Party**	**River**	**Disposal Location**	**Type**	**Land Area mu**	**Capacity 10,000 m^3**	Drainage Channel, m	Number of Sedimentation Tanks
37	Fuwen	Liulian Village	Qingpingyuan River	Liulian Village	Open	0.96	0.26	95	1
38	Pingmen	Jiangkeng Village	Jinxianxi Stream	Disposal site in Jiangkeng Village	Open	2	0.31	190	2
39		Kantou Village	Jinxianxi Stream	H-speed railway disposal site in Kantou Village	Open	1	0.13	95	1
40		Folinghou Village	Jinxianxi Stream	H-speed railway disposal site in Folinghou Village	Open	2	0.51	190	2
41	Songcun	Xiashi Village	Zhaikengyuan River	Xiashi Village	Open	1.1	0.33	201	2
	Total					54.13	16.02	5150	33

5.1.7 Ecological Impact Analysis and Mitigation Measures

5.1.7.1 **Impact on Terrestrial Ecosystem and Mitigation Measures**

Ecosystem in the project area is composed of forest ecosystem and farmland ecosystem. Vegetation in the river basin mainly comprises of natural secondary vegetation and little artificial vegetation, such as mingled evergreen broad-leaved forest, deciduous broad-leaved forest and coniferous forest and miscellaneous shrub forest, with masson pine being the dominating species. Vegetation along the river comprises of farmland crops, aquatic plants and artificial secondary forest. There is no bird habitat within project construction area although there are local ordinary bird species.

Construction will damage vegetation habitat, and the direct result of vegetation damage will be land bareness and greater water and wind erosion. Furthermore, modified ecosystem structure and function will lead to deterioration of regional ecological environment. Movement of construction equipment and workers during construction will damage vegetation on construction site. Therefore, necessary environmental protection measures should be taken during construction for effective control of impact of construction activities on local vegetation. For example, scope of construction activities should be narrowed and construction stage should be shortened where possible, and vegetation should be restored once construction is finished to minimize local ecological impact. Construction activities will disturb waterside bird species along the river, but ecological system along the river will be restored after construction and will be improved over time.

In the construction process of Hangtou Wetland in Jiande City, temporary stockpiles of earth and exposed surface resulting from excavation will be subject to rain scours, resulting in local soil erosion and impacts on water quality of Shouchang River. Construction noise and dust will also generate certain local impacts. However, with a relatively small volume, a short construction time and located more than 200m away from the villages, such civil works will involve insignificant environmental impacts, which will disappear as the construction activities come to an end. The project area is currently a waste plain with sparrows and egrets commonly seen locally, but involves no bird habitats. With the extensive farmland and forests in the neighborhood, birds can forage in other places during the construction stage. Therefore, the construction of the Project will not have impacts on bird activities. Mitigation measures for environmental impacts in the construction stage are described in detail in the ECOP for River Rehabilitation.

5.1.7.2 **Impacts on Aquatic Ecology and Mitigation Measures**

Water-related construction activities, dredging and river rehabilitation may

affect aquatic ecosystem of the concerned river. Based on survey major aquatic animal species are ordinary species. There is no fish spawning field, feeding field, winter habitat or rare aquatic animal species in the river. Water-related construction, such as embankment and dike construction and river dredging, will result in disappearance of some benthos, but this will be restored over time after dredging is finished. Therefore, implementation of the Project will have insignificant impact on aquatic life.

5.1.8 **Conclusion of Dam Safety Assessment and Action Plan**

World Bank Safeguard Policy OP/BP 4.37 for dam safety is triggered by this Project. Therefore, the IAs have summarized basic information of the 57 concerned dams, conducted dam safety survey, and proposed rehabilitation measures and action plan for dam with safety issues. Details are given in **Table 5.1-6**. A summary of the Dam Action Plan and the corrective measures is included in Table 5.1-7.

Table 5.1-6 Basic Information of Reservoir Dams Linked with the WB Project

SN	Reservoir	Catchment Area (km^2)	Location (Town, River)	Total Capacity (10^4m^3)	Dam Type	Dam Height (m)	Time of Construction	Time of Last Round of Dam Reinforcement	Operation Agency	IA
Chun'an County										
1	Xin'anjiang (Qiandao Lake)	10442	Within Chun'an County	2,160,000	Concrete gravity dam	105	1959		Xin'anjiang Hydropower Plant	
2	Xiayuan	12.8	Fenkou Town, Wuqiangxi Stream	1,370	Earth dam	37	1960-1967	Commenced in 2010 and finished in 2014	Xiayuan Reservoir Management Department	Chun'an County Water Resources and Hydropower Investment Company
3	Fengshuling	227	Fengshuling Town, Fenglingang River	5,744	Gravity dam	64.5	1988-1992	Commenced in 2017 and in progress	Chun'an County Water Resources and Hydropower Investment Company	Chun'an County Water Resources and Hydropower Investment Company
4	Tongshan	45.1	Fengshuling Town, Fenglingang River	1,695	Arch dam	61.5	1996-1998		Chun'an County Water Resources and Hydropower Investment Company	Chun'an County Water Resources and Hydropower Investment Company
5	Yanjia	73	Wangfu Town, Yungangyuan River	2,146	Gravity dam	51.4	2003-2006		Hangzhou City Qiandao Lake Hengxin Hydropower Development Company	Hangzhou City Qiandao Lake Hengxin Hydropower Development Company
6	Jintong	56.6	Weiping Town, Qiduyuan River	540	Earth dam	24.45	1958-1964	2006	Weiping Town Gov.	Weiping Town Gov.

Table 5.1-6 Basic Information of Reservoir Dams Linked with the WB Project

SN	Reservoir	Catchment Area (km^2)	Location (Town, River)	Total Capacity (10^4m^3)	Dam Type	Dam Height (m)	Time of Construction	Time of Last Round of Dam Reinforcement	Operation Agency	IA
7	Hecun	15.5	Weiping Town, Liuduyuan River	376	Earth dam	27	1957-1968	Commenced in 2010 and finished in 2012	Weiping Town Gov.	Weiping Town Gov.
8	Yejiayuan	8	Weiping Town, Liuduyuan River	108.5	Earth and stone dam	31.15	1966-1990		Weiping Town Gov.	Weiping Town Gov.
9	Damaoling	7.8	Fuwen Town, Qingpingyuan River	220	Earth dam	35.15	1971-1978	Commenced in 2011 and finished in 2014	Fuwen Town Gov.	Fuwen Town Gov.
10	Jiulong	3.65	Zuokou Town, Shibaduyuan River	113	Earth dam	32.7	1970-1975	Commenced in 2013 and finished in 2015	Zuokou Town Gov.	Zuokou Town Gov.
11	Longyao	13.1	Fenkou Town, Langchuan Stream	358	Earth dam	35.1	1966-1973	Commenced in 2017 and in progress	Fenkou Town Gov.	Fenkou Town Gov.
12	Hongqi	2.25	Fenkou Town, Wuqiangxi Stream	210	Earth dam	20	1958-1966	Commenced in 2017 and in progress	Fenkou Town Gov.	Fenkou Town Gov.
13	Chengfengyuan	5.6	Zhongzhou Town, Wuqiangxi Stream	115	Earth and stone dam	26.6	1970-1974	2005	Zhongzhou Town Gov.	Zhongzhou Town Gov.
14	Mugua	38.1	Zhongzhou Town, Wuqiangxi Stream	188	Double-arch dam	35.3	2009-2011		Chun'an County Water Resources and Hydropower Investment Company	Chun'an County Water Resources and Hydropower Investment Company
15	Xindian	5.35	Langchuan Town, Langchuan Stream	225	Earth dam	29.5	1958-1964	Commenced in 2013 and finished in 2015	Langchuan Town Gov.	Langchuan Town Gov.
16	Linjiawu	15.2	Langchuan Town, Langchuan Stream	118.38	Rock fill dam	40.5	2005-2007		Chun'an County Water Resources and Hydropower	Chun'an County Water Resources and Hydropower Investment Company

Table 5.1-6 Basic Information of Reservoir Dams Linked with the WB Project

SN	Reservoir	Catchment Area (km^2)	Location (Town, River)	Total Capacity (10^4m^3)	Dam Type	Dam Height (m)	Time of Construction	Time of Last Round of Dam Reinforcement	Operation Agency	IA
									Investment Company	
17	Datongkeng	9.26	Jiangjia Town, Yuchuanxi Stream	144.5	Earth dam	39.5	1973-1977	2004	JiangjiaTown Gov.	JiangjiaTown Gov.
18	Longtou	159.7	Wangfu Town, Yunyuangang River	194	Gravity dam	23	1997-1999		Hangzhou City Qiandao Lake Hengxin Hydropower Development Company	Hangzhou City Qiandao Lake Hengxin Hydropower Development Company
19	Yunxi	16.09	Yaoshan Town, Jinxianxi Stream	173.4	Rock fill dam	47.3	2005-2008		Chun'an County Yunxi Tongda Water Resources Company	Chun'an County Yunxi Tongda Water Resources Company
20	Hefu	4.275	Weiping Town, Qiduyuan River	45.4	Earth dam	17.1	1975-1978	2011	Weiping Town Gov.	Weiping Town Gov.
21	Hengkengwu	2.479	Weiping Town, Qiduyuan River	30.4	Earth dam	23.9	1971-1972	Commenced in 2014 and finished in 2016	Weiping Town Gov.	Weiping Town Gov.
22	Shaozhai	0.986	Weiping Town, Liuduyuan River	11.8	Earth dam	15.24	1963-1965	2005	Weiping Town Gov.	Weiping Town Gov.
23	Qingwu	0.21	Weiping Town, Liuduyuan River	10	Earth dam	14	1965-1967	Commenced in 2007 and finished in 2012	Weiping Town Gov.	Weiping Town Gov.
24	Shaokengwu	0.71	Weiping Town, Qiduyuan	14.9	Earth dam	16.3	1957-1962	Commenced in 2017 and in progress	Weiping Town Gov.	Weiping Town Gov.
25	Daoren	2.131	Weiping Town, Liuduyuan River	16.7	Earth dam	19.8	1958-1963	Commenced in 2012 and finished in 2014	Weiping Town Gov.	Weiping Town Gov.

Table 5.1-6 Basic Information of Reservoir Dams Linked with the WB Project

SN	Reservoir	Catchment Area (km^2)	Location (Town, River)	Total Capacity (10^4m^3)	Dam Type	Dam Height (m)	Time of Construction	Time of Last Round of Dam Reinforcement	Operation Agency	IA
26	Songkeng	0.43	Weiping Town, Liuduyuan River	20	Earth dam	21	1965-1967	Commenced in 2013 and finished in 2015	Weiping Town Gov.	Weiping Town Gov.
27	Xingfu	13.6	Pingmen Town, Jinxianxi Stream	40	Earth dam	26	1970-1972	Commenced in 2017 and in progress	Pingmen Town Gov.	Pingmen Town Gov.
28	Chaoyang	2.1	Zuokou Town, Longyuanzhuang Stream	28.81	Earth dam	21.05	1971-1972	Commenced in 2010 and finished in 2012	Zuokou Town Gov.	Zuokou Town Gov.
29	Xihe	2.86	Wenchang Town, Tantou Stream	21.7	Earth dam	13.5	1964-1965	2003	Wenchang Town Gov.	Wenchang Town Gov.
30	Shiyanmen	3.6	Jiangjia Town, Yuquan Stream	43.6	Earth dam	24.7	1964-1967	Commenced in 2007 and finished in 2012	Jiangjia Town Gov.	Jiangjia Town Gov.
31	Huangmengkeng	0.66	Jiangjia Town, Yuchuanxi Stream	17	Earth dam	22.1	1965-1972	Commenced in 2008 and finished in 2012	Jiangjia Town Gov.	Jiangjia Town Gov.
32	Juyuan	0.78	Jiangjia Town, Yuchuanxi Stream	14	Earth dam	17	1969-1975	Commenced in 2011 and finished in 2013	Jiangjia Town Gov.	Jiangjia Town Gov.
33	Gongkeng	6.15	Zitong Town, Zitong Stream	42.7	Earth dam	24.1	1968-1971	2003	Zitong Town Gov.	Zitong Town Gov.
34	Jijiawu	2.213	Zitong Town, Zitong Stream	11.3	Earth dam	20.2	1957-1968	Commenced in 2017 and in progress	Zitong Town Gov.	Zitong Town Gov.
35	Hengzhaiwu	0.39	Langchuan Town, Langchuan Stream	13.7	Earth dam	15.1	1965-1979	Commenced in 2007 and finished in 2012	Langchuan Town Gov.	Langchuan Town Gov.
36	Xiahengzhai	0.782	Langchuan Town, Langchuan Stream	11.9	Earth dam	12.8	1966-1970		Langchuan Town Gov.	Langchuan Town Gov.
37	Ruitang	0.27	Langchuan Town, Langchuan Stream	18.2	Earth dam	9.15	1957-1963	Commenced in 2007 and finished in 2012	Langchuan Town Gov.	Langchuan Town Gov.

Table 5.1-6 Basic Information of Reservoir Dams Linked with the WB Project

SN	Reservoir	Catchment Area (km^2)	Location (Town, River)	Total Capacity (10^4m^3)	Dam Type	Dam Height (m)	Time of Construction	Time of Last Round of Dam Reinforcement	Operation Agency	IA
38	Liantangwu	0.24	Langchuan Town, Langchuan Stream	15	Earth dam	16.8	1963-1976	Commenced in 2014 and finished in 2017	Langchuan Town Gov.	Langchuan Town Gov.
39	Tangwu	0.386	Fenkou Town, Langchuan Stream	20	Earth dam	15.43	1962-1978	Commenced in 2012 and finished in 2014	Fenkou Town Gov.	Fenkou Town Gov.
40	Hudetang	0.47	Fenkou Town, Wuqiangxi Stream	22.58	Earth dam	6.3	1954	2009	Fenkou Town Gov.	Fenkou Town Gov.
41	Jingkengyuan	1.9	Fenkou Town, Wuqiangxi Stream	64	Earth dam	20.87	1957-1978		Fenkou Town Gov.	Fenkou Town Gov.
42	Wenchao	0.7	Fenkou Town, Wuqiangxi Stream	16	Earth dam	14.46	1956-1966	Commenced in 2009 and finished in 2011	Fenkou Town Gov.	Fenkou Town Gov.
43	Yanchang	77.82	Fengshuling Town, Fenglingang River	52.2	Gravity dam	17.8	2003-2004	2003	Chun'an County Water Resources and Hydropower Investment Company	Chun'an County Water Resources and Hydropower Investment Company
44	Ganyuan	0.53	Anyang Town, Shangwuxi Stream	10.13	Earth dam	10	1958-1959	Commenced in 2011 and finished in 2013	Anyang Town Gov.	Anyang Town Gov.
45	Liaokeng	6.59	Lishang Town, Shangjiayuan River	10.85	Gravity dam	20.5	2011-2012	Acceptance in 2014	Hangzhou City Qiandao Lake Lingyun Tourism Development Company	Hangzhou City Qiandao Lake Lingyun Tourism Development Company
46	Quankeng	6.96	Lishang Town, Shangjiayuan River	18.9	Gravity dam	29	2011-2012	Acceptance in 2015	Hangzhou City Qiandao Lake Lingyun Tourism Development	Hangzhou City Qiandao Lake Lingyun Tourism Development Company

Table 5.1-6 Basic Information of Reservoir Dams Linked with the WB Project

SN	Reservoir	Catchment Area (km^2)	Location (Town, River)	Total Capacity (10^4m^3)	Dam Type	Dam Height (m)	Time of Construction	Time of Last Round of Dam Reinforcement	Operation Agency	IA
									Company	
Jiande City										
47	Sanzhawu	1.72	Datong Town, Fengjia Stream	197	Clay core dam	29.42	1978.10	1986.6	Datong Town Gov.	Datong Town Gov.
48	Yakeng	3.83	Datong Town, Zhenyuanxi Stream	213	Stone mortar masonry gravity dam	33	1973.5		Datong Town Gov.	Datong Town Gov.
49	Hongtang	4.6	Hangtou Town, Wulongxi Stream	265	Stone mortar masonry buttress dam	38.5	1996.12		Hangtou Town Gov.	Hangtou Town Gov.
50	Wutang	2.99	Hangtou Town, Wulongxi Stream	207	Inclined-wall clay dam	31.1	1974.2	2009.3	Hangtou Town Gov.	Hangtou Town Gov.
51	Bailingkeng	13.82	Hangtou Town, Wulongxi Stream	579	Stone mortar masonry gravity dam	32	1967.5	2015.2	Hangtou Town Gov.	Hangtou Town Gov.
52	Houlongtang	0.11	Datong Town, Qingtan Stream	14.5	Homogeneous earth dam	10.32	1971.4		Datong Town Gov.	Datong Town Gov.
53	Dawo	0.18	Datong Town, Zhenyuanxi Stream	13.62	Inclined-wall clay dam	7.2	1959.10	2009.8	Datong Town Gov.	Datong Town Gov.
54	Pangangshan	0.74	Datong Town, Qingtan Stream	21.56	Homogeneous earth dam	13.54	1972.2	2013.6	Datong Town Gov.	Datong Town Gov.

Table 5.1-6 Basic Information of Reservoir Dams Linked with the WB Project

SN	Reservoir	Catchment Area (km^2)	Location (Town, River)	Total Capacity (10^4m^3)	Dam Type	Dam Height (m)	Time of Construction	Time of Last Round of Dam Reinforcement	Operation Agency	IA
55	Yangwu	0.66	Hangtou Town, Wulongxi Stream	22	Clay core dam	13.87	1972.10	2009.8	Hangtou Town Gov.	Hangtou Town Gov.
56	Pingtang	0.45	Hangtou Town, Wulongxi Stream	12.3	Clay core dam	14	2002.4	2015.11	Hangtou Town Gov.	Hangtou Town Gov.
57	Watang	0.24	Hangtou Town, Shimulingxi Stream	22	Clay core dam	11.02	1960.3	2007.8	Hangtou Town Gov.	Hangtou Town Gov.

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
1	Jiande City Xin'an Jiang Reservoir Dam	Xin'an Jiang Reservoir has been operated for more than 60 years. There is a strict and effective regulatory system of dam safety. At present, the fourth round of periodic dam safety inspection has been completed, and the dam is assessed to be a normal dam (equivalent to Class I Dam of the standards of Ministry of Water Resources (MWR)). The dam is well managed and maintained. The observation data are analyzed and reported to the Hangzhou Center every year. No significant abnormalities were found during site inspection. The dam can be operated according to design. No follow-up action is needed.	N/A
2	Chun'an County Mugua Reservoir Dam	Mugua Reservoir was recently constructed with proper design standard and construction quality. According to the approval and completion acceptance of the reservoir, the dam design meets the requirement of codes and standards, and the construction quality meets the design specifications. The dam has been operated for 6 years after impoundment. No significant abnormalities were found during site inspection. The management system is implemented well and the reservoir can be operated as designed. However, some issues need to be addressed, including: the crest of the dam was eroded by frost weathering; there is no water level ruler in the reservoir; there are two through cracks at the hoist room of the dam arc gate; the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved. Follow-up actions are required.	(1) Repair the crest of the dam which has been eroded by frost weathering. (2) Install more water level rulers in the reservoir (3) Strengthen the observations of cracks at the hoist room (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2018 Cost estimation: CNY 100,000
3	Chun'an County Xinfu Reservoir Dam	The design of Xifu Reservoir rehabilitation and reinforcement met the requirements of relevant codes and standards. The construction is now in progress. The completed components look good. The management system is implemented well. No significant abnormalities were found during site inspection. After the completion of rehabilitation and reinforcement project, the reservoir can be operated as per design. However, some issues need to be addressed, including: there is no seepage monitoring facilities; the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved. Follow-up actions are required.	(1) Build a new weir to monitor the seepage flow of the dam (2) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2018 Cost estimation: CNY 500,000
4	Chun'an County Qianyuan Reservoir Dam	The design of Qianyuan Reservoir rehabilitation and reinforcement met the requirements of relevant codes and standards. The construction quality met the operational requirement. The reservoir has been operated for 6 years after the completion of rehabilitation and reinforcement project. No significant abnormalities were found during site inspection. The management system is implemented well. The reservoir can be operated as per design. However, some issues need to be addressed, including: too many weeds growing at the drainage prism and seepage under the prism cannot be observed; there is no seepage drain	(1) Remove the weeds on the drainage prism as soon as possible, build new seepage drain and weir (2) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2018 Cost estimation: CNY 50,000

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		and flow measuring weir at the foot of the downstream dam; the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved. Follow-up actions are required.	
5	Chun'an County Quankeng Reservoir Dam	Quankeng Reservoir was recently constructed and has been operated for 5 years. It was found during site inspection that the reservoir is not well managed and maintained. Although it still can be operated normally, the maintenance must be enhanced as soon as possible. Some issues need to be addressed, including: there is no bridge at the non-overflow sections of the dam, which is not convenient for urgent repair work; the galvanized railings and drain pipes at the right non-overflow dam section were rusted; hoists and gates are lack of maintenance; no water level ruler in the reservoir; there is seepage at the foot of the dam and there is localized erosion of concrete structures; there are landsides at both sides of the embankment, affecting flood discharge and traffic; the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved. Follow-up actions are required.	(1) Conduct the next round of periodic dam safety inspection as soon as possible[3] (2) Build a bridge at the overflow dam section (3) Install additional water level ruler and seepage monitoring facilities, replace hoist, strengthen maintenance of gate, railings and discharge steel pipe. (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2018 Cost estimation: CNY 300,000
6	Chun'an County Liaokeng Reservoir Dam	Liaokeng Reservoir was recently constructed and has been operated for 5 years. It was found during site inspection that the reservoir is not well managed and maintained. Although it still can be operated normally, the maintenance must be enhanced as soon as possible. Some issues need to be addressed, including: there is no monitoring facilities including water level ruler; there is signs of seepage at the foot of the downstream dam, but the seepage flow cannot be observed; there is crack on hoist equipment; the galvanized railings and drain pipes are rusted due to lack of maintenance; the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved. Follow-up actions are required.	(1) Conduct the next round of periodic dam safety inspection as soon as possible (2) Install additional water level ruler and seepage monitoring facilities, replace hoist, strengthen maintenance of gate, railings and discharge steel pipe. (3) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2018 Cost estimation: CNY 150,000
7	Chun'an County Fengshuling Reservoir Dam	Fengshuiling Reservoir has conducted two rounds of periodic dam safety inspection– in 2006 and 2015, which indicates the reservoir is well managed. Both assessments concluded that the dam was a Class II dam, indicating that the dam is well constructed and there are no major problems in flood control, seepage and structural stability. The major task is to improve the daily maintenance. The reservoir has been operated for 10 years after the completion of rehabilitation and reinforcement project. Recent	(1) Strengthen the capacity building of the reservoir management staff on dam safety monitoring data analysis. (2) Verify the elevation of uplift pressure piezometer tube, and analyze the causes of high uplift pressure at

[3] The local water administration authority is responsible for the periodic technical inspection of dam safety following the applicable Chinese laws and regulations on dam safety management. The first round of inspection should be conducted within 5 years after final acceptance and then the periodic inspections should be conducted once every 6 to 10 years.

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		observations show that the deformation and seepage of the dam are normal. No significant abnormalities were found during site inspection. The reservoir can be operated as per design. Some issues need to be addressed, including: there is not enough capacity for dam safety monitoring data analysis; emergency response plan need to be further improved. Follow-up actions are required.	some points. (3) Strengthen the reservoir emergency response plan and conduct training. Time of completion: 30 Nov 2018 Cost estimation: CNY 50,000
8	Chun'an County Tongshan Reservoir Dam	Tongshan Reservoir was assessed as Class II dam in the last round of dam safety inspection in 2016. The issues identified in the assessment were all localized problems and most of them have been addressed. The reservoir has been operated as per design for nearly 20 year. Recent observations show that the deformation and seepage of the dam are normal. No significant abnormalities were found during site inspection. The reservoir can be operated as per design. Some issues need to be addressed, including: there is not enough capacity for dam safety monitoring data analysis; emergency response plan need to be further improved. Follow-up actions are required.	(1) Strengthen the capacity building of the reservoir management staff on dam safety monitoring data analysis. (2) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2018 Cost estimation: CNY 30,000
9	Chun'an County Xiayuan Reservoir Dam	Xiayuan Reservoir was assessed to be Class II dam in the last round of dam safety inspection. The design of rehabilitation and reinforcement met the requirements of relevant codes and standards. The construction quality met the design specifications. The reservoir has been operated for 10 years after the completion of rehabilitation and reinforcement project. The deformation and seepage of the dam are normal. It can be operated as per design. Some issues need to be addressed, including: the downstream water course in polluted by the herbicide used at downstream embankment; There is too many weeds between the first and secondary bench, which might be a sign of seepage; measurement of the monitoring weir is not accurate; there is not enough capacity for dam safety monitoring data analysis; emergency response plan need to be further improved. Follow-up actions are required.	(1) To prevent water pollution, herbicide should be avoided. It's better to use mower to remove weeds. (2) To check seepage at the place between the first and secondary bench where there are a lot of weeds growing. (3) Clear the shrubs between the seepage drain and right side of the drainage prism to improve the accuracy of the weir. (4) Analyze the reason why the levels of some piezometer tubes are as high as the reservoir water level, and to participate in data analysis training when possible. (5) Prepare a practical emergency response plan and conduct training. Time of completion: 30 Nov 2018 Cost estimation: CNY 200,000
10	Chun'an County Linjiawu Reservoir Dam	Linjiawu Reservoir has been operated for nearly 10 years since 2007. It was assessed to be Class II dam in the last round of dam safety inspection, indicating there in no major safety hazards of the reservoir. The deformation and seepage of the dam are normal. It can be	(1) Strengthen daily maintenance, and gradually implement recommendations provided in the last round of dam safety inspection.

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		operated as per design. Some issues need to be addressed, including: there is no seepage monitoring facilities at the foot of the dam; dam maintenance should be strengthened. Follow-up actions are required.	(2) Remove the weeds on the drainage prism and conduct seepage monitoring. Time of completion: 30 Nov 2018 Cost estimation: CNY 200,000
11	Chun'an County Hecun Reservoir Dam	Hecun Reservoir Dam was assessed to be Class III dam in the last round of dam safety inspection. The design of rehabilitation and reinforcement met the requirements of relevant codes and standards. Although there is no construction completion acceptance report submitted for review, the reservoir has been operated for nearly 10 years, which indicating the construction quality met the operational requirement. It was found during the site investigation that the reservoir was well maintained and managed with adequate personnel. The deformation and seepage of the dam are normal. It can be operated as per design. Some issues need to be addressed, including: there are too many weeds on the embankment; whether the existing piezometer tube is workable need to be confirmed; there is seepage monitoring facilities at the foot of the dam; emergency response plan need to be further improved. Follow-up actions are required.	(1) Mow the downstream embankment timely and remove upstream weeds. (2) When possible, check whether the existing piezometer tubes are still functioning. If yes, they can be used to observe seepage pressure. (3) Build a new weir to observe the seepage flow of the dam (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2018 Cost estimation: CNY 100,000
12	Chun'an County Chaoyang Reservoir Dam	Zhaoyang Reservoir Dam was assessed as Class III dam after several rounds of investigation of the relevant authorities and design institutes. The design of rehabilitation and reinforcement met the requirements of relevant codes and standards. Although there is no construction completion acceptance report submitted for review, the reservoir has been operated for nearly 10 years, which indicating the construction quality met the operational requirement. The reservoir is well maintained and managed with standardized protocols and procedures which were established in 2017. The deformation and seepage of the dam are normal. It can be operated as per design. It is recommended to strengthen daily maintenance and management and address the comments raised in the technical assessment report of the municipal water resource bureau in 2016. No follow-up action is needed.	N/A
13	Damaoling Reservoir Dam	The rehabilitation and reinforcement project of Damaoling Reservoir started from 2010. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The construction quality met the design specifications. The reservoir has been operated for 7 years after completion of the rehabilitation and reinforcement project. It can be operated as per design. Fuwen Township government formulated Emergency Responses Plan of Damaoling Reservoir in 2017, which met the requirement of the guidelines, but the effectiveness, predictability and maneuverability	(1) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 50,000

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		of the emergency response plan need to be further improved. Follow-up actions are required.	
14	Jiangjia Town Datongkeng Reservoir Dam	The rehabilitation and reinforcement project of Datongkeng Reservoir started from 2004. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The construction quality met the design specifications. The reservoir has been operated for 13 years after completion of the rehabilitation and reinforcement project. The reservoir is maintained in good condition and operated well. There is no abnormal deformation and seepage of the dam even the reservoir is currently operated with a relatively high water level. There is a complete management system. Inspections are carried out on a regular basis. Weeds are mowed timely. Some issues need to be addressed, including: (i) hoist gate has been damaged; (ii) there are too many weeds at the downstream of the drainage prism. Seepage cannot be observed and monitored; (iii) the reservoir has been operated for 40 years but no periodic dam safety inspection has been conducted so far. Follow-up actions are required.	(1) Conduct next round of dam safety inspection as soon as possible (Technical assessment). (2) Repair the screw hoist, remove the weeds at the downstream of the drainage prism and monitor the seepage. (3) Find out the reason of rusty color water follow at the reservoir outlet culvert. (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 1,000,000
15	Juyuan Reservoir Dam	The rehabilitation and reinforcement project of Juyuan Reservoir started from 2011. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 6 years after completion of the rehabilitation and reinforcement project. It can be operated as per design. Some issues need to be addressed, including: (i) the water level ruler is corrode and cannot read; (ii) there are too many weeds on the embankment, therefore the seepage cannot be observed and monitored; (iii) Jiangjia Town government formulated Emergency Responses Plan of Juyuan Reservoir in 2017, which met the requirement of the guidelines, but the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved. Follow-up actions are required.	(1) Change water level rulers in the reservoir (2) Remove the weeds in the seepage drain, add measuring weir to monitor seepage. (3) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 100,000
16	Yanjia Reservoir Dam	(1) The reservoir dam passed the safety appraisal for impounding in Dec 2005 by Nanjing Institute of Hydraulic Research. It completed impoundment acceptance in 2006. After the reservoir is put into operation, so far no periodic dam safety inspection has been conducted. According to the regulation, the first dam safety inspection should be conducted in 5 years after new reservoir is put into operation. Yanjia Reservoir has been operated for 12 years, therefore periodic dam safety inspection should be conducted as soon as possible. (2) The steel wire of the debris barrier hoist at the water inlet of the generator is broken. (3) No pressure gauge installed to monitor	(1) Replace the steel wire of the debris barrier hoist at the water inlet of the generator (2) Install pressure gauge to monitor uplift pressure. (3) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 800,000

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		uplift pressure. (4) Hangzhou Qiandao Lake Hengxin Hydropower Development Co, Ltd formulated “Emergency Responses Plan of Chun’an County Yanjia Reservoir” in Jan 2017, which met the requirement of the guidelines, but the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved. Follow-up actions are required.	
17	Yanchang Hydropower Station Reservoir Dam	(1) Yanchang Reservoir has been operated for 11 years, periodic dam safety inspection should be conducted as soon as possible. (2) The screw of the hoist offset to the right. It needs to be repaired and maintained. (3) The corner of the flip is torn, and water seal is aging, follow-up actions are needed.	(1) Conduct periodic dam safety inspection as soon as possible (2) Strengthen maintenance of the hoist. (3) Repair the torn flip, replace the seal if necessary. (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 500,000
18	Longtou Reservoir Dam	The last round of periodic dam safety inspection for Longtou Reservoir was conduct in Jan 2017. The dam was assessed to be Class I dam and can be operated as per design, which again proved the dam is well designed and constructed. The daily maintenance is sufficient to meet operational requirement. Hangzhou Qiandao Lake Hengxin Hydropower Development Co, Ltd formulated “Emergency Responses Plan of Chun’an County Longtou Reservoir” in Jan 2017, which met the requirement of the guidelines, but the effectiveness, predictability and maneuverability of the emergency response plan need to be further improved.	Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 50,000
19	Chun’an County Hongqi Reservoir Dam	The rehabilitation and reinforcement project of Hongqi Reservoir started from 2017. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The project is still ongoing. No issues relating construction quality or management have been identified so far. No follow-up action is needed.	N/A
20	Chun’an County Liantangwu Reservoir Dam	The rehabilitation and reinforcement project of Liantangwu Reservoir started from 2014. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 3 years after the completion of the rehabilitation and reinforcement project. It can be operated as per design. However, the width of the dam crest is only about 3m, which cannot meet the requirement of relevant codes and standards. Follow-up actions are needed.	(1) Thicken the downstream dam slope and widen the dam crest to 4m. (2) Improve emergency response plan for flood control Time of completion: 30 Nov 2019 Cost estimation: CNY 100,000

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
21	Chun'an County Jijiawu Reservoir Dam	The rehabilitation and reinforcement project of Jijiawu Reservoir started from 2016. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 1 year after the completion of the rehabilitation and reinforcement project. It can be operated as per design. However, the width of the dam crest is only about 3m, which cannot meet the requirement of relevant codes and standards. Follow-up actions are needed.	(1) Thicken the downstream dam slope and widen the dam crest to 4m. (2) Improve emergency response plan for flood control Time of completion: 30 Nov 2019 Cost estimation: CNY 100,000
22	Chun'an County Huangmengkeng Reservoir Dam	The rehabilitation and reinforcement project of Huangmengkeng Reservoir started from 2007. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 10 years after the completion of the rehabilitation and reinforcement project. It can be operated as per design. However, some issues still need to be addressed: there is no water level ruler; the stairs of downstream dam slope and the drain at dam shoulder are eroded severely by weathering; no seepage drain at the downstream dam foot; too many weeds at the downstream dam foot and seepage cannot be observed and monitored; the emergency response plan need to be further improved. Follow-up actions are needed.	(1) Construct seepage drain at the foot of downstream dam to monitor seepage. (2) Install water level ruler (3) Repair the stairs of downstream dam slope and the drain at dam shoulder. (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 150,000
23	Chun'an County Shiyanmen Reservoir Dam	The rehabilitation and reinforcement project of Shiyanmen Reservoir started from 2006. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 11 years after the completion of the rehabilitation and reinforcement project. It can be operated as per design. However, some issues still need to be addressed: there is no water level ruler; the top of the dam is used as a road for traffic for long term, the heavy loading has caused the depression in the middle of the dam crest; no seepage drain at the drainage prism and there are too many weeds there; the overflow from the stilling basin of the culvert outlet also falls to the drainage prism, which makes it hard to monitor the seepage; the emergency response plan need to be further improved. Follow-up actions are needed.	(1) Construct seepage drain at the foot of downstream dam to monitor seepage. (2) Install water level ruler (3) Restrict heavy truck at dam crest. (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 100,000
24	Chun'an County Jingkengyuan Reservoir Dam	Jingkengyuan Reservoir was identified as Class III dam in 2015. The design of the rehabilitation and reinforcement project, which will commence in Oct 2017, met the requirements of relevant codes and standards. After the project, the presentation of the reservoir will be significantly improved. Many issues were identified during site investigation, which will need to be addressed after the project completion. The daily maintenance and the implementation of management system need to be further strengthened. Follow-up actions are needed.	(1) Strengthen the daily inspection and maintenance before the project. (2) Strictly control the construction quality of the rehabilitation and reinforcement project (3) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
			50,000
25	Chun'an County Jiulong Reservoir Dam	The rehabilitation and reinforcement project of Jiulong Reservoir started from 2013. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 4 years after the completion of the rehabilitation and reinforcement project. No obvious abnormalities were identified during site investigation. The management system is implemented well. The reservoir can be operated as per design. However, some issues still need to be addressed: the precast concrete cover of the seepage drain is too heavy to lift; the emergency response plan need to be further improved. Follow-up actions are needed.	(1) Replace the seepage drain cover with light material or remove the cover. (2) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 30,000
26	Chun'an County Hengkengwu Reservoir Dam	The rehabilitation and reinforcement project of Hengkengwu Reservoir started from 2014. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 3 years after the completion of the rehabilitation and reinforcement project. No obvious abnormalities were identified during site investigation. The management system is implemented well. The reservoir can be operated as per design. However, some issues still need to be addressed: the width of the dam crest is only about 3.5m, which cannot meet the requirement of relevant codes and standards; the dam crest has a slight depression, the depression at the upstream side is depressed more severely; the emergency response plan need to be further improved. Follow-up actions are needed.	(1) Strengthen the inspection for the depression of the dam crest, report to relevant authorities whenever there are any abnormalities. (2) Widen the dam crest to at least 4m. (3) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 300,000
27	Chun'an County Jintong Reservoir Dam	Chun'an County Water Resources and Hydropower Bureau organized the project completion acceptance of Jintong Reservoir Security Construction Project in Aug 2010. The dam can be operated safely. However, some issues still need to be addressed: there are too many weeds at the seepage drain which affects the seepage observation and monitoring; hoist gate cannot be fully closed, there is a gap between the hoist gate and discharge culvert, the leakage is severe; there is localized seepage at the overflow spillway and there are also weeds in the spillway. Follow-up actions are needed.	(1) Remove the weeds as soon as possible and observe the seepage. (2) Fix the problem of the hoist gate and seepage of the spillway. (3) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 600,000
28	Chun'an County Qingwu Reservoir Dam	Chun'an County Water Resources and Hydropower Bureau organized the project completion acceptance inspection of Qingwu Reservoir rehabilitation and reinforcement project in Aug 2012. The inspection confirmed that the dampening of the dam slop, installation of inverted siphon pipe, reconstruction of the spillway, well casing backfill and dam emergency rescue road construction have been completed. The dam can be operated safely. However, some issues still need to be addressed: the prefabricated concrete blocks in	(1) Repair the precast concrete blocks at the upstream slope, inlet section of the spillway and the spillway retaining wall. (2) Replace the manual diesel engine. (3) Prepare a practical emergency response plan and conduct training

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		the fluctuation area of water table are severely eroded; manual diesel engine of the siphon facilities is damaged; there are two obvious cracks in the inlet section of the spillway; there is some localized weathering of the spillway retaining wall. Follow-up actions are needed.	Time of completion: 30 Nov 2019 Cost estimation: CNY 500,000
29	Wenchang Town Chun'an County Xihe Reservoir Dam	The rehabilitation and reinforcement project of Xihe Reservoir was completed in 2004. The dam can be operated safely. However, some issues still need to be addressed: There is no stairs at either downstream or upstream of the dam, which is not convenient for daily maintenance; outlet of the stilling tank is relatively small and low, which may get blocked frequently; there is no seepage drain at the downstream of the dam foot; emergency response plan is not comprehensive. Follow-up actions are needed.	(1) Construct stairs for both upstream and downstream side of the dam. (2) Improve the stilling tank. (3) Construct a seepage drain that at the downstream side of the dam drainage prism for seepage observation. (4) Improve emergency response plan for flood control Time of completion: 30 Nov 2019 Cost estimation: CNY 80,000
30	Chun'an County Gongkeng Reservoir Dam	The rehabilitation and reinforcement project of Gongkeng Reservoir started from 2013. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 14 years after the completion of the rehabilitation and reinforcement project. The reservoir can be operated as per design. However, some issues still need to be addressed: water level ruler is worn-out; there is no deformation and settlement observation facilities; no access road to the dam; the hoist room is old and shabby; there are no stairs at dam slopes; there is no administration building. Follow-up actions are needed.	(1) Change water level ruler; (2) Set up dam safety automation monitoring system; (3) Construct dam access road; (4) Reconstruct hoist room; (5) Construct stairs on the dam slopes; (6) Build administration building Time of completion: 30 Nov 2019 Cost estimation: CNY 900,000
31	Chun'an County Yunxi Reservoir Dam	The design of Yunxi Reservoir Project (2015) met the requirements of relevant codes and standards. The construction quality met the requirements of design specifications. The reservoir has been operated for 9 years after project completion in 2008. The reservoir can be operated as per design. However, some issues still need to be addressed: water level ruler is worn-out; there is no administration building; there are too many weeds at the downstream side of the dam. Follow-up actions are needed.	(1) Install water level ruler. (2) Build reservoir administration building. (3) Remove the weeds on the slopes of the dam Time of completion: 30 Nov 2019 Cost estimation: CNY 500,000
32	Chun'an County Langchuan Township Xindian Reservoir	The rehabilitation and reinforcement project of Xindian Reservoir started from 2013. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 4 years after the completion of the rehabilitation and reinforcement project. The reservoir can be operated as per design. However, the maintenance of spillway outlet and culvert outlet need to be strengthened	(1) Strengthen daily maintenance and remove the weeds in the spillway. Time of completion: 30 Nov 2019 Cost estimation: CNY 20,000

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		(weeds should be removed).	
33	Chun'an County Langchuan Township Ruitang Reservoir	The rehabilitation and reinforcement project of Ruitang Reservoir started from 2006. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 11 years after the completion of the rehabilitation and reinforcement project. The reservoir can be operated as per design. However, some issues still need to be addressed: there is no stilling tank at the culvert outlet; there is no railing at both sides of the spillway entrance; there is no safety warning sign near the reservoir; the dam crest is not even. Follow-up actions are needed.	(1) Rehabilitate the stilling tank at the culvert outlet. (2) Install handrails at both side of the spillway entrance. (3) Place safety warning signs near the reservoir. (4) Pave the dam crest with permeable bricks Time of completion: 30 Nov 2019 Cost estimation: CNY 200,000
34	Chun'an County Langchuan Township Hengzhaiwu Reservoir	The rehabilitation and reinforcement project of Hengzhaiwu Reservoir started from 2006. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The reservoir has been operated for 11 years after the completion of the rehabilitation and reinforcement project. The reservoir can be operated as per design. However, some issues still need to be addressed: there are many weeds at the downstream side of the drainage prism and at the spillway outlet, there is no railing at both sides of the spillway entrance; there is no safety warning sign near the reservoir; the dam crest is not even. Follow-up actions are needed.	(1) Remove the weeks and silt. (2) Install handrails at both side of the spillway entrance. (3) Place safety warning signs near the reservoir. (4) Pave the dam crest with permeable bricks Time of completion: 30 Nov 2018 Cost estimation: CNY 200,000
35	Chun'an County Langchuan Township Xiahengzhai Reservoir	Some issues need to be addressed: (1) there is no pavement on the dam crest road and there is no wave wall. The crest of the dam is inclined downward as a whole, the elevation difference between the two ends of the dam is about 30cm: (2) the existing dam cannot meet flood control standards; (3) The slope of the water face of the dam is steep and has a certain degree of depression. There are no slope protection measures of the upstream side of the dam. There are weeds above normal water level. There are no stairs on the dam slopes. The back face of the dam is protected with turf. However, there are obvious bumps and depressions. There is no obvious abnormal deformation or seepage on the dam surface. There is no drainage ditch on the both left and right hand of the dam where the dam is connected to the hillside. There is no stairs at the downstream dam surface, which is not convenient for daily inspection; (4) spillway entrance are constructed with dry masonry and there is potential risk of seepage. The hill slope at the right of the dam is basically stable, but the rock is fragmented. The concrete structure of weir is cracking and sagging. The spillway is in relative good condition. The bottom spillway slab and the side walls are made of concrete, but the aging of the concrete structure is also serious. (5) The pipe structure of the concrete drain pipe is poor. Although the hoists can still	(1) Conduct comprehensive rehabilitation and reinforcement of the dam. Rehabilitate both upstream and downstream slope with proper embankment. Backfill sleeve wells with clay. Implement curtain grouting seepage control at dam foundation. (2) Demolish the old spillway and construct a new spillway; (3) Block the water culvert and build new water culvert using tunneling method, and replace the full set of hoist equipment; (4) Build administration building (5) Install reservoir safety monitoring facilities; (6) Raise the dam crest or widen the spillway to meet flood control

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		be used but they are all exceed their service life. (6) There is no dam safety monitoring facilities; (7) there is no inspection stairs or safety warning signs or administrative buildings.	standards. Time of completion: 30 Nov 2019 Cost estimation: CNY 3,000,000
36	Chun'an County Chengfengyuan Reservoir Dam	The reservoir has been operated for 12 years after the completion of the rehabilitation and reinforcement project in 2005. The reservoir can be operated as per design. However, some issues still need to be addressed: there is settlement at the dam crest; the access road is too narrow and steep; the screw of hoist is bending; there is no administration building.	(1) Repair the settlement at the dam crest. (2) Improve the seepage drain at the bottom of drainage prism and observe seepage; (3) Widening the upper dam road to 5m and install handrails on both sides to eliminate safety hazards; (4) Change hoist screw; (5) Build reservoir administration building; (6) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 450,000
37	Chun'an County Longyao Reservoir Dam	The design of the rehabilitation and reinforcement project in 2016 met the requirements of relevant codes and standards. The construction is still in progress. The presentation of the completed project is good. The management system is implemented well with adequate staff. After the completion of the rehabilitation and reinforcement project, Longyao Reservoir can be operated as per design.	(1) It is recommended to conduct project complete acceptance inspection as soon as possible after the project completion to confirm bill of quantities of the project. Time of completion: 30 Nov 2019 Cost estimation: 0
38	Chun'an County Tangwu Reservoir Dam	Chun'an County Water Resources and Power Bureau organized the project completion acceptance inspection of Tangwu Reservoir in 2014. Generally the reservoir is well operated. However, some issues still need to be addressed: access road of the dam is in poor condition; there is risk of landslide at the hill slope close to the hoist room; the old water diversion pipe still left at the right side of the dam.	(1) Pave the dam access road. (2) Carry out slope protection of the hill slope close to the hoist room. (3) Remove the old water diversion pipe. (4) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 400,000
39	Chun'an County Hudetang Reservoir Dam	The reservoir has been operated for 9 years after the completion of the rehabilitation and reinforcement project in 2008. The reservoir can be operated as per design. However, some issues still need to be addressed: the width of the dam is less than 3m which cannot meet the	(1) Immediately remove the wall constructed in the spillway. (2) Implement the management system and remove the weeds

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		requirements of standards; the dam access road is covered with weeds; there no water level ruler at upstream side of reservoir; there is no stairs at the downstream side of the reservoir, there is a wall constructed in the spillway.	as soon as possible. (3) Thicken the downstream dam slope and widen the dam crest to 4m. (4) Remove the weeds on the dam access road and pave the road. (5) Install water level ruler. (6) Construct stairs at the downstream side of the dam. (7) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 400,000
40	Chun'an County Wenchao Reservoir Dam	The reservoir has been operated for 7 years after the completion of the rehabilitation and reinforcement project in 2010. The reservoir can be operated as per design. However, some issues still need to be addressed: the width of the dam is less than 3m which cannot meet the requirements of standards; the dam access road is not paved; there is no water level ruler; there are weeds at the upstream side of the dam.	(1) Thicken the downstream dam slope and widen the dam crest to 4m. (2) Pave the dam access road. (3) Install water level ruler. (4) Remove the weeds at the upstream side of the dam and weeds in the seepage drain. (5) Prepare a practical emergency response plan and conduct training Time of completion: 30 Nov 2019 Cost estimation: CNY 350,000
41	Chun'an County Yejiayuan Reservoir Dam	The reservoir has been operated for 27 years after the completion of the rehabilitation and reinforcement project in 1990. However, some issues still need to be addressed: There are weeds at both dam shoulders and at the back slope of the dam; there is no bridge at the overflow section of the dam; there is no administration building, emergency response plan needs to be further improved.	(1) Build bridge at the overflow section of the dam. (2) Build administration building. (3) Remove the weeds at the dam shoulders and at the back slope of the dam as soon as possible. (4) Improve emergency response plan for flood control Time of completion: 30 Nov 2019 Cost estimation: CNY 1,000,000
42	Chun'an County Hefu Reservoir Dam	Chun'an County Water Resource Bureau organized project completion acceptance inspection of the rehabilitation and reinforcement of the reservoir in 2013. The design of the rehabilitation and reinforcement	(1) Build a reservoir administration building. (2) Improve emergency response plan for flood

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		project met the requirements of relevant codes and standards. The construction quality met the requirements of design specifications. The reservoir has been operated for 6 year after the completion of the project. It can be operated as per design. However, some issues still need to be addressed: emergency response plan needs to be further improved; there is no administration building. Follow-up actions are needed.	control. Time of completion: 30 Nov 2019 Cost estimation: CNY 500,000
43	Chun'an County Shaozhai Reservoir Dam	The reservoir has been operated for 12 years after the completion of the rehabilitation and reinforcement project in 2005. However, some issues still need to be addressed: there is no seepage drain behind the drainage prism; there is sign of seepage of the dam; the dam access road is too narrow and some road sections are collapsed; there is no administration building, emergency response plan needs to be further improved.	(1) Construct seepage drain behind the drainage prism for seepage observation. (2) Construct the dam access road as soon as possible. (3) Curtain grout to the dam. (4) Build a reservoir administration building. (5) Improve emergency response plan for flood control Time of completion: 30 Nov 2019 Cost estimation: CNY 1,300,000
44	Chun'an County Shaokengwu Reservoir Dam	The reservoir has been operated for 17 years after the completion of the rehabilitation and reinforcement project in 2000. However, some issues still need to be addressed: the flood control system of the dam cannot meet the requirements of relevant standards; there are no slope protection measures of the dam; the permeability coefficient of the seepage control of the dam is relatively high; the saturation line of the dam body is relatively high; there is seepage points at the left dam foot and on the left dam slope; there is a layer of medium-permeability briquette-silty clay in the dam foundation of the river bed section; there is no cut-off trench at the dam shoulders; strong weathered bedrock are present at the left and right shoulders of the dam which are of medium-permeability; there are seepage and by-pass seepage at dam foundation, therefore the dam seepage control system does not meet the current requirement of seepage control; the concrete of bottom and the side wall of the spillway is aged seriously; there is no lining of the slab of the spillway, the surface is uneven; there is no energy dissipation measures; downstream flood discharge canal is not compatible with the upstream design; there is no seepage monitoring facilities; there is no drainage at the dam access road; several road sections are too steep; many sections of the road are damaged and cannot meet the requirement of emergency access road.	(1) Curtain grout to the dam. (2) Reinforce the spillway. (3) Build a reservoir administration building. Construct seepage drain behind the drainage prism. Construct measuring weir to monitor seepage of the dam. (4) Improve emergency response plan for flood control Time of completion: 30 Nov 2019 Cost estimation: CNY 3,500,000
45	Chun'an County Daoren	Chun'an County Water Resource Bureau organized project completion acceptance	(1) Construct seepage drain and measuring

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
	Reservoir Dam	inspection of the rehabilitation and reinforcement of the reservoir in 2013. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The construction quality met the requirements of design specifications. The reservoir has been operated for 6 year after the completion of the project. It can be operated as per design. However, some issues still need to be addressed: there is no administration building; there is no seepage drain behind the drainage prism; emergency response plan needs to be further improved; Follow-up actions are needed.	weir for seepage monitoring. (2) Build reservoir administration building. (3) Improve emergency response plan for flood control Time of completion: 30 Nov 2019 Cost estimation: CNY 500,000
46	Chun'an County Songkeng Reservoir Dam	Chun'an County Water Resource Bureau organized project completion acceptance inspection of the rehabilitation and reinforcement of the reservoir in 2015. The design of the rehabilitation and reinforcement project met the requirements of relevant codes and standards. The construction quality met the requirements of design specifications. The reservoir has been operated for 4 year after the completion of the project. It can be operated as per design. However, some issues still need to be addressed: the width of the dam is less than 3m which cannot meet the requirements of standards; there are weeds at the dam crest, dam slopes, spillway outlet and drainage prism; water level sensor is damaged. Follow-up actions are needed.	(1) Removed the weeds at the dam crest, dam slopes, and spillway outlet and drainage prism. (2) Repair the water level sensor as soon as possible. (3) Thicken the downstream dam slope and widen the dam crest to 4m. Time of completion: 30 Nov 2019 Cost estimation: CNY 1,400,000
47	Sanzhawu Reservoir	Jiande Municipal Water Resource Bureau planned to implement the rehabilitation and reinforcement of the reservoir in 2019.	(1) Carry out reinforcement of the dam based on the findings of periodic dam safety inspection. (2) Carry out hilly pond reclamation according to standard practices (3) Improve emergency response plan for flood control Time of completion: By end of 2021 for Item (1) Cost estimation: CNY 19,700,000
48	Yakeng Reservoir	Jiande Municipal Water Resource Bureau commenced the rehabilitation and reinforcement of the reservoir in 2017.	(1) Carry out reinforcement of the dam based on the findings of periodic dam safety inspection. (2) Carry out hilly pond reclamation according to standard practices (3) Improve emergency response plan for flood control Time of completion: By end of 2019 for Item (1) Cost estimation: CNY 18,300,000
49	Hongtang Reservoir	Hongtang Reservoir was assessed as Class I Dam. The quality of the reservoir is generally	(1) Improve emergency response plan for flood

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		good and there is no need for reinforcement. Jiande Municipal Water Resource Bureau commenced the standardized maintenance program of the reservoir in 2017. No follow-up action is needed.	control Time of completion: Feb 2018 Cost estimation: CNY 20,000
50	Wutang Reservoir	The reservoir has been operated for 7 years after the completion of the rehabilitation and reinforcement project in 2009. Jiande Municipal Water Resource Bureau began to establish the standardized management of Wutang Reservoir in June 2017. The reservoir is maintained in good condition. No follow-up action is needed.	(1) Improve emergency response plan for flood control Time of completion: Feb 2018 Cost estimation: CNY 20,000
51	Bailingkeng Reservoir	The rehabilitation and reinforcement project of the reservoir commenced in 2015. The standardized management of Bailingkeng Reservoir was established in 2017. The reservoir is maintained in good condition. No follow-up action is needed.	(1) Improve emergency response plan for flood control Time of completion: Feb 2018 Cost estimation: CNY 20,000
52	Houlongtang Reservoir	Houlongtang Reservoir was assessed as Class III Dam based on the dam safety inspection conducted in Dec 2012. It has not been reinforced. So far no follow-up action is needed.	(1) Carry out reinforcement of the dam based on the findings of periodic dam safety inspection. (2) Carry out hilly pond reclamation according to standard practices (3) Improve emergency response plan for flood control Time of completion: By end of 2022 for Item (1) Cost estimation: CNY 1,770,000
53	Dawo Reservoir	The rehabilitation and reinforcement project of the reservoir was implemented in 2009 and there is no updated safety assessment after the project. Jiande Municipal Water Resource Bureau began to establish the standardized management of Dawo Reservoir in June 2017. The reservoir is maintained in good condition. No follow-up action is needed.	(1) Improve emergency response plan for flood control Time of completion: Feb 2018 Cost estimation: CNY 20,000
54	Pangangshan Reservoir	The rehabilitation and reinforcement project of the reservoir was implemented in 2013. Jiande Municipal Water Resource Bureau began to establish the standardized management of Dawo Reservoir in June 2017. The reservoir is maintained in good condition. No follow-up action is needed.	(1) Improve emergency response plan for flood control Time of completion: Feb 2018 Cost estimation: CNY 20,000
55	Yangwu Reservoir	The reservoir has been operated for 7 years after the completion of the rehabilitation and reinforcement project in 2009. The reservoir is generally maintained in good condition. There are some follow-up actions.	(1) Carry out hilly pond reclamation according to standard practices (2) Improve emergency response plan for flood control Time of completion: By end of 2019 for reinforcement of the reservoir Cost estimation: CNY 440,000
56	Pingtang Reservoir	The reservoir has been operated for 2 years after the completion of the rehabilitation and reinforcement project in 2015. The reservoir is	(1) Carry out hilly pond reclamation according to standard practices

Table 5.1-7 Dam Action Plan and Corrective Measures

S/N	Name of Reservoirs	Follow-ups Actions	Corrective Measures
		generally maintained in good condition. There are some follow-up actions.	(2) Improve emergency response plan for flood control Time of completion: By end of 2019 for reinforcement of the reservoir Cost estimation: CNY 250,000
57	Watang Reservoir	The reservoir has been operated for 9 years after the completion of the rehabilitation and reinforcement project in 2007. The reservoir is generally maintained in good condition. There are some follow-up actions.	(1) Carry out hilly pond reclamation according to standard practices (2) Improve emergency response plan for flood control Time of completion: By end of 2019 for reinforcement of the reservoir Cost estimation: CNY 440,000

5.2 Analysis of Environmental Impacts in the Operation Stage

5.2.1 Analysis of Benefits in the Operation Stage

1. Water Source and Soil Conservation and Soil Improvement

Through biological and physical function of crown canopy, fallen branches and leaves and soil, the forest will weaken stormwater erosion, improve soil structure, improve soil anti-erosion capacity, retain, absorb and evaporate stormwater, increase soil penetration rate, prolong formation time of surface runoff, reduce surface runoff flow and velocity, and as a result will improve flood control, water source conservation, prevent soil erosion, and improve water quality.

This Project will significantly improve water and soil conservation of the forest and capacity against extreme condition. Water source conservation and rehabilitation of artificial forest will improve forest quality, prevent pest disease occurrence and transmission, and improve soil quality by greatly increasing soil nutrients.

Upon completion of the Project, the annual forest water reserve will increase by 6,7862,112 tons, the forest water purification capacity will increase by 6,411,820 tons, soil fixing by 23,286 tons, nutrient retention by 4,223 tons, CO_2 absorption by 33,592 tons, oxygen release by 24,633 tons, and SO_2 absorption by 339 tons, dust interception by 45,831 tons, and nutrient accumulation by 555 tons.

2. Increased Biodiversity

Forest rehabilitation will improve existing ecology of project area and create favorable condition for habitation and reproduction of biotic population. Biodiversity of plant species and vegetation coverage in the project area will increase and animals such as birds and small-size beasts will be attracted, leading to increased fauna diversity in the region.

3. Reduced Pollutant Discharge

Through implementation of four agricultural NPS pollution control programs including IPM, pesticide container recovery, liquid fertilizer distribution and organic fertilizer extension, the scope of scientific fertilizer application in the project area will be expanded and the structure and methods of fertilizer application will be improved. The total application of chemical fertilizer per farmland area will be decreased by 10%, representing a reduced discharge of total nitrogen and total phosphorus by 930.35 tons and 930.35 tons respectively. Regional application of pesticide/herbicide and chemical fertilizer will be reduced and pollutant load into rivers and reservoirs will be reduced accordingly.

With operation of Jiande City Shouchang WWTP Phase I expansion, industrial wastewater and domestic sewage from Shouchang Town and Shouchang Economic Development Zone (Hangkong Community) and Hangtou Town will be treated in Shouchang WWTP and the effluent will meet applicable standard before discharge. Discharge of COD, BOD, SS, NH_3-N and TP into river will be reduced respectively by 638.75t/a, 219t/a, 346.75t/a, 45.63t/a, and 4.56t/a, thus helpful to improving water quality of Shouchang River.

Hangtou Wetland is capable of handling farmland backwater in a total volume of about 2000t from Nanba Village and achieve high-efficiency reduction of nitrogen and phosphorus in the water bodies in the construction area on a perennial basis with an annual average nitrogen removal rate of 15% to 25% and an annual average phosphorus removal rate of 10% to 20%. It is thus estimated that the wetland component can achieve a TN reduction of 0.219t/a to 0.365t/a and a TP reduction of 0.029t/a to 0.058t/a in total.

4. Improved Water Quality in Rivers and Qiandao Lake

Zhejiang Province is characterized by rich water resources, and relies on water resources for beauty and prosperity. As a developed coastal region, economic development imposes big pressure on water environment. Agricultural NPS pollution source has become major source of nitrogen and phosphorus in Qiandao Lake, which is an important water body of Qiantang River Basin. Implementation of rehabilitation measures, such as agricultural NPS pollution control, river dredging and reservoir outlet wetland construction, will reduce pollutant load into and improve water quality of rivers and reservoirs.

5. Facilitating Transformation of Agriculture

Small river basin rehabilitation will mitigate soil erosion and improve land capacity against natural disaster and increase land productivity. Rehabilitation will change existing unused land, flood land and sloping land to farmland or forest land, and increase farming production and incomes. Land rehabilitation, improvement of rural infrastructure and improved wastewater and solid waste treatment will facilitate urban and rural development and improve living condition of rural residents. Rural area will have clean and clear rivers and ponds and restore the beauty of water scenes in this part of China. Change and upgrade of rural area farming practice, life style and development practice will be helpful to accelerate the construction of beautiful countryside with blue sky, clean water, green mountain, clean land and fresh air.

6. Increased Livestock Feces Reuse Capacity

With years of efforts, discharge of livestock waste in project area has decreased to zero. However, some livestock waste treatment facilities have worn out and have risk of operation failure. This Project will improve existing

livestock waste treatment facilities and construct new livestock waste treatment facilities to improve livestock waste utilization and disposal.

7. Reduced GHG Emission

Major greenhouse gases (GHG) affecting air quality include carbon dioxide and methane. Biogas tanks to be built will generate 50,000 m^3 biogas each year and reduce emission of 70.5 tons of carbon dioxide, 230 kilograms of sulfide dioxide, and 200 kilograms of NOx. Construction and operation of livestock waste utilization, prevention and treatment facilities will achieve centralized treatment of livestock waste through application of methane generating technologies, and will reduce methane emission from uncontrolled waste dumping, composting or direct farmland application.

8. Improved Regional Flood Control

Some individual parts of the flood dikes along the river sections to be rehabilitated are unconnected and were mostly earth dikes built by local farmers with low flood control capacity, small embankment width, poor anti-scouring capacity and noncompliant crest elevation. Some dikes have been destroyed. Due to the absence of scouring mitigation structures, the river courses under the cofferdam are seriously scoured with many deep pits and the bottom elevation of the existing diversion channels cannot be satisfied due to the damaged cofferdams, resulting in a situation where the water diversion channels have no water to divert.

The flood control standards are selected based on actual situation of river sections to be rehabilitated under the Project and the scope of protection, population, level of importance, extent of flooding loss or impact to protect the river sections along villages and large area of farmland against 1-in-10 years flood and Level 5 is set for major buildings. A small number of the farmland river sections will be protected against scouring but inundation is allowable; and Level 5 is set for temporary buildings. This Project will help improve flood control layout and improve flood control capacity along the rivers.

River rehabilitation in the rural area will increase flood discharge cross-section area and retention capacity to not only improve flood control capacity of rural area but also provide more assurances for water supply for farmland irrigation. Additionally, water environment of the rivers will be significantly improved.

5.2.2 Impact on Air Environment and Mitigation Measures

Major air impact in the operation stage is odor impact from Jiande City Shouchang WWTP.

WWTP will inevitably generate odor in the operation stage. Odor generation

concentrates in bar screen, wastewater pump chamber, grit removing tank, A^2/O reaction tank, sludge thickening tank, and dewatering facility. Odor is caused by generation of H_2S, ammonia, volatile phenol, methane, and methanol in the process of biological anaerobic and aerobic fermentation. Based on information collected of municipal WWTP odor analysis, uncontrolled H_2S and NH_3 emission has relatively higher concentration and will pollute ambient air within and outside the WWTP.

As specified in EIA Technical Guidelines for Air Environment (HJ2.2-2008), SCREEN 3 model was applied to forecast H_2S and NH_3 emission. Projected maximum landing concentrations of H_2S and NH_3 are 0.00003 mg/m^3 and 0.0005mg/m^3 respectively, which meet Health Standard for Industrial Facility Design (TJ36-79) for allowable maximum air pollutant concentration in residential area.

Projected maximum landing concentrations of H_2S in He Village and Shanfeng Village near the WWTP are 0.000024 mg/m^3 and 0.00023mg/m^3 respectively and concentrations of NH_3 are 0.00058 mg/m^3 and 0.00057 mg/m^3 respectively, which all meet Health Standard for Industrial Facility Design (TJ36-79) for allowable maximum air pollutant concentration in residential area.

Based on uncontrolled odor emission intensity of the WWTP, applicable environmental standard and local meteorological condition, health protection distance of 100 m should be ensured. The nearest village is He Village that is 145 m east to WWTP boundary, therefore applicable health protection distance can be met.

Odor capture and treatment measures can be taken for major odor-generating structures to make sure odor level could meet applicable standard at WWTP boundary. WWTP expansion design includes enclosure of inverted A/A/O tank with access hole for equipment maintenance and manhole, and odor pollutants are collected through pipelines for treatment in odor removal system. Sludge thickening tank is covered and odor pollutants are collected and treated in the same odor removal system. Biological odor removing method is adopted for this Project. Biological odor removal depends on micro-organic metabolism to degrade odor substances and is suitable for removal of WWTP odor. Biological filter is the most mature technology and is odor removing method widely applied. Under suitable condition, solid carrier (stuffing) attached by large quantity of micro-organics absorbs odor pollutants and decomposes odor pollutants to carbon dioxide and water. Bio-filter has advantages of low operation cost, high removing efficiency, and easy operation without secondary pollution, and is widely applied.

As sodium hypochlorite is used for water disinfection of the WTP, there is no possibility of uncontrolled or accidental chlorine emission and there is no waste gas impact on air environment during WTP operation.

5.2.3 Impact on Water Environment and Mitigation Measures

5.2.3.1Impact of Shouchang WWTP Effluent on Water Environment

Receiving water body of Shouchang WWTP is Shouchang River, with outfall being located middle of the river. S-P model recommended by EIA Technical Guidelines for Surface Water (HJ/T2.3-93) is adopted for water quality prediction.

Prediction results show that CODcr concentration will decrease to 12.8533mg/l at 50 m downstream from the WWTP outfall and meet Class III of Surface Water Environment Quality Standard (GB3838-2002). The projected ammonia nitrogen concentration will decrease to 0.2581 mg/l at 50 m downstream from the WWTP outfall and meet Class III of Surface Water Environment Quality Standard (GB3838-2002). Discharge of WWTP effluent will have insignificant impact on receiving water body.

In the event of abnormal WWTP discharge (pollutant removing rate 50%), CODcr concentration at 50m downstream from WWTP outfall will be 19.8111mg/l, which meets Class III of Surface Water Environment Quality Standard (GB3838-2002), and ammonia nitrogen concentration will be 0.7231mg/l and also meets Class III of Surface Water Environment Quality Standard (GB3838-2002).

In the event of accidental WWTP discharge (effluent flow 10,000 m^3/day), CODcr concentration at 50m downstream from WWTP outfall will be 39.3596 mg/l, which fails to meet Class III of Surface Water Environment Quality Standard (GB3838-2002). This applicable standard can be met at location 13.3 km downstream from the WWTP outfall, which means a 13.3 km long polluted zone will be caused by accidental WWTP discharge. There is no WTP water intake or other sensitive receptors within 13.3 km downstream from the WWTP outfall.

5.2.3.2 Impact on Hydrologic Condition

Currently existing river sections of some rivers are not able to fight against 1-in-10 years flood, and there are even no embankment in particular river sections next to farmland. Through rehabilitation of Wuqiangxi Stream, Yuchuanxi Stream, Liuduyuan River, Shangwuxi Stream, Zitongyuan River, Shouchang River and Datongxi Stream by new construction of embankment and improvement of existing unqualified embankment, this Project will greatly improve flood control capacities of the rivers and mitigate flood risk. Construction will not change watercourse alignment, will not change water level in non-rainy seasons, and will not change total runoff volume of the river, therefore generally this project will have insignificant impact on hydrologic condition.

5.2.3.3 Impact of Water intake by WTP

As pipeline extension of existing WTP will increase water supply service area relying on balance capacity of the existing WTP, the designed water intake

capacity will remain unchanged.

Based on water source justification in the FSR and hydrologic information, percentages of water intake by WTP expansion in runoff volume of the river are shown in **Table 5.2-1**. Water balance analysis is conducted based on daily flow data provided in the FSR for the last 54 years from 1962 to 2015, and water balance analysis of each water intake is summarized in **Table 5.2-2**.

Table 5.2-1 Water Source Analysis of WTP Expansion

WTP	Capacity (m^3/d)	Water Source	Catchment Area (km^2)	Annual Runoff 10,000 m^3	Annual Water intake 10,000 m^3	Percentage
New Fengshulin WTP	5000	Tongshanxi Stream	45.1	5444	135.2	2.48%
Baima WTP	600	Guanchuan Power Station 3# Water Diversion Channel	6.48	795	16.2	2.04%
Wangfu WTP	2200	Yanjia Reservoir	73	8200	59.5	0.73%
Yejia WTP	1400	Yejiayuan Reservoir	8	857	37.9	4.42%
Zitong No.2 WTP	2000	Xin'anjiang Reservoir	10442	972000	54.1	0.0056%
Weiping WTP (Expansion)	Expansion 2500 Total 5000	Xin'anjiang Reservoir	10442	972000	135.2	0.014%
Xiashan WTP	2100	Wuqiangxi Stream (Huixi Stream)	68.7	8563	56.8	0.66%
Pingmen WTP	800	Qiuyuanxi Stream	30.8	3413	21.6	0.63%

Table 5.2-2 Water Balance of Water Source for WTP Expansion

WTP	Water Source	Water intake Percentage	Assurance for Water intake	Assurance for Irrigation	Decrease of Ecological Flow
New Fengshulin WTP	Tongshanxi Stream	2.48%	100%	100%	0%
Baima WTP	Guanchuan Power Station 3# Water Diversion Channel	2.04%	100%	No irrigation	27.76%
Wangfu WTP	Yanjia Reservoir	0.73%	100%	100%	0%
Yejia WTP	Yejiayuan Reservoir	4.42%	100%	88%	0%
Zitong No.2 WTP	Xin'anjiang Reservoir	0.01%	100%	100%	0%
Weiping WTP (Expansion)	Xin'anjiang Reservoir	0.01%	100%	100%	0%
Xiashan WTP	Wuqiangxi Stream (Huixi Stream)	0.66%	100%	No irrigation	8.94%
Pingmen WTP	Qiuyuanxi Stream	0.63%	100%	No irrigation	8.57%

Analysis concludes that:

① Water intake of each WTP is 5% of the total runoff volume of the concerned river at the most, representing an insignificant impact on hydrologic condition.

② Benefited from adjustment of reservoir, water intake from Yanjia, Yejiayuan and Xin'anjiang reservoirs has no impact on downstream ecological flow, and the designed assurance rate for water intake and irrigation could be met.

③ Regulated by upstream Tongshan Reservoir, ecological flow of Tongshanxi Stream, water supply assurance and irrigation assurance rate could be maintained and water intake does not have insignificant impact on river hydrological condition.

④ Although there are no effective water structures on Wuqiangxi Stream (Huixi Stream) and Qiuyuanxi Stream for runoff regulation, water intake accounts for a very small percentage and no irrigation and no water demand

for irrigation is needed. Impact extent of water intake on ecological flow is smaller than 9% even in dry season. Therefore water intake has little impact on hydrological condition.

⑤ Guanchuan Hydropower Plant diverts water from Zhutiankeng, Zhuwukeng and Yanglanli Rivers for power generation and the water intake accounts for only 2.04% of its annual average inflow. Analysis shows that average annual runoff flow at water intake is 7,950,000 m^3 with the smallest daily runoff volume being 691 m^3, which could meet demand for water supply with assurance rate greater than 95%. There is no water demand for irrigation. Water intake is located on a small tributary of Baima Stream (with a catchment area of 6.48km^2) and there is substantially no need of ecological flow in the 80 m long watercourse from power plant outlet to Baima Stream. The downstream Baima Stream has a relatively large watershed area (and a catchment area of 118km^2). The catchment area at the diversion site accounts for 5.49%. therefore, the decrease of ecological flow of this tributary only affect 1.52% of the ecological flow of Baima Stream. Therefore, the Project has little impact on hydrological condition.

5.2.3.4 Impact of WTP Water intake on Hydropower Generation

The proposed Fengshuling WTP, Baima WTP, Wangfu WTP and Yejia WTP will abstract water from Fengshuling Reservoir, Guanchuan Hydropower Station, Yanjia Reservoir and Yejiayuan Reservoir, and power generation of these 4 hydropower stations will somewhat reduce affected by water intake. Impact extent is directly proportional to runoff flow decrease, which is 2.48%, 2.04%, 0.73% and 4.42% for Fengshuling Reservoir Hydropower Station, Guanchuan Hydropower Station, Yanjia Reservoir and Yejiayuan Reservoir, respectively, and impact is little. Additionally, interview of hydropower station operator shows that water intake does not have significant impact on hydropower stations except for Yejiayuan Reservoir that is also affected by its own operation problem and has unsatisfactory profits. The IAs have coordinated with the hydropower stations and loss of actual power generation will be compensated.

Table 5.2-3 Loss of power generation arising from WTP water intake

SN	WTP (Hydropower station/reservoir)	Loss of power generation (kwh)	Loss of electricity tariff revenue(CNY)
1	Baima WTP (Guanchuan Hydropower Station)	59228	29614
2	Wangfu WTP (Yanjia Reservoir)	14443	7221
3	Yejia WTP (Yejiayuan Reservoir)	17627	8814
4	Fengshuling New WTP (Fengshuling Reservoir)	51956	25978

5.2.3.5 Impact of WTP Production Wastewater and Domestic Sewage

1. Production Wastewater

WTP production wastewater is from flocculation sedimentation tank, filtration tank and thickening tank and the major pollutant is suspended solid. Supernatant from sedimentation tank is classified as production wastewater. With reference to operation experience of existing local WTPs, production wastewater has good water quality with little SS and can be reused for water production.

2. Domestic and Lab Sewage

The rural drinking water safety improvement subproject will involve the additional employment of 74 persons (including 65 persons for centralized water supply facilities and 9 for pipeline extension). Plus the existing staffing of 88 persons in all the WTPs, the WTPs, upon completion, will involve a total staffing of 162 employees.

It is assumed that the water consumption per person per day is 30 L, the wastewater generation coefficient is 90% and concentrations of major pollutants of CODcr, BOD_5 and NH_3-N are 350 mg/l, 200 mg/l and 35 mg/l, respectively. The total volume of production wastewater and domestic sewage is 1596.7 m^3/a, including 867.2 from existing facilities and 729.5 from the proposed facilities. Details are given in **Table 5.2-4**.

Survey indicates existing WTPs generate very little lab wastewater with parameters like color, turbidity, pH and residual chorine being analyzed automatically by instruments and fecal coliform being analyzed through culture experiment. WTP generates almost no lab wastewater.

Each of the new WTPs will be installed with a set of underground powered domestic sewage treatment facility. Domestic sewage will be treated to meet Urban Wastewater Reuse Standard for Miscellaneous Municipal Purposes (GB/T 18920-2002) and reused for greening, which will have insignificant impact on surrounding surface water.

5.2.3.6 Impact Analysis for Hangtou Wetland

Jiande City Hangtou Composite Wetland Subproject is currently a river flood plain mainly comprising of uncultivated beach land and farm fields with a total area of 16247.2m^2. The subproject, with a relatively small footprint, is designed to explore for and provide demonstrative functions for wetland construction, provide a referential and demonstrative model of watershed ecological improvement and create a demonstrative ecological landscape of ecological wetland in Jiande City. Engineering technologies to be adopted in this subproject include Non-powered water distribution system, multi-stage enhanced biofilm system, grass and shrub wastewater interception and purification system, high-efficiency and self-purifying aquatic ecosystem, composite ecological filtration system and stabilized operation management system. The nutritive salt and organic and inorganic pollutants in the reservoir water are transformed as a resource into biomass resources and extracted for reuse. The processes to be adopted are mainly for removal of BOD, COD, nitrogen and phosphorus and also further removal of organic

matter, harmful synthetic compounds that are difficult to decompose, heavy metals. In normal operation, the wetland is capable of receiving about 2000 tons of farmland backwater from Nanba Village in the vicinity.

According to the site survey, the subproject site is currently a river flood plain mainly covered by grass and farmland vegetation. Local birds are visible in the area of land use, but there are no bird foraging grounds and habitats. Upon completion, local and native vegetation will be transplanted to set up a framework of plant ecosystem before more animal and plant species are introduced to enrich the varieties in the region. For example, plants growing in the wetlands will undergo natural and seasonal change with seasons and water levels. Before spring cultivation, paddy grass and wild flowers and the like are growing in the paddy fields. In the dry season, there are lotus plants and wild chrysanthemums. In the wet season, watercress and Equisetum ramosissimum Desf. will grow. Among the wetland weeds, there are many wetland plants and aquatic plants such as water beans, waterweeds and bitter grasses. The rich plants also provide a good environment for animals, such as frogs, dragonflies laying eggs in the water, and an excellent larval habitat and ideal foraging ground for waterfowls such as egrets, providing birds with rich food and excellent space of existence and breeding.

It is known from the FSR of the Project that the wetland subproject will treat farmland backwater from Nanba Village to significantly relax the environmental pressure on the streams by agricultural NPS pollution in the region. In addition, with the poor drainage regularity of farmland backwater, the existing rolling dam on Shouchang River will be used under the subproject to divert stream water as backup water for the wetland to avoid possible dry-up of the wetland due to excessively small supply of farmland backwater and assure normal growth of wetland vegetation and maintain wetland stability. Available data shows that the key pollutants in the farmland backwater are TN and TP with a content of ≥2.0mg/L and ≥0.4mg/L respectively, resulting in a water quality level of Class V and even worse than Class V. It is shown in the FSR that Hangtou Composite Eco-wetland is capable of treat approximately 2000 tons of farmland backwater every day in normal operation (with stream water diverted in case of water shortage) and will be able to achieve high-efficiency purification of farmland backwater from Nanba Village in the vicinity. As a result, nitrogen and phosphorus in the water bodies in the subproject area and other trace toxic pollutants will be efficiently reduced and effectively removed, with an annual average removal rate of 15% to 20% for nitrogen and10% to 20% for phosphorus and an estimated TN and TP removal of 0.219t/a~0.365t/a and 0.029t/a~0.058t/a respectively.

When the wetland is completed and put into operation, it will, in addition to

treatment of farmland backwater and removal of nitrogen and phosphorus and other pollutants, become a local landscape. Hangtou Town Government will be responsible for the operation and management of the wetland and 2 special personnel will be assigned to be responsible for daily wetland management. Plants with long frost-free period and growth period will be selected for the wetland subproject and the wetland plants will be harvested on a regular basis each year and sediments will be dredged periodically to avoid odor generated from rotten plants. The harvested plants will be returned to the farmland. In the operation period, effluent quality and plant growth in the wetland will be monitored on a regular basis.

Table 5.2-4 Estimate of Domestic Sewage Generation by WTP under This Project

WTP	Existing				To be Added in this Project				Total			
	Sewage (t/a)	COD_{Cr} (kg/a)	BOD_5 (kg/a)	NH_3N (kg/a)	Sewage (t/a)	COD_{Cr} (kg/a)	BOD_5 (kg/a)	NH_3N (kg/a)	Sewage (t/a)	COD_{Cr} (kg/a)	BOD_5 (kg/a)	NH_3N (kg/a)
Wangfu WTP	0.0	0.0	0.0	0.0	78.8	27.6	15.8	2.8	78.8	27.6	15.8	2.8
Yejia WTP	0.0	0.0	0.0	0.0	59.1	20.7	11.8	2.1	59.1	20.7	11.8	2.1
Xiashan WTP	0.0	0.0	0.0	0.0	78.8	27.6	15.8	2.8	78.8	27.6	15.8	2.8
Pingmen WTP	0.0	0.0	0.0	0.0	49.3	17.3	9.9	1.7	49.3	17.3	9.9	1.7
New Fengshuling WTP	0.0	0.0	0.0	0.0	118.3	41.4	23.7	4.1	118.3	41.4	23.7	4.1
Baima WTP	0.0	0.0	0.0	0.0	59.1	20.7	11.8	2.1	59.1	20.7	11.8	2.1
Zitong No.2 WTP	0.0	0.0	0.0	0.0	78.8	27.6	15.8	2.8	78.8	27.6	15.8	2.8
Weiping WTP	29.6	10.4	5.9	1.0	118.3	41.4	23.7	4.1	147.9	51.8	29.6	5.1
Fenkou WTP Pipeline Extension	207.0	72.5	41.4	7.2	19.7	6.9	3.9	0.7	226.7	79.4	45.3	7.9
Linqi WTP Pipeline Extension	39.4	13.8	7.9	1.4	9.9	3.5	2.0	0.3	49.3	17.3	9.9	1.7
Qiaobei WTP Pipeline Extension	59.1	20.7	11.8	2.1	9.9	3.5	2.0	0.3	69.0	24.2	13.8	2.4
Langchuan WTP Pipeline Extension	98.6	34.5	19.7	3.5	9.9	3.5	2.0	0.3	108.5	38.0	21.7	3.8
Pingshan WTP Pipeline Extension	187.2	65.5	37.4	6.6	9.9	3.5	2.0	0.3	197.1	69.0	39.4	6.9
Jieshou WTP Pipeline Extension	0.0	0.0	0.0	0.0	9.9	3.5	2.0	0.3	9.9	3.5	2.0	0.3
Jiangjia WTP Pipeline Extension	59.1	20.7	11.8	2.1	9.9	3.5	2.0	0.3	69.0	24.2	13.8	2.4
Qiandaohu WTP Pipeline Extension	187.2	65.5	37.4	6.6	9.9	3.5	2.0	0.3	197.1	69.0	39.4	6.9
Total	867.2	303.6	173.3	30.5	729.5	255.7	146.2	25.3	1596.7	559.3	319.5	55.8

5.2.3.7 Impact on Water Environment and Mitigation Measures

1. WTP Water Source Protection Zoning

Drinking water protection zone has been designated for water source of existing WTPs with pipeline extension and Weiping WTP, but this has not been done for other WTPs. Drinking water protection zone should be designated in accordance with Technical Guidelines for Designating Drinking Water Source Protection Zone (HJ/T 338-2007) and based on actual condition. Eye-catching signs should be posted and requirements stipulated by applicable laws and regulations should be enforced to further strengthen control of domestic, agricultural and tourism pollution sources in surrounding area.

In accordance with Technical Guidelines for Designating Drinking Water Source Protection Zone (HJ/T 338-2007), this EIA proposes the following for designating water source protection zone for the proposed WTPs:

① Yanjia Reservoir (Wangfu WTP water source)

Yanjia Reservoir will be water source of Wangfu WTP, which is mountain area type medium-sized reservoir with total capacity of 21.40 million m^3.

Class 1 protection zone: water area within 300m from the water intake and terrestrial area within 200m from waterline next to the water intake (or watershed, whichever is the nearer).

Class 2 protection zone: water area outside Class 1 protection area, terrestrial area within crest line around the reservoir (outside Class 1 protection zone) and catchment area 3,000m upstream from river estuary.

Water quality target is Category II.

② Yejiayuan Reservoir (Yejia WTP water source)

Yejiayuan Reservoir will be water source of Yejia WTP, which is mountain area type small-sized reservoir with total capacity of 1.085 million m^3.

Class 1 protection zone: water area below normal waterline and terrestrial area within 200m from waterline next to the water intake (or watershed, whichever is the nearer).

Class 2 protection zone: water area outside Class 1 protection area, terrestrial area upstream from the reservoir (outside Class 1 protection zone).

Water quality target is Category II.

③ Qiandaohu Reservoir (Zitong No.2 WTP water source)

Zitong No.2 WTP abstracts water from Qiandaohu Reservoir, which is mountain area type large-sized reservoir.

Class 1 protection zone: water area within 500m from the water intake and

terrestrial area within 200m from waterline next to the water intake (or watershed, whichever is the nearer).

Class 2 protection zone: water area within 2000m outside Class 1 protection area, terrestrial area within 3000m outside Class 1 protection zone (or watershed, whichever is the nearer).

Water quality target is Category II.

④ Zhutiankeng Reservoir (Baima WTP water source)

Zhutiankeng Reservoir will be water source of Baima WTP, which is mountain area type small-sized reservoir.

Class 1 protection zone: water area below normal waterline and terrestrial area within 200m from waterline next to the water intake (or watershed, whichever is the nearer).

Class 2 protection zone: water area outside Class 1 protection area, terrestrial area upstream from the reservoir (outside Class 1 protection zone).

Water quality target is Category II.

⑤ Wuqiangxi Stream (Xiashan WTP water source)

Water source of Xiashan WTP is river section upstream Wuqiangxi Stream. New dike and water intakes will be built on two tributaries upstream from Wuqiangxi Stream. Dike 1 is located at Daxikou on east tributary of Wuqiangxi Stream, and dike 2 is located near Banshan Village along west tributary of Wuqiangxi Stream. Total catchment area is 57.7 km^2.

Class 1 protection zone: water area below water level under 1-in-5 years flood from 1,000m upstream from water intake dike to 100m downstream from water intake dike, and terrestrial area within 50 m of both sides outside Class 1 protection zone water area.

Class 2 protection zone: water area below water level under 1-in-10 years flood from 2,000 m upstream from upper boundary of Class 1 protection zone and 200m downstream from lower boundary, and terrestrial area upstream from the water intake dike.

Water quality target is Category II.

⑥ Qiuyuanxi Stream (Pingmen WTP water source)

New dike for water intake of Pingmen WTP will be built Qiuyuanxi Stream upstream from Qiuyuan Village with catchment area being 30.8km^2 in total.

Class 1 protection zone: water area below water level under 1-in-5 years flood from 1,000m upstream from water intake dike to 100m downstream from water intake dike, and terrestrial area within 50 m of both sides outside Class 1 protection zone water area.

Class 2 protection zone: water area below water level under 1-in-10 years flood from 2,000 m upstream from upper boundary of Class 1 protection zone and 200m downstream from lower boundary, and terrestrial catchment area upstream from the water intake dike.

Water quality target is Category II.

⑦ Tongshanyuan River (Fengshuling WTP water source)

The planned water source for new Fengshuling WTP is Tongshanxi Stream downstream from Tongshan Reservoir. Two dikes for water intake will be built upstream and downstream from Tongshan Class 1 Hydropower Station. Catchment area totals 45.1km^2.

Class 1 protection zone: water area below water level under 1-in-5 years flood from 1,000m upstream from water intake dike to 100m downstream from water intake dike, and terrestrial area within 50 m of both sides outside Class 1 protection zone water area.

Class 2 protection zone: water area below water level under 1-in-10 years flood from 2,000 m upstream from upper boundary of Class 1 protection zone and 200m downstream from lower boundary, and terrestrial catchment area from the water intake dike to Tongshan Reservoir.

Water quality target is Category II.

⑧ Zhutiankeng Stream (Baima WTP water source)

Water source of Baima WTP is Zhutiankeng Reservoir upstream from Zhutiankeng Stream and Yanglanli dike. Water source protection zoning has been done for Zhutiankeng Reservoir, and water source protection zoning for Zhutiankeng Stream is as below:

Class 1 protection zone: water area below water level under 1-in-5 years flood from 1,000m upstream from water intake dike to 100m downstream from water intake dike, and terrestrial area within 50 m of both sides outside Class 1 protection zone water area.

Class 2 protection zone: water area below water level under 1-in-10 years flood from 2,000 m upstream from upper boundary of Class 1 protection zone and 200m downstream from lower boundary, and terrestrial catchment area upstream from the water intake dike.

2. Measures for Drinking Water Source Protection (The local government and EPB will be responsible for implementation of such measures)

①As specified in PRC Water Pollution Prevention and Control Law, Regulation on Drinking Water Source Protection Zone Pollution Control and Zhejiang Province Drinking Water Source Protection Regulation, pollution control should be done in designated water source protection zone. Enclosed management approach should be adopted for protection of Class 1 protection zone,, if possible,.

② Automatic monitoring station should be set for water intake to monitor COD_{Mn}, NH_3-N and TP. Water intake water quality monitoring plan should be enforced in accordance with Implementation Program for Centralized Drinking Water Source Water Quality Monitoring and Notice of Further Improving Water Functional Zone and Drinking Water Source Water Quality Monitoring (Zhejiang Water Affairs [2016] Document No.6).

③The following are banned in Class 2 drinking water source protection zone:

1) Wastewater discharge outlet;

2) New construction, modification or expansion of facility that discharges pollutants;

3) Storage of solid wastes or other pollutants that may cause water body pollution;

4) Loading/unloading of hazardous goods on water;

5) Ship deck cleaning and discharge of cabin cleaning water or ballast water.

④Additionally the following are banned in Class 1 drinking water source protection zone:

1) New construction, modification or expansion of facility that is irrelevant to water supply or water source protection;

2) Aquaculture with bait supply, tourism, swimming or fishing;

3) Application of chemical fertilizer and toxic, and highly residual pesticide/herbicide.

4) Berthing of ship not related to water source protection;

5) Other activities that possibly pollute water source.

⑤ Enforcement of environmental regulations should be enhanced. Development activities should be reasonably distributed in response to drinking water source protection zone and pollution sources should be strictly controlled. Any activity that will affect water source quality is prohibited such as sand excavation.

3. WTP should be installed with underground powered domestic sewage treatment facility. Production and domestic sewage should be treated to meet Urban Wastewater Reuse Standard for Miscellaneous Municipal Purposes (GB/T 18920-2002) and reused for greening.

4. WTP production wastewater from flocculation sedimentation tank, filtration tank and thickening tank will be treated in sedimentation tank. Supernatant is reused for water production.

5. Actual power generation loss of Fengshuling Reservoir, Guanchuan Hydropower Station, Yanjia Reservoir and Yejiayuan Reservoir will be compensated.

5.2.4 Impact on Acoustic Environment and Mitigation Measures

1. Prediction Model

Model recommended in Technical Guidelines for Acoustic Environment Impact Assessment (HJ2.4-2009) is applied to noise prediction, as below.

$$L_p = L_0 - 20 \times \lg\left(\frac{r}{r_0}\right) - A_{其它}$$

Where:

L_p - Noise level r meters away from noise source, dB(A)

L_0 - Noise level r_0 meters away from noise source, dB(A)

A_{other} - Other attenuation (air adsorption, ground effect, barrier), dB(A), mostly mitigated by buildings and walls. Experiential attenuation value is approximately 25 dB(A).

r – Distance between prediction location and noise source, m

2. Impact of WWTP Noise

Noise sources of WWTP include various kinds of machines and pumps mostly located in inflow pump chamber, sludge dewatering structure, sludge circulating pump and air blower chamber. Noise intensity is shown in **Table 5.2-5**.

Table 5.2-5 Noise Intensity of Major WWTP Equipment

Equipment	Noise Source Intensity, dB (A)	
	Without Mitigation Measure	With Mitigation Measure
Wastewater Pump	90-100	80
Sludge Pump	90-100	80
Air Compressor	95-105	85
Air Blower	80-90	80

Major noise-generating equipment of WWTP includes water pump, air compressor and air blower. Noise level in air blower room ranges from 80 to 90 dB (A), and will decrease to 80 dB (A) when noise reduction measures are taken. Usually pumps are installed within buildings, in which noise level is 90 to 100 dB (A) and will decrease to 80 dB (A) after mitigation measures are taken. Further reduced by ambient air and distance, noise at WWTP boundary can meet Ambient Noise Emission Standard on the Boundary of Industrial Enterprises (GB12348-2008) Category 2, allowable maximum noise level 60 dB (A) for daytime and 50 dB (A) in nighttime.

Noise level in Datangbian Village and Shanfeng Village near WWTP could meet Acoustic Environment Quality Standard (GB3096-2008) Category II, allowable maximum noise level 60 dB (A) for daytime and 50 dB (A) in nighttime.

3. Impact of WTP Noise

Noise sources of WTP include various kinds of pumps, and chemical dosing and chlorine dosing equipment, which are all located indoors and not movable with noise intensity ranging from 75 to 95 dB (A).

Prediction indicates, after noise damping and insulation measures are taken, noise level at boundary of each WTP will meet Ambient Noise Emission Standard on the Boundary of Industrial Enterprises (GB12348-2008) Category 1, allowable maximum noise level 55 dB (A) for daytime and 45 dB (A) in nighttime. WTP noise has insignificant impact on surrounding area.

Villages near WTP include Yanjiaping Village and Yanjia Village near Wangfu WTP, Wangjia and Xujia villages near Xiashan WTP, Hepu Village near Pingmen WTP, Qinchuan Village near Weiping WTP #1 booster pump chamber, Lianhe and Longtan villages near Weiping WTP #2 booster pump chamber, and Xiangjia Village near Weiping WTP #3 booster pump chamber. These villages are quite far away from the concerned WTP and pump station, where Acoustic Environment Quality Standard (GB3096-2008) Category II can be met.

4. Mitigation Measures

(1) Selection of low-noise and efficient equipment.

(2) Damping and insulation measures should be taken to mitigate impact of high-noise equipment like water pump in order to meet Industrial Facility Noise Health Standard.

(3) Regular inspection and maintenance of various machines and noise reduction equipment should be improved and equipment in failure should be replaced in a timely manner to avoid noise from improper operation.

(4) Water pump should be equipped with anti-vibration pad and sound insulating door and window should be installed for pump chamber. High-noise equipment like air blower should be installed within building, if possible, for better noise insulation.

(5) Equipment foundation should be equipped with anti-vibration pad to reduce vibration noise.

(6) Proper maintenance of water pump, regular inspection of concentricity of motor and pump axle, and good lubrication of bearings to reduce abrasion of pump components and parts.

5.2.5 Impact of Solid Waste and Mitigation Measures

1. WTP and WWTP Sludge

WTP sludge in the operation stage is from WTP sedimentation process and is classified as ordinary solid waste. Based on survey, quantity of sediment from WTP coagulation sedimentation process is very small as local source water has good quality. Sediment will be hauled to solid waste landfill for disposal.

Sludge quantity of Shouchang WWTP is estimated 3.6 ton/day or 1,095 ton/year. Generation of screenings will be approximately 0.1 ton/day or 36.5 ton/year. Sludge cake and grid debris will be transported to Jiande municipal solid waste landfill for disposal.

2. Domestic Solid Waste

Solid waste generation by WTP is calculated based on 1kg/person/day, and annual solid waste generation will be 59.4 tons including 32.2 tons in existing WTPs and 27.2 tons from proposed facilities. Details are given in **Table 5.2-6**. Shouchang WWTP will generate solid waste 50 kg each day or 18.2 tons each year. Domestic solid waste will be collected by municipal sanitation utility for disposal.

Table 5.2-6 Estimate of Domestic Solid Waste Generation by WTP

Facility	Existing Solid Waste Generation (t/a)	New Solid Waste Generation (t/a)	Total (t/a)
Wangfu WTP	0	2.9	2.9
Yejia WTP	0	2.2	2.2
Xiashan WTP	0	2.9	2.9
Pingmen WTP	0	1.8	1.8
New Fengshuling WTP	0	4.4	4.4
Baima WTP	0	2.2	2.2
Zitong No.2 WTP	0	2.9	2.9
Weiping WTP	1.1	4.4	5.5
Fenkou WTP Pipeline Extension	7.7	0.7	8.4
Linqi WTP Pipeline Extension	1.5	0.4	1.9
Qiaobei WTP Pipeline Extension	2.2	0.4	2.6
Langchuan WTP Pipeline Extension	3.7	0.4	4.1
Pingshan WTP Pipeline Extension	6.9	0.4	7.3
Jieshou WTP Pipeline Extension	0	0.4	0.4
Jiangjia WTP Pipeline Extension	2.2	0.4	2.6
Qiandaohu WTP Pipeline Extension	6.9	0.4	7.3
Total	32.2	27.2	59.4

3. Recovery of Pesticide/Herbicide Containers

The waste pesticide packaging materials in the project area are collected by the farmers on their own or by the village committees and then delivered to and temporarily stored in the waste packaging material storage buckets at the various collection sites. Then, such waste materials will be transported by Hangzhou Lijia Environmental Service Co., Ltd. in enclosed trucks to a designated site for disposal. The environment impact will be insignificant.

4. Mitigation Measures

(1) WTP sludge is classified as ordinary inorganic solid waste with stable characteristics and small quantity. WTP sludge will be collected by municipal sanitation utility for disposal.

(2) Sludge of Shouchang WWTP will be hauled to Jiande City solid waste landfill for disposal.

(3) Domestic solid waste of WTP and WWTP will be collected by municipal sanitation utility.

(4) A proper solid waste management account book should be prepared to standardize the records of various solid wastes. An appropriate transfer manifest system should be developed for hazardous wastes.

(5) The waste pesticide packaging materials in the project area are collected by the farmers on their own or by the village committees and then delivered to and temporarily stored in the waste packaging material storage buckets at the various collection sites. Then, such waste materials will be transported by Hangzhou Lijia Environmental Service Co., Ltd. in enclosed trucks to a designated site for disposal. The transportation operator must keep proper records of the waste packaging materials for transportation and also the hand-over manifest records.

5.3 Analysis and mitigation measures for forestry impacts

5.3.1 Analysis and mitigation measures of environmental impacts in the construction stage

The main impacts of the construction period of the project are soil erosion caused by site and hole preparation, noise impacts caused by the operation of mechanical equipment during the cutting process, and the impact of transportation of seedlings and so on.

(1) Soil erosion caused by site and hole preparation: According to the construction method proposed in the feasibility study report, planting holes of different sizes are excavated for different seedlings, usually 50cm long × 50cm wide × 40cm deep. The dimension of the planting holes of large seedlings is 60cm long × 60cm wide × 50cm deep. Surface vegetation will be damaged in the excavation process and, if not vegetated and backfilled in time, the excavated surface soil and the exposed surface will be scoured by rain, resulting in local soil erosion. The IA is required to adopt the

method of simultaneous excavation and planting so that soil excavated from planting holes is used for backfill of tree planting. All efforts should be made to avoid the rainy season when planning the construction period.

(2) The main mechanical equipment involved in the logging process are brushing machines, chain saws and other tending machines and no large machines are involved. The operational noise of brush cutters and chain saws ranges from 75 to 95dB based on the different models. The project area is mainly in forest land with a certain distance from the centralized residential areas of villagers. therefore, the key objects of impact of the operational noise of mechanical equipment under the project are the construction workers . It is recommended that the IA should take proper protective measures for the construction workers, who should wear earmuffs to reduce the noise damage to the operators.

Mitigation measures for environmental impacts in the afforestation process are described in detail in the ECOP for Afforestation.

5.3.2 Analysis and mitigation measures of environmental impacts in the operation stage

Although the forest coverage is high in Chun'an County, the unit stock volume is still low, with an average stand of 2.64 m3 / mu; only half of the national average stocking volume per unit area. The dominant vegetation in forests is mostly secondary artificially cultivated or naturally developed forests, featuring in irrational age structure, with the young and middle-aged forest accounting for 71.3% of the arbor forest and the mature forest taking a relatively small percentage. The timber stands take a large proportion, accounting for 48.7% of the area of forest land. The artificial forests in the surrounding areas of Qiandao Lake are single layer forests. The forest vegetation mainly comprises of pure Pinus massoniana forest, with broadleaf forest and mixed forest taking a minor proportion. Plant community in such a structure type features in single tree species and non-diversified forest form and it is difficult to form a stable forest ecosystem, which does not only have a poor landscape heterogeneity, but also affects biodiversity and lead to frequent occurrence of forest pests and diseases.

Jiande City has a large forest area, but declining forest quality, which is mainly reflected in the following aspects: (1) Irrational structure of forest species and tree species structure. The low hill areas with an elevation of below 200m are mainly covered with artificially cultivated economic forest and bamboo forests. The mountainous areas with an elevation of 200 ~ 500m are mainly distributed with coniferous forest, economic forest, and bamboo forest mixed with a small amount of evergreen broad-leaved forest. Evergreen broad-leaved forest, coniferous forest, conifer and broad-leaved mixed forest, shrubs, and bamboo forests are mainly found in the mountainous areas with an elevation of 500 to 800m. The middle and low mountain areas with an elevation of more than 800 meters above sea level are mainly covered with natural secondary vegetation dominated by evergreen and deciduous broadleaf forest or mixed forest, coniferous and broad-leaved mixed forest and

shrubbery. In general, pure forests, such as trees and coniferous forests, take an excessively high proportion while the natural broad-leaved forests and mixed forests take a small percentage, leading to the simplification of the forest system. (2) The proportion of plantation area is high and the proportion of natural forest is declining. The mountainous areas with an elevation of 500m, in particular, is nearly all used for economic forests and the native vegetation is almost destroyed.

The Project aims to rehabilitate the degraded forest in the Qiandao Lake reservoir area and plant trees and replace coniferous forest with broadleaved forest on sloping farmland and wasteland in important watershed and replant broadleaved forest on slopes with poor stand, degraded coniferous forest and after deforestation. Upon the completion of the forest form transformation, huge ecological benefits will be produced to give full play to the various functions and benefits of forests. In particular, obvious improvements will be made to the forest structure and forest quality and the ecological environment in the region.

Implementation of the Project will help increasing forest reserve and vegetation coverage rate, increasing vegetation interception of precipitation and soil permeability, reducing rainfall impacts on soil to effectively prevent soil erosion.

After afforestation, the vegetation coverage will increase rapidly and the air humidity in the woodland will increase. As temperature and wind speed decrease, the evaporation of soil moisture decreases too, with a part of the evaporation of soil moisture replaced by plant transpiration, which is more conducive to the activity of microorganisms and the cumulative activation of nutrients. In addition, the decomposed branches and leaves will becomes an important source of soil organic matter, nitrogen and phosphorus, which is conducive to the growth of soil fertility.

The value of forest conservation of water is mainly reflected in the increase of valid water volume, improvement of water quality and regulation of runoff. In this Project, forest vegetation plays an important role in conservation of water sources and adjustment of river flow and also reduces lake erosion and sedimentation.

The forest vegetation achieves carbon sequestration and oxygen release through photosynthesis. Through implementation of this Project, the forest biomass and coverage rate will be increased and, on the other hand, the forest phase structure of the vegetation in Chun'an County will be changed and the percentage of coniferous and broad-leaved mixed forest will be increased to facilitate improvement of the role of carbon fixation and oxygen release of the forest ecosystem.

The major forest pests and diseases in the project area are Dendrolimus punctatus and Monochamus alternatus, with Dendrolimus punctatus causing the biggest damage. The Project aims to improve the stability of forest stand, enrich the biodiversity and improve the regional forest type structure so as to attain resistance to pests and diseases through rehabilitation of the forest form of low-efficiency coniferous forests and afforestation on the barren hills.

In the operation stage of the Project, a pest management approach dominated by

biological control and supplemented by chemical control will be used. Using the biological control method, a living environment suitable for the natural enemies of pests is created and insectivorous birds are artificially attracted and protected to increase the number of natural enemies of pests; bacteria and predators are used to control pests and diseases. Chemical control is needed when necessary. In the pesticide spraying process, impacts will be generated on local air. Rainfall shortly after pesticide application will result in a situation where pesticide is washed into the surface water and affects the surface water quality. Pesticides should be sprayed according to the law of pest occurrence and at suitable frequency and appropriate dosage. Used pesticide bottles shall not be abandoned in the woodland after use and shall be collected by a qualified unit for centralized disposal.

Details of forestry pest prevention and mitigation measures are shown in the Forestry Pest Management Plan.

5.4 Analysis and mitigation measures of environmental impacts of the agricultural NPS pollution control subproject

5.4.1 Analysis and mitigation measures of environmental impacts in the construction stage

The Agricultural NPS pollution control subproject include organic fertilizer promotion, liquid fertilizer distribution, ecological interception of nitrogen and phosphorus, and soil and water conservation prevention and protection, and NPS pollution control of livestock and poultry breeding. During the excavation of ecological ditches, digesters and reservoirs, etc. the temporary stockpiles of excavated earth and the exposed surface will be scoured by rain and result in local soil erosion. Construction machinery noise and construction dust will also have some impacts on the vicinity, but these civil works are of small scale, short construction time and insignificant environmental impacts, which will end as the construction activities come to an end.

Details of mitigation measures for environmental impacts in the construction stage of the agricultural NPS pollution control subproject are shown in the ECOP for Small Civil Works.

5.4.2 Analysis and mitigation measures of environmental impacts in the operation stage

Under the Project, agricultural NPS pollution control will be achieved in Qiandao Lake Basin, including IPM, pesticide bottle recovery, liquid fertilizer distribution and organic fertilizer promotion and pollution control for livestock and poultry breeding. Through application of high-quality organic fertilizers, chemical fertilizers will be gradually replaced; green control of agricultural crop pests and diseases will be achieved using insecticidal lamps, color plates, bio-pesticides and the amount of application of chemical fertilizers and chemical pesticides will be reduced to provide an important assurance for control of soil environmental risks and safety of food production in the development of modern agriculture. In addition, the supporting facilities for livestock

and poultry manure disposal in the farms will be improved and the technological models for comprehensive utilization of livestock and poultry manure will be promoted based on local conditions to standardize and guide the beneficial use of breeding wastes from livestock and poultry farms. The agricultural facilities will be gradually improved through ecologicalization of drainage ditches so as to continuously expand the scope of application of scientific fertilization technologies in the project area, improve the fertilization structure and method. the total application of chemical fertilizers per unit area will be reduced by 10% and the total nitrogen (TN) emissions and total phosphorus (TP) emissions will reduce respectively by more than 930.35 tons. The use of pesticides and fertilizers in the region, pollutants entering rivers and the reservoirs, the import of agricultural pollutants from the source will be reduced at the source to make significant contribution to the improvement of water quality and protection of water resources in the project area and in the watershed.

Manure from the egg chicken farm in the NPS pollution control subproject for livestock and poultry breeding farms in Jiande City in the operation stage will be subject to centralized treatment. With such an approach, the manure will be temporarily stored in the chicken farm and then transported on a regular basis to Jiande City Yitian Microbial Organic Fertilizer Company and used as raw materials needed for production of organic fertilizer. Fecal wastewater from the 3 household breeding farms in Chun’an County will be transported to and digested in farm fields. In the transportation process, odor generated from spillage of manure will generate impacts on air environment and local residents. It is thus required that full-enclosed manure transportation vehicles will be used and checked before departure to avoid possible spillage during transportation. Since the breeding farms in the project are distributed in a scattered way, each farm will have a designated transportation route away from the centralized residential areas and the operators shall travel along the designated route. Observation shall be conducted in the transportation process to immediately discover and clean any spillage in a timely manner.

According to the survey, an internal manure and biogas slurry record system has been set up by the livestock and poultry breeding enterprises in Chun'an County, which is used to record the volume of production, treatment and disposal of manure and biogas slurry. Chun'an County Government has implemented a demonstration project of liquid fertilizer distribution and logistics network facilitated by the government-led, managed by the enterprise, operated based on the market aiming to develop a number of independent and self-financed enterprises supported on the various types of bases in agriculture, forestry, animal husbandry and fishery in the county through distribution of liquid fertilizers and excrement produced by the biogas digesters, sewage tanks and biochemical tanks located in the various livestock and poultry breeding farms. The biogas slurry is delivered in enclosed tanker trucks, with the transportation process subject to double supervision by the distribution manifest system and the online flow measurement system of the storage tank. Modernized fertilizer management approaches, such as GPS online liquid fertilizer monitoring and dispatching model, the precise soil test and formulated fertilization technology, are used to achieve rational and beneficial use of liquid fertilizer (manure) and develop a county-wide eco-cycle through combination of livestock and poultry breeding and crop farming.

The waste pesticide packaging materials are collected by the farmers on their own or by the village committees and then delivered to and temporarily stored in the waste packaging material storage buckets at the various collection sites. Then, such waste materials will be transported by Hangzhou Lijia Environmental Service Co., Ltd. in enclosed trucks to a designated site for disposal.

In order to mitigate the environmental impacts in the transportation process of manure and biogas slurry, the following measures should be taken:

(1) An internal manure and biogas slurry record system should be set up by each livestock and poultry breeding enterprise (including individual farmers, breeding farms or organic fertilizer processing enterprises) to record the volume of production, treatment and disposal of manure and biogas slurry.

(2) The manure transportation operators must set up a record management system for the transportation process and implement the transfer manifest system.

(3) A collection and transportation schedule should be developed in advance to assure that the manure collection and transportation work is carried out in an orderly and efficient manner. A special transportation route must be designated for each farm in such a way that the centralized residential areas and water source protection areas are avoided to the best possibility. The operators must follow and shall not alter the designated routes without authorization.

(4) Enclosed tanker trucks installed with GPS should be used to achieve online monitoring.

(5) Trucks should be inspected before departure and the pumping pipes and buckets must be cleaned after manure pumping operation is over. Actions should be taken to prevent possible leakage and spillage in the transportation process.

(6) The transportation process should be observed from time to time so that any spillage can be cleaned in time.

The IPM concept will be promoted on tea, grain, vegetables, mulberry and fruit trees among other crops. Local air impacts may be generated in the process of pesticide application and, in the event of a rainfall shortly after pesticide application, impacts may be generated on the surface water quality by pesticide washed into the surface water. Random disposal of waste pesticide bottles will also have impacts on local environment.

Details on the mitigation measures for environmental impacts involved in agricultural pest management are shown in the Agriculture Pest Management Plan.

5.5 Cumulative Impact Assessment

the EA team has consulted with the relevant local and provincial government agencies, collected and analyzed all the relevant plans within the two counties, and confirmed that the rural sewage treatment facilities/plants in villages and towns of the two counties have been constructed and put into operation during the 12th five year

plan, the major infrastructure and development activities within the two countieshave been completed, according to the government development strategy and plans, the watershed areas around Qiandao Lake will be protected as the important ecosystem for the Lake and no intensive development program will be undertaken in those areas in the future. in this sense, no reasonable foreseeable future development activities are expectedand available to assess the cumulative impacts together with past, current and future activities.

In summary, the project aims to demonstrate the integrated pollutions management in selected small scale watersheds and it will contribute to reduce pollutions discharge from existing land management and to improve ecological environment. all the project activities within the areas will have positive impacts on the water quality and ecological environment of the Qiandao Lake, and there are no reasonable foreseeable future development activities are expectedand available within the two counties given the strictest ecologicaland environmental protection requirements from the Central and Provincial government, the local government will focus on the pollution reduction and ecological environmental improvement within the watershed, there will be no incremental and cumulative impacts on people and communities within the watershed.

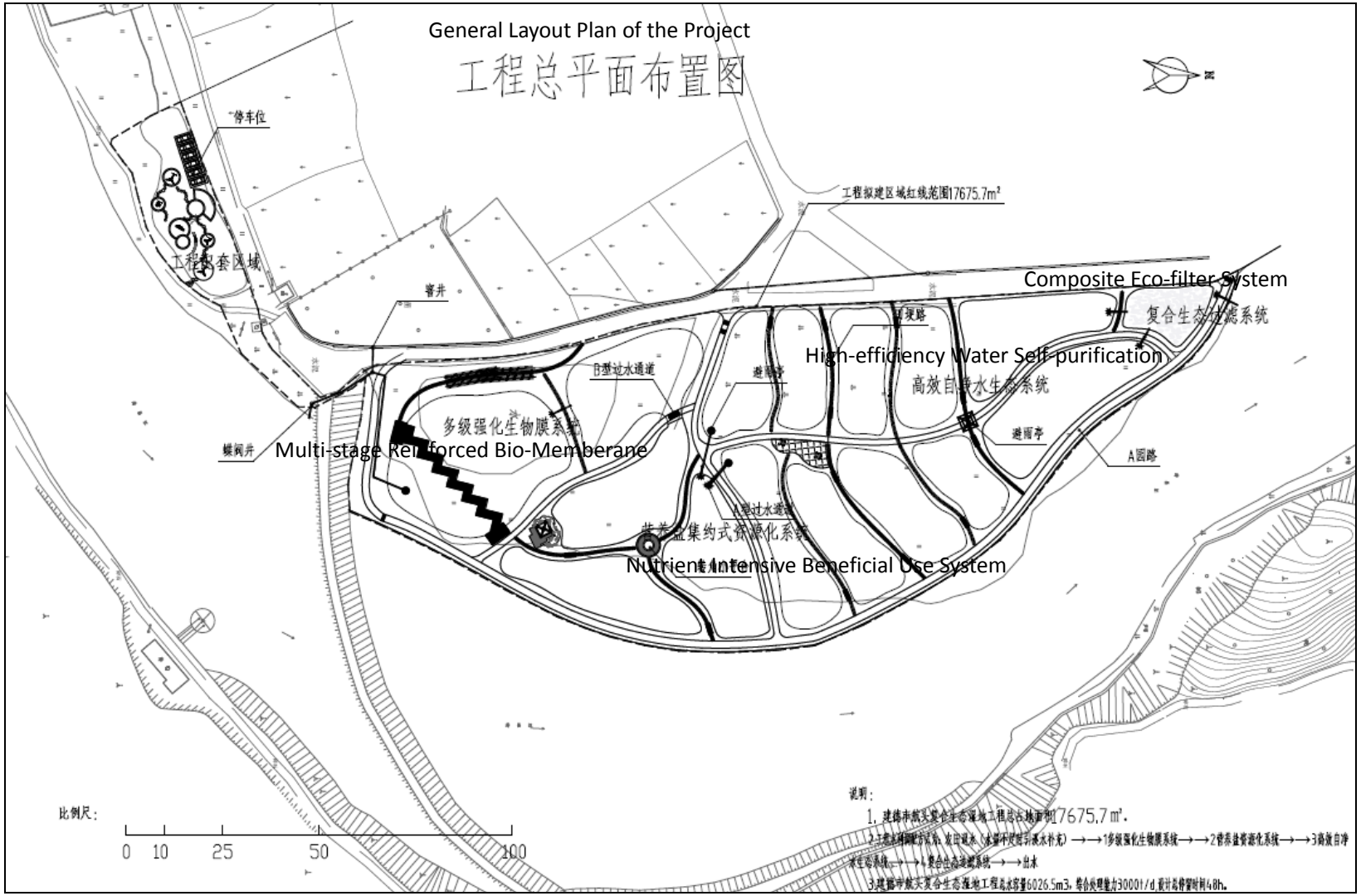


Figure 5.2-1: General layout plan of Hangtou Composite Wetland in Jiande City

6. Environmental risk analysis and mitigation measures

6.1 Identification of environmental risks

Pollution impact analysis conducted based on the engineering characteristics of the various subprojects shows that the main subproject likely to generate environmental risks is Jiande City Shouchang WWTP. The key environmental risks include:

(1) massive direct discharge of untreated sewage may occur in case of any events of emergency, such as power outages, natural disasters and equipment failure ;

(2) Environmental risks may arise from leakage of sewage into storm water pipe and discharge of untreated sewage into surface water caused by broken sewage pipes;

(3) Personal safety risks may arise from the accumulation of harmful gas in the course of sewage pipeline maintenance.

6.2 Analysis of potential impacts from WWTP accidents with environmental risks

6.2.1 Emergency accidents

Improper equipment maintenance or quality problem may cause failure of equipment and facilities and reduction of treatment efficiency, or even cause direct discharge of untreated sewage. Some irresistible external causes, such as power outage, natural disaster might result in equipment failure and direct discharge of untreated sewage. This is the worst case of abnormal operation. The sewage will be discharged into surface water through bypass if power outage causes facility failure.

6.2.1.1 Water quality prediction model

The effluent of Shouchang WWTP will be discharged into Shouchang River. Since there is no centralized intake downstream of Shouchang River as the pollutant recipient of the Project, prediction is conducted using the S-P mode recommended in the Technical Guideline of Environmental Impact Assessment-Surface Water (HJ/T2.3-93). The impact of discharge of untreated sewage (i.e. at the designed influent concentration of the WWTP) was also predicted in the scenario of accidental discharge.

According to the prediction results, in the event of emergency discharge by Shouchang WWTP (predicted based on the tail water discharge capacity of 1000m3/d after expansion), the CODcr concentration at a site 50m downstream of the outlet is 39.3596mg/L and exceeds the Class III standard specified in the Surface Water Environment Quality Standard (GB3838-2002) and the water quality at a site 13.3km from the WWTP meets the Class III standard specified in the Surface Water

Environment Quality Standard (GB3838-2002). Therefore, a 13.3km long CODcr pollution belt will be generated in the event of emergency discharge. Within the 13.3km long section downstream of the outlet, there are no sensitive sites such as tap water intake under the Project.

According to the prediction results, in the event of emergency discharge by Shouchang WWTP (predicted based on the tail water discharge capacity of 1000m3/d after expansion), the NH_3-N concentration at a site 50m downstream of the outlet is 2.5796mg/L and exceeds the Class III standard specified in the Surface Water Environment Quality Standard (GB3838-2002) and that at a site 14.9km from the WWTP is 1.9992mg/L and meets the Class III standard specified in the Surface Water Environment Quality Standard (GB3838-2002). Therefore, a 14.9km long NH_3-N pollution belt will be generated in the event of emergency discharge. Within the 14.9km long section downstream of the outlet, there are no sensitive sites such as tap water intake under the Project.

It can thus be seen that the water quality of Shouchang River will be affected to a certain extent or even exceeds the standard at some downstream sections in the case of accidental discharge. Therefore, it is necessary to strengthen WWTP operation and management to prevent accidental discharge.

6.2.2 Risks of sewage pipeline leakage

In case of any leakage of sewage pipelines, collection of sewage will become unlikely. Untreated sewage will cause pollution to surface water environment. Sewage leaked from pipelines and permeated into the ground may result in pollution of not only the soil and environment in the surrounding areas and also negative impacts on ground water quality. Based on the status of operation of the existing stormwater and sewage pipelines, the probability of pipeline leakage is not high unless in the case of uncivilized construction and human damages.

6.2.3 Staff health risks from failures of WWTP system

As the WWTP system failure is always unexpected, it will cause significant damage to the working staff and endanger their life. When environmental accident occurs, the first thing affected is the health and safety of the staff in the wastewater treatment plant.

6.2.3.1 Analysis on poisoning risks and impacts caused by toxic gases

When an accident occurs in a particular structure of the sewage treatment system, maintenance workers need to enter the enclosed space, such as sewer, water collection well and wastewater tank, to repair the system immediately. In such places, high-concentration toxic gases, such as hydrogen sulfide, methane, carbon dioxide, etc. are likely to occur and accumulate. If no protective measures are taken during maintenance, the workers might inhale the toxic gases due to poor ventilation, which might result in dizziness, poor breath and other symptoms or even casualty.

According to relevant data, there have been dozens of accidents with threats personal safety in more than 20 cities caused by exposure to toxic gases in the sewers and combined pipelines or fire explosions resulted from flammable methane in the

pipelines. Therefore, it is essential for the WWTP operators to take occupational safety measures to prevent damages from toxic gases. The most effective way to prevent poisoning is to take ventilation measures to disperse the poisonous and harmful gases completely and make the working space full of fresh air. If adequate ventilation is not possible, the dangerous space should be avoided and effective protective equipment must be worn during operation. Protective equipment includes gas marks, air supply masks and so on. Testing devices needed include test paper and gas detector, etc.

6.2.3.2 Analysis on health risks and impacts caused by pathogens

The wastewater and sludge contain a variety of pathogens and parasite eggs. The fog and water on the treatment facilities can spread bacteria and viruses. The WWTP workers exposed to the micro-organisms in the sewage and sludge have the risk of infection through direct inhalation of gas or caused by droplets on the skin or clothing. This kind of gas can be found at aeration tank, effluent weir, irrigation outlet, blower room, dewatering workshop and other places. In places where water vapor is highly condensed, the gauze-type respirator can reduce the inhalation of toxic substances. This type of environmental risk mainly results diseases caused by direct infection of pathogen. People outside of the plant is unlikely to be infected, but their heath will be also endangered by spread of disease due to poor control of the condition of infected workers..

6.3 Risk mitigation measures

6.3.1 Equipment safety assurance measures

The failure of pump, valve, electrical apparatus and other instrument used in the treatment facilities and system will reduce the treatment efficiency or even cause outage of the whole WWTP. This is a kind of potential risk. The emergency response actions in this regard include:

(1) A redundancy equivalent to 0.5 times of the maximum capacity is considered in the process design for the WWTP system so as to have a buffer in the event of accidents; Compatible processing equipment (reflux pump, reflow pipes, valves and meters) should be provided so that the system buffer and backflow equipment can be started to retreat the unacceptable effluent to the specified discharge standard in case of equipment failure affecting the normal operation of the system.

(2) For the vulnerable equipment, multiple standby equipment and adequate spare parts should be assured on site. All key mechanical and electrical equipment should be configured in such a way that one standby is available.

(3) Use high-quality equipment. All machinery, electrical appliances, instruments and other equipment selected should have good quality, low failure rate, good durability and be easy to maintain and repair.

(4) During operation, the operators shall strictly follow the rules and regulations of facility operation and conduct regular inspection and timely maintenance to reduce equipment failure rate.

(5) The electrical equipment should be operated in compliance with the grounding protection regulation and be equipped with automatic tripping circuit. The main equipment shall be operated under the surveillance of a computer data monitoring system and be capable of giving alarms and recording the location, time and features of accident so that the workers can organize maintenance promptly. All electrical equipment shall be installed with a protection system according to the relevant safety requirements.

(6) Dual-circuit power supply shall be used to assure normal operation of the power supply facilities and lines.

6.3.2 Protection measures for abnormal wastewater discharge

1. Emergency responses to unstable water amount caused by various factors shall be fully considered in the design to alleviate the unfavorable situations.

2. Technical management measures during WWTP operation include:

(1) Establishing a WWTP operation and management responsibility system;

(2) Organizing trainings for the management and technical staff and establishing technical appraisal records so that those failing the technical appraisal are not allowed to be on duty;

(3) Employing experienced professional and technical staff to be responsible for the technical management in the WWTP;

(4) Organizing domestic and abroad trainings for the technical staff;

(5) Strengthening inspection of pipelines and detecting and resolving problems in a timely manner;

(6) Strengthening maintenance and management of equipment and facilities. Key equipment shall have standby and dual power supply.

6.3.3 Emergency responses to unexpected wastewater discharge accident

The following measures shall be taken in the event of unexpected wastewater discharge accident in a WWTP:

(1) Ensuring the normal operation of grid and grit chamber so that the SS and COD in the influent can be reduced to certain extent;

(2) In the event of irresistible external causes, such as blackout of dual power supply and natural disaster that will lead to discharge of untreated wastewater, the wastewater shall be stored in the emergency tank and treated once the wastewater treatment system is repaired to ensure the safety of the water body;

(3) In the event of and during the handling of an accident, warning signs shall be erected in the waters near the outfall to remind all parties concerned to take precautionary measures.

6.3.4 Prevention and control measures for risks of pipeline leakage

（1） The local conditions shall be considered to select proper pipe material and ensure pipeline quality and service life. The drainage foundation shall meet the mechanical design requirements and be constructed in strict accordance with the detailed design of width, thickness and strengths of foundation to assure good construction quality.

（2） Careful inspection shall be conducted before pipeline installation. All pipe materials shall be carefully checked to avoid any cracks and leakage. On the other hand, it is necessary to check the center line and the edge of the foundation with the drawings and ensure the size and strength of all bed courses satisfy the requirement. It is also necessary to check whether the manhole location, spacing and concrete strength and the preparation of anti-seepage mortar can comply with the national standard.

（3） During pipeline installation, the cement mortar shall be prepared according to the stipulated mix design. Protruded seams often occur at the pipeline connections due to squeezing during installation. If not handled in a timely manner, the water flow profile and velocity may be affected and debris accumulation and pipeline congestion may occur.

（4） The pipe base concrete and plaster mortar must reach the required strength before trench backfill. Action should be taken to avoid gravel impacts on the pipelines. Large crushed stone and hard objects should not be contained in the gravel and aggregates. Backfill and compaction should be conducted simultaneously on both sides of the pipeline and lay-by-layer on top of the pipeline so as to form an integral load-carrying mass to spread the unloading force at the pipe crest to protect the pipelines.

（5） The IA shall establish a complete system of pipeline monitoring and management during operation, and clear the pipe network and replace the damaged pipes in time to avoid water pollution caused by pipeline leakage.

6.3.5 Personal safety protection measures

（1） The operation and management staff shall receive safety education before formal operation. The plant shall establish a set of safety operation procedures and management system. These procedures shall be strictly enforced and the performance shall be inspected during operation.

（2） The requirements of water supply and drainage, heating and ventilation, lighting and health shall be considered in the design. Air conditioning facilities shall be provided in the places involving lengthy operation. The enclosed structure or work place with poor ventilation shall have mechanical ventilation facilities.

（3） Life jacket, life buoy, safety belt and safety helmets and other personal protective supplies shall be provided on site. The workers who have to enter the pipeline for inspection or operation shall wear the necessary protective devices, such as safety suits, gas masks, air masks, gas detection equipment, test strips, etc., to prevent poisoning and at least two persons present.

（4） The walkway of tanks shall have handrails and lighting facilities to ensure pedestrian’s safety.

（5） All electrical equipment shall have protection system that meet the relevant safety requirements and grounding protection shall be properly executed for high-voltage equipment.

（6） The hazardous parts of machinery and equipment, such as belt, gear and wheel shall be installed with protective device.

（7） It is necessary to strengthen safety management and establish a responsibility system. All dangerous areas shall have warning signs at visible positions. Platforms with a height of more than 1.2 m shall have fences. Ventilation shall be provided in the places where toxic and harmful gas might gather. The operation and maintenance unit shall set up a safety and labor protection department to be responsible for safety protection and labor protection.

（8） Sanitation room (toilets, lavatories, dressing rooms, etc.) shall be provided for the sake of actual needs and convenience. In addition to providing ventilation in the places with poor working condition and shading for the outdoor work, lounge shall also be provided. There shall be centralized bathrooms in the plant.

（9） The staff directly exposed to sludge, wastewater or domestic solid waste shall take physical examination and be vaccinated on a regular basis (such as hepatitis A, hepatitis B, etc.).

6.4 Environmental Risk Emergency Response Plan

6.4.1 General requirements

According to the results of project identification and the national requirements on development of emergency response plans against environmental accidents, Shouchang WWTP is the only component of the Project requiring the development of an Environmental Risk Emergency Response Plan. According to relevant regulations, this emergency response plan will be developed and implemented by Shouchang WWTP, which is also required to be submitted to and filed at the local EPB.

Prevention is a fundamental measure for preventing accidents. However, emergence response measures should be available because proper responses to an accident concern the scope and magnitude of impacts and losses from an accident. Enterprises are required to strictly follow the “Guidelines on Development of Emergency Response Plans for Environmental Accidents in Zhejiang Province” in developing their emergency response plans for environmental accidents. This EIA has presented a framework of such plans according to the requirements included in the “Guidelines on Development of Emergency Response Plans for Environmental Accidents in Zhejiang Province” for reference. See Table 6.4-1 for the outlines of contents required to be included in an emergency response plan that the IAs may take for reference.

Table 6.4-1: Emergency Response Plan for Accidents with Environmental Risks

SN	Item	Contents and Requirements
1	General	Mainly including objectives, rationale, applicability, incident rating, work principles and emergency response plan system
2	Basic information	Mainly including the address, economic nature, number of staff and affiliation of producers and operators and the destination of discharge and measures for management of wastewater, solid wastes and exhaust gas; location of discharge outlets; Survey of local environment includes geographical location, hydrological characteristics, meteorological and climatic characteristics, terrain and topography and the conditions of environmental objects and environmentally sensitive sites in the neighborhood.
3	Identification of environmental risks	Identifying the names, current quantities and possible maximum quantities and physical and chemical properties of the enterprise's production materials, fuels, products, intermediate products, byproducts, catalysts, auxiliary production materials and wastewater, solid wastes and exhaust gases as well as their hazards to human, animal and plants; identifying the relevant standards and limits of the various substances; identifying the enterprise's production processes, wastewater discharge destinations, safety and production control measures, environmental risk prevention and control measures and the implementation status of EIA and the other approved environmental risk prevention and control measures, environmental risk emergency response management and fundamental environmental management; identifying the environmental receptors around the enterprise.
4	Emergency response capacity development	Evaluating the status of emergency response resources available at the earliest possible time, including emergency response staff and equipment, as well as the emergency response capability of the enterprise and determining, based on the results of evaluation, the types of essential emergency response resources and equipment required for the enterprise.
5	Organization and responsibilities	Determining the organizational structure of emergency response, which usually comprises of emergency response leading group and emergency response implementation group and identifying the on-site supervisor based on the rating of different incidents to be responsible for commanding the emergency response work and implementing the respective measures; specifying the duties, scope of coordination and management and key problems to address and specific steps of operation related to emergency response of the various job positions in the emergency response system.
6	Prevention, early warning and information reporting	The enterprises should revise the comprehensive emergency response plans in a timely manner based on the actual situation of their production activities and develop special emergency response plans for new risks and on-site response plans for key job positions based on the changes of environmental hazard sources and production technologies; the enterprises may, in association with their own actual circumstances as well as the work arrangement included in the "Periodical Inspection and Reporting System for Potential Environmental Safety Hazards in Zhejiang Province", carry out daily inspections over the production equipment and disposal of wastewater, solid wastes and exhaust gases and monthly inspections over their own environmental risk prevention and control measures and the condition of environmental safety so that any existing and potential environmental safety

Table 6.4-1: Emergency Response Plan for Accidents with Environmental Risks

SN	Item	Contents and Requirements
		hazards are corrected in time. Environmental risk inspection reports should be developed after the monthly self-inspections are carried out and management records for environmental safety risk sources should be produced; emergency monitoring and preparation work should be implemented with specific targets based on the level of emergency response capability and the classification of possible emergency environmental incidents; the contents, rating, way of reporting and content of reporting of the early warning messages and other contents of the early warning procedure should be determined.
7	Emergency response	Rating the corresponding emergency responses based on the level of emergency and the degree of hazards involved in the respective incident; identifying and presenting in the form of flowchart the procedures and steps for emergency mobilization of the emergency response commanding body, allocation of the emergency response resources, emergency rescue and extended emergency response; identifying the conditions and procedures for terminating the emergency response actions based on the specific situation of the environmental emergencies of different types and different levels as well as the contents of emergency response actions and identifying follow-up plans for continuous environmental monitoring and evaluation after the emergency state is terminated.
8	Information disclosure	Identifying the department, responsible person and procedure and principles for disclosing information on the respective incidents to the media and the public.
9	Post-accident actions	Identifying plans for handling pollutants and compensating for the environmental damages caused by the incident; cooperating with the concerned authorities to evaluate the long-term environmental impacts involved in the emergency accidents; following the requirements of the local environmental protection authorities to identify the contents and procedures for environmental restoration and reconstruction work.
10	Safeguard measures	Developing operable plans of medical treatment to the injured based on the types and rating of the incidents as well as the availability and capability of the local disease control and medical treatment bodies; developing emergency traffic and security plans and determining the detailed standards and measures for mobilizing the emergency response teams. Identifying the responsible entities and emergency response tasks, determining external dependent agencies and developing measures against the deficiencies identified in the emergency response competence evaluation; identifying the contact information of organizations and personnel related to the emergency response work and providing backup plans; setting up a sound emergency response telecommunication system and auxiliary facilities to assure smooth information exchange in emergency; developing other related safeguard measures based on the needs of emergency response.
11	Plan management	Describing the plan, methods and requirements of staff training on emergency responses and identifying the activities of advertisement, education and information disclosure for the residents and organizations likely to be affected; identifying the ways, scope, frequency, contents of rehearsal of the emergency response plans for different environments and the requirements on rehearsal evaluation and summary; organizing at the appropriate time the

Table 6.4-1: Emergency Response Plan for Accidents with Environmental Risks

SN	Item	Contents and Requirements
		relevant organizations to observe and exchange ideas on the rehearsal; identifying the basic requirements, deadlines and methods of evaluating, revising, amending and improving the emergency response plans to realize continual improvement of the enterprise's environmental emergency response system; identifying the method, deadline, competent department of emergency response plan filing and the catalog of documents to be filed; reviewing the integrity and effectiveness of the emergency response plan and having the key responsible person signing the plan for accountability confirmation and issuing the plan for implementation.

6.4.2 Emergency response agency

The emergency response unit of a WWTP mainly comprises of the leading group office and the emergency response teams of different disciplines, including rescue team, liaison team, logistics team and fleet team. The roles and responsibilities of each team are as follows and shown in Figure 6-1.

1. The leading group is responsible for i) developing and implementing emergency response plans; ii) guiding and coordinating with external agencies.
2. The leading group office will assist the leading group in task allocation, supervision and inspection.
3. The rescue team is responsible for handling accidents and repair equipment under the guidance of the leading group.
4. The liaison team is responsible for communication and coordination with the rescue team, logistic team and vehicle team.
5. The logistics team is responsible for assisting in the rescue of poisoned victims and taking appropriate first aid measures, hospitalization, nursing the poisoning victims and mobilizing rescue resources.
6. The vehicle team is responsible for arranging vehicles and sending the poisoned victims to hospital and delivering rescue materials, etc.

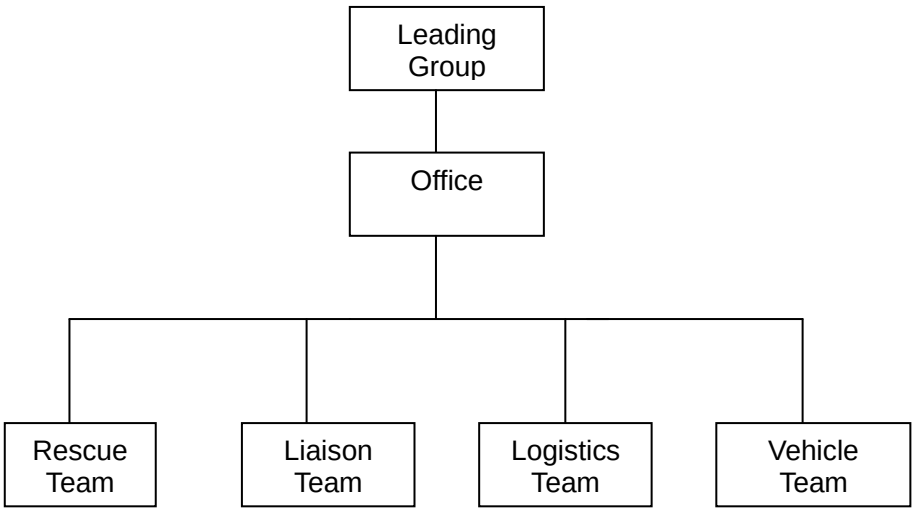


Figure 6-1: Emergency Response Mechanism of Wastewater Treatment Plants

6.5 Environmental health hazards and protective measures

6.5.1 Shouchang WWTP

Shouchang WWTP has about 50 employees, who, in their operating environment, are highly exposed to sewage or sludge containing a variety of pathogens and parasites eggs. Mist and moisture on the wastewater treatment facilities can spread bacteria and viruses and the WWTP workers are exposed to micro-organisms in sewage and sludge and may be infected directly through inhalation or indirectly through water droplets on the skin or clothing. Such gas will be condensed in aeration tanks, effluent weir, blower room and dehydration room. In areas where water vapor is highly concentrated, tulle respirators can help reduce the inhalation of toxic substances. The environmental impact is mainly reflected in the possibility of diseases resulting from direct infection of the workers by the pathogen. The probability of direct infection and getting ill for people outside the plant premises is very small. However, the health of people outside the plant premises may be threatened if diseases of the infected workers cannot be effectively controlled. Therefore, the following measures should be taken to protect the health of employees:

1. Appropriate protective clothing, gloves, respirators should be provided for the workers; antiskid shoes should be provided for transportation workers and hard-sole safety boots should be provided for all workers to prevent feet injuries. Workers around large noise equipment must be provided with noise protection devices. Workers operating at heavy lifting equipment, fork lifts, cranes and loading and unloading sites should be provided with safety helmets. Guardrails should be installed around all processing tankers and water pools. Workers operating within the guardrails are required to use lifelines and personal floating devices and it should be assured that relevant life-saving devices are available in the event of any accidents.

2. Design and material specifications allowing reduction of exposure to hazards should be designed and developed (e.g. ventilation, air-conditioning, enclosed conveyor belt, low-load and classified height, antiskid floor, staircase and corridor safety guardrails, splash protection and leakage prevention, noise control, dust prevention, gas alarm system, fire alarm and control system and emergency evacuation facilities, etc.).

3. Shower and dressing zone should be provided for workers' convenience and working clothing laundry service should be provided. Personnel working at the WWTP should be encouraged to wash hands frequently.

4. Plans for access to enclosed spaces complying with the national requirements and internationally accredited standards should be developed for any construction works implemented in the enclosed treatment areas. Ventilation before access is required

and personal gas detectors should be carried. Valves leading to the processing tank should locked to prevent unexpected spillage in the process of maintenance.

5. Eating, smoking and drinking outside the designated areas are banned.

6. Workers should be isolated from bacterial spread channels by means of mechanical flip (e.g. using tractors or front-end loaders having a driver cabinet equipped with enclosed air-conditioning or ventilating system) or artificial flip, in which case ventilation system is preferred.

7. Suitable personal protection clothing and devices should be provided and used as a mandatory requirement to prevent contact with wastewater (e.g. rubber gloves, skirts and boots, etc.). In particular, timely medical care should be provided and timely bandaging should be provided in case of any skin injuries, e.g. cuts and scratches, to prevent possible infection. Protective clothing and glasses should be used to prevent possible contact of splashes.

8. Codes of safety operation and personal health should be incorporated into the safety training plan of workers to reduce exposure to pathogens and bacteria media.

9. The workers should be provided with immunity (e.g. Hepatitis B and tetanus) and health monitoring, including periodical health examination. It is recommended that personnel with asthma, diabetes or immune system dysfunction are not allowed to work in a WWTP.

10. Periodical air samples should be taken in the operation zone to check air quality.

11. A duty shift system should be implemented for staff of different departments in the WWTP to reduce inhalation of hazardous gas in the air.

6.5.2 WTP

The following measures should be taken to reduce and control accidents and injuries inside the water supply facilities:

1. Appropriate protective clothing, gloves, respirators should be provided for the workers; antiskid shoes should be provided for transportation workers and hard-sole safety boots should be provided for all workers to prevent feet injuries. Workers around large noise equipment must be provided with noise protection devices. Workers operating at heavy lifting equipment, fork lifts, cranes and loading and unloading sites should be provided with safety helmets. Guardrails should be installed around all processing tankers and water pools. Workers operating within the guardrails are required to use lifelines and personal floating devices and it should be assured that relevant life-saving devices are available in the event of any accidents.

2. Sodium hypochlorite should be stored in a cool, dry and dark condition for no longer than one month in containers made of anti-corrosion materials.

3. Plans for access to enclosed spaces complying with the national requirements and internationally accredited standards should be developed for any construction works

implemented in the enclosed treatment areas. Ventilation before access is required and personal gas detectors should be carried. Valves leading to the processing tank should locked to prevent unexpected spillage in the process of maintenance.

4. Training on safety treatment specification and emergency response procedures should be provided for operators of the chlorine activities. Suitable personal protection devices should be provided and training should be organized on correct use and maintenance of equipment.

7. LAR social impacts and mitigation measures

7.1 Project land acquisition

Here summarized as follows is the information of LAR under the Project based on the Resettlement Plan for the proposed World Bank Loan Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project prepared by Hohai University in November, 2017.

The Project involves a permanent land acquisition of 3236.24 mu, including 1411.09 mu for Chun'an County and 1825.15mu for Jiande City and 238.4mu as permanent land acquisition (including 39.4mu for Chun'an County and 199mu for Jiande City) and 2997.84mu as temporary land occupation (including 1371.69mu for Chun'an County and 1626.15mu for Jiande City).

The Project will affect a total population of 12434 persons from 3447 households, including 1585 households and 6685 persons for Chun'an County (including 71 households and 272 persons affected by permanent land acquisition and 1514 households and 6413 persons affected by temporary land occupation) and 1862 households and 5749 persons for Jiande City (including 63 households and 196 persons affected by permanent land acquisition and 1799 households and 5553 persons affected by temporary land occupation).

Table 7.1-1 Impacts of Land Acquisition and Temporary Land Occupation of the Project

	Permanent land acquisition			Temporary land occupation		
	No. of HHs	No. of persons	Area	No. of HHs	No. of persons	Area
Chun'an	71	272	39.4	1514	6413	1371.69
Jiande	63	196	199	1799	5553	1626.15
Total	134	468	238.4	3313	11966	2997.84

The Project will involve a permanent land acquisition of 238.4mu, affecting 468 persons of 134 households in 22 administrative villages, including 39.4mu in Chun'an County affecting 272 persons of 71 households in 12 administrative villages and 199mu in Jiande City affecting 196 persons of 63 households. Results of survey indicate that, in the 12 administrative villages subject to land acquisition impacts in Chun'an County, the percentage of arable land affected on average is 0.03% to 2.825. The rural collectively-owned land to be acquired mainly comprises of forest land and garden land and the income of the affected villages is mainly non-agricultural income. The situation in Jiande is similar to Chun'an County. In general, the Project produces very insignificant impacts of land acquisition.

The Project will involve a temporary land occupation of 2997.84mu, affecting 12434 persons of 3447 households, including 1371.69mu in Chun'an County

affecting 6413 persons of 1514 households and 1626.15mu in Jiande City affecting 5749 persons of 1862 households.

7.2 Measures for mitigating social impacts under the Project

Land acquisition and resettlement represents the most significant social impact under the Project. in order to avoid or minimize land acquisition and resettlement, the PMO will conduct full consultation with the affected villages and persons on project siting, compensation method and standard. Measures, such as optimizing the project design, strengthening project management, improving construction technology and public consultation and participation have been taken to minimize the adverse impact of land acquisition and resettlement on local residents.

In addition to the measures to reduce land acquisition and resettlement during feasibility study and preliminary design stage, compensation standards for permanent land acquisition, temporary land occupation and young crops are determined based on the Notice on the Outcomes of Benchmark Land Price Updating in Chun'an County (CG Circular No. [2016]10) and "Notice on Renewal of the Composite Price for Acquisition of Collectively-owned Land Parcels in Chun'an County" and the Notice on Renewal of the Composite Price for Acquisition of Collectively-owned Land Parcels in Jiande City" (JG Letter No. [2014]119) and other relevant policies and laws and regulations. Resettlement is conducted on the basis of consultation with local governments and affected persons and with reference to the current practices. Livelihood restoration program is developed for the farmers whose farmland will be acquired. Compensation and resettlement plan are developed for the rural residential relocated households, affected ground attachments and public utilities and affected vulnerable groups. Livelihood restoration plan is also developed for women to protect their right and interests. The specific compensation standards and measures are presented in the Resettlement Plan for the World Bank Loan Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project. The social impacts and compensation measures are summarized in Table 7.2-1.

7.3 Public participation and consultation

During preparation of the project plan and the resettlement plan, the resettlement consultant team identified all the stakeholders and conducted various interviews, meetings and consultations on the land acquisition and compensation policy. The stakeholders of the Project can be divided into three different categories, i.e. governmental departments, IA/contractor and affected persons. The resettlement consultant team conducted equal consultations with the affected persons in the project area to inform them of all aspects of the Project. The stakeholders in the project area have understood the project information through public consultation and expressed their support to the Project. Meanwhile, concerns were also expressed over possible reduction of income and temporary impacts from the construction activities on their livelihood.

In order to properly and promptly address the problems and demands of the

affected persons, public consultation will continue before the commencement of the project construction and implementation of the resettlement plan so that all the problems may be resolved. The implementation agencies shall organize resettlement workshops/meetings appropriately. For details, please refer to Chapter 9 for arrangements of public consultation during the implementation of the Resettlement Plan (RP).

Table 7.2-1: Summary of LAR Impacts and Compensation Measures

Area	Type of impact	Degree of impact	Eligible beneficiary of compensation	Compensation policy and standard	Responsible agency
Chun'an County	Permanent land acquisition	Permanent acquisition of 39.4mu rural collectively-owned land, including 0.9mu arable land, 19.57mu forest land, 18.05mu garden land and 0.87mu land of other types and affecting 272 persons from 71 households.	All affected HH will receive cash compensation. Compensation for collective land will be shared equally by the production group. The tenant will be compensated at equivalent value as the land attachments.	LAR compensation shall be made based on the local comprehensive price in accordance with the Notice on "Outcomes of Updating of the Benchmark Land Prices in Chun'an County" (ChunGovCircular No. [2016]10) and the Notice on Renewal of the Local Comprehensive Price for Acquisition of Collectively-owned Land in Chun'an County". Comprehensive compensation for arable land and construction land: CNY 40000/mu for Pingmen Township, Zhongzhou Town and Wangfu Township; CNY 44000/mu for the other towns and townships; no comprehensive cost is used for forest land and unused land, which are compensated at a price of CNY 19000/mu. The comprehensive compensation shall be paid to the rural collective economic organizations and the farmers to be resettled due to land acquisition and used for production activities and livelihood restoration of farmers; compensation on ground attachments shall be paid; opportunities of training and employment shall be provided; actions shall be taken to make sure that the income of the affected persons is not reduced; pension shall be provided to land-loss farmers if the required conditions are met.	Chun'an County Qiandao Lake Construction Group Co., Ltd., Chun'an County Land and Resources Bureau, town and township governments and land and resources bureau
	Temporary land occupation	Temporary occupation of 1371.69mu collectively-owned land and affecting 6413 persons from 1514 households.	All affected HH will receive cash compensation. Compensation for collective land will be shared equally by the production group. The tenant will be compensated at equivalent value as the land attachments.	Young crop compensation: CNY 1000/mu for arable land in general; upon the completion of the construction works, the project unit should be responsible for restoring the occupied land to the original standard and original scale. The comprehensive compensation shall be paid to the rural collective economic organizations and the farmers to be resettled due to land acquisition and used for production activities and livelihood restoration of farmers.	Chun'an County Qiandao Lake Construction Group Co., Ltd., Chun'an County Land and Resources Bureau, town and township governments and land and resources bureau, IAs
	Special facilities	13 tombs, 29.81mu	All APs or owners shall be equally compensated.	The APs will get compensated at a rate of CNY 10 for per tea tree, CNY 6.5 to 338 for per Carya cathayensis and CNY 18 to 1800 per osmanthus fragrans	Chun'an County

Table 7.2-1: Summary of LAR Impacts and Compensation Measures

Area	Type of impact	Degree of impact	Eligible beneficiary of compensation	Compensation policy and standard	Responsible agency
	and ground attachments	tea trees; 252 Carya cathayensis and 1982 osmanthus fragrans.		and CNY 1800 per tomb. The special facilities shall be fully compensated at the replacement price. The affected infrastructure and ground attachments shall be compensated by the project unit to the ownership unit at the replacement price and reconstructed by the ownership unit or the project unit against the original standard and the original scale.	Qiandao Lake Construction Group Co., Ltd., Chun'an County Land and Resources Bureau, town and township governments and land and resources bureau
	Vulnerable groups	The Project involves no vulnerable groups.			
	Women	Affected women	Affected women	Create employment and livelihood opportunities for women. Ensure women participation. The local government and resettlement office shall ensure the female has the same rights as male in terms of land property. Gender discrimination shall be eliminated to encourage women to create their own business. The affected women have access to information related to land acquisition and assured participation in the land acquisition and public participation process; the compensation agreement must be signed by both the husband and wife; Technical training should be provided to the affected women employees with priority; In the process of project implementation, jobs in the catering and temporary jobs should be provided to affected women with priority to assure their income restoration.	Chun'an County Qiandao Lake Construction Group Co., Ltd., Chun'an County Land and Resources Bureau, town and township governments and land and resources bureau
Jiande City	Permanent land acquisition	Permanent acquisition of 199mu collectively-owned	All affected HH will receive cash compensation. Compensation for collective land will be shared equally by the	Compensation standard: CNY 24,000/mu for forest land; The comprehensive compensation shall be paid to the rural collective economic organizations and the farmers to be resettled due to land acquisition and used for production activities and livelihood restoration of	Jiande City Xinshui Construction Co., Ltd.,

Table 7.2-1: Summary of LAR Impacts and Compensation Measures

Area	Type of impact	Degree of impact	Eligible beneficiary of compensation	Compensation policy and standard	Responsible agency
		forest land and affecting 196 persons from 63 households.	production group. The tenant will be compensated at equivalent value as the land attachments.	farmers; compensation on ground attachments shall be paid; opportunities of training and employment shall be provided; actions shall be taken to make sure that the income of the affected persons is not reduced; pension shall be provided to land-loss farmers if the required conditions are met.	Jiande City Land and Resources Bureau, town and township governments and land and resources bureau
	Temporary land occupation	Temporary occupation of 1626.15 mu land, including 5mu state-owned land and 1621.15mu collectively-owned land and affecting 5553 persons from 1799 households.	All affected HH will receive cash compensation. Compensation for collective land will be shared equally by the production group. The tenant will be compensated at equivalent value as the land attachments.	Temporary occupation of state-owned land under the Project shall be free of land occupation compensation while the demolished ground attachments shall be compensated at the replacement price or restored by the project unit against the original standard and the original scale. Young crop compensation: CNY 1000/mu for arable land in general; upon the completion of the construction works, the project unit should be responsible for restoring the occupied land to the original standard and original scale. Temporary use of state-owned land shall be approved by the land administration authority of the respective city/county. If the temporary use of land is located in the planned urban area, a consent shall be obtained from the concerned urban planning administration authority. The land user shall enter into a contract of temporary land use with the concerned land administration authority based on the land ownership and pay the compensation for temporary land use as agreed in the contract and shall not build any permanent buildings. Upon the expiry of the temporary land use contract, the temporary land use organizations and individuals shall be responsible for restoring the land to its original state and, where such restoration is unlikely and losses are resulted, the temporary land use organizations and individuals shall take the corresponding responsibilities of economic compensation. The project construction units shall pay compensation to the land user based on the temporary land occupation compensation policy developed by the local government and pay reclamation fee to the land owners to enable restoration of cultivation; the young crop compensation shall be paid to the land contractors.	Jiande City Xinshui Construction Co., Ltd., Jiande City Land and Resources Bureau, town and township governments and land and resources bureau
	Special facilities	Water ditches,	All APs or owners shall be equally compensated.	The APs will get compensated at a rate of CNY 36/m^2 for water ditches, CNY 200/m for drainage pipes and CNY 5 per well and CNY 200 per fruit tree.	Jiande City Xinshui

Table 7.2-1: Summary of LAR Impacts and Compensation Measures

Area	Type of impact	Degree of impact	Eligible beneficiary of compensation	Compensation policy and standard	Responsible agency
	and ground attachments	drainage pipes, wells, scattered fruit trees, etc.; The Project involves no special facilities.		The affected infrastructure and ground attachments shall be compensated by the project unit to the ownership unit at the replacement price and reconstructed by the ownership unit or the project unit against the original standard and the original scale.	Construction Co., Ltd., Jiande City Land and Resources Bureau, town and township governments and land and resources bureau
	Vulnerable group	The Project involves no vulnerable groups.			
	Women	97 persons	Affected women	Create employment and livelihood opportunities for women. Ensure women participation.) The local government and resettlement office shall ensure the female has the same rights as male in terms of land property.) Gender discrimination shall be eliminated to encourage women to create their own business.) The affected women have access to information related to land acquisition and assured participation in the land acquisition and public participation process; the compensation agreement must be signed by both the husband and wife;) Technical training should be provided to the affected women employees with priority;) In the process of project implementation, jobs in the catering and temporary jobs should be provided to affected women with priority to assure their income restoration.	Jiande City Xinshui Construction Co., Ltd., Jiande City Land and Resources Bureau, town and township governments and land and resources bureau

7.4 Resettlement agencies

In order to assure smooth implementation of the Project, Zhejiang Province World Bank Loan Project Leading Group was established and Hohai University is responsible for providing guidance on the development of the Resettlement Plan (RP). In each project county/city, the county/city PMOs are responsible for developing the RPs, implementing and managing and internal monitoring of the land acquisition and resettlement work for the respective subproject. The Land and Resources Bureau is responsible for implementing the land acquisition and resettlement process for rural collectively-owned land. Table 7.4-1 and Table 7.4-2 show details of the project resettlement organizations of Chun'an County and Jiande City.

Table 7.4-1: Resettlement agencies and responsibilities in Chun'an County

Key responsibilities	EA	Specific departments/towns and townships	Staffing
Comprehensive management and coordination	Chun'an County Land and Resources Bureau	LAR office	
Implementation	Town and township governments and land and resources divisions	Wangfu Township	Cheng Honglai
		Weiping Town	Zhang Weibin
		Zhongzhou Town	Jiang Xiangyong
		Pingmen Township	Wang Daoping
		Fengshuling Town	Yu Qingping
		Zitong Town	Xiao Jinping

Table 7.4-2: Resettlement agencies and responsibilities in Jiande City

SN	Agency	Staffing	Contact information
1	Jiande City DRC	Liu Ying	13735838528
3	Jiande City HURB	Qian Jianjun	13506811788
4	Shouchang Town People's Government	Xu Xiping	13306537661
5	Hangtou Town People's Government	Zheng Guangming	13777895640
6	Datong Town People's Government	Wu Jianxin	13429691389
7	Forest Farm	Shao Weizhong	13805704501

Zhejiang Province World Bank Loan Project Leading Group shall be responsible for leading and making policies for the LAR activities under the Project, reviewing and approving the RP, developing and submitting to the World Bank internal monitoring reports on a periodical basis.

The Project Implementation Agency shall be responsible for resettlement

survey, RP development and land acquisition implementation.

The functional government departments shall be responsible for developing the LAR compensation standards, fulfilling the formalities and reviewing and approving land acquisition for the Project and carrying out the coordination, management, supervision and arbitration work.

The Project designer shall be responsible for the design of the Project and determining the specific scope of land acquisition and resettlement.

The National Research Center for Resettlement of Hohai University shall be responsible for providing technical supports and developing the Resettlement Action Plan.

7.5 Grievance redress mechanism

The affected persons will sign the agreement to confirm their rights and entitlements if they are satisfied with the proposed compensation and resettlement method. A procedure for information disclosure in the process of resettlement is helpful to increase the transparency of the Project. Through information disclosure, the APs will be informed of the multiple complaint channels (including village committees, departments, PMO, land acquisition and demolition office, external monitoring agency, government petition office, and court) and a variety of ways (such as petition and telephone) to express complaints and appeal.

In the process of development and implementation of the RP of the Project, great attention will be paid to the participation of affected persons and a grievance redress mechanism will be established to handle complaints and appeals from the APs in the following procedure:

Stage 1: If not satisfied with the resettlement plan, the APs can express their complaints to the “Villager Group Supporting Xin’an River – Qiandao Lake Integrated Environment Improvement Project”, which shall give a timely feedback within 2 weeks.

Stage 2: If not satisfied with the resettlement plan, the APs can express their complaints to the village committees or the project resettlement implementation agency in oral or written form; oral complaints must be handled and recorded in writing by the village committees or project resettlement implementation agency. The oral complaints shall be handled and documented by the villager committee or project resettlement implementation agency. The village committee or the project resettlement implementation agency shall address the complaints within 2 weeks.

Stage 3: If the APs are still not satisfied with the resolutions made in Stage 2, an appeal can be filed to the World Bank PMO / project management agency after such resolution is received and the World Bank PMO / project

management agency shall make a further resolution within 2 weeks.

Stage 4: If the APs are still not satisfied with the resolutions made in Stage 3, an appeal can be filed according to the “Law of Executive Accusation of the People’s Republic of China” level by level to the competent government department for arbitration after such resolutions are received.

Stage 5: If the APs are not satisfied with the arbitrator resolution, a law suit may be filed to the civil court based on the “Law of Civil Procedure” upon receipt of such resolution.

7.6 Monitoring and evaluation arrangements

In order to ensure the smooth implementation of land acquisition and resettlement work and proper resettlement of the APs, the resettlement progress will be monitored and evaluated regularly in strict accordance with the terms specified in World Bank’s Operation Policy (OP 4.12) of Involuntary Resettlement and Guidance on Resettlement Monitoring and Evaluation for Business in PRC. Such monitoring shall comprises of two parts, namely the internal monitoring carried out by the resettlement agency and the external independent monitoring.

The internal monitoring will be conducted by Chun’an County World Bank Project Leading Group and World Bank PMO to ensure the resettlement activities are carried out in accordance with the principles and timetable specified in the Resettlement Plan. The purpose of internal monitoring is to enable the resettlement institutions to maintain excellent functions during implementation.

The external monitoring refers to the regular monitoring and evaluation on land acquisition and resettlement activities conducted by the independent monitoring agency. This monitoring shall be undertaken by a competent external independent agency appointed by the PMO.

7.7 Key conclusions of social assessment

1. Construction of the Project will facilitate local sustainable development and improvement of residents’ livelihood.

Construction of the Project will not only improve the residents’ living environment, assure drinking water quality and agricultural safety, and reduce discharge of domestic sewage, realize reduction of agricultural pollution and promote public health and residents’ livelihood, but will also significantly improve the investment environment to drive the development of local tourism and local economy. The Rural Drinking Water Safety Improvement Component will assure the rural and urban residents with an access to stable and high-quality tap water; the Dike Reinforcement and River Rehabilitation and Small Watershed Integrated Improvement Components will not only improve the surrounding environment through river dredging, but also assure supply of

water for agricultural crop irrigation; the Forest Eco-system Rehabilitation Component will not only beautify the landscape and attract tourists, but will also reduce soil erosion; the High-efficiency Composite Eco-wetland Purification Component will not only purify rural domestic sewage, but will also create a wetland park and provide the local residents with some recreational sites; the Agricultural NPS Pollution Control Component will not only reduce pollution caused by excessive usage of pesticides and chemical fertilizers, but will also increase yield of agricultural products and realize the production of ecological-friendly and pollution-free agricultural products. The Sewage Interception and Treatment Component will produce more direct benefits reflected in the reduction of wastewater discharge and promotion of residents' awareness of environmental protection.

2. The affected residents are supportive to the construction of the Project.

The local residents in the project area are extremely supportive to the water supply subproject and expressed no significant objections to the pipeline construction. The local residents have become fully aware of the impacts of the current water quality on human health and the fact that drinking ground water also constitutes a threat to human health as the water environment has been seriously damaged in some rural areas, in particular. With reasonable compensation and confirmed arrangement that they can continue cultivation after the construction works is completed, the farmers temporarily affected by land occupation will have no objections.

Villagers in the vicinity of the WWTP are a bit concerned about the Project, worrying about odor generated from the process of wastewater treatment and that the wastewater may pollution to local ground water. Believing that WWTP is an urban infrastructure and the local economy will benefit from the construction and operation of the infrastructure, they are supportive to the construction of the Project.

3. Risks from land acquisition

The Project will not result in large quantity of resettlement in the construction process and there are no families of ethnic minority groups among the affected persons and not many affected vulnerable groups.

Results of social survey show that the APs are relatively supportive to the construction of WTP and wetland on their land that they live on and thus present no objections. They hope that they can get government care and reasonable compensation and appropriate resettlement. Survey shows that the construction of the WTP will involve tomb relocation and the respective town and township governments have experiences in tomb resettlement. Therefore, such risks of land acquisition are within the scope of control.

4. Risks of vulnerable groups

Land acquisition in the WTP and wetland components involves only a small number of directly affected vulnerable groups. Where any such vulnerable groups are affected in a subproject, the resettlement plan specialist has proposed resettlement measures for the directly affected vulnerable groups to control such impacts within a controllable scope.

In addition, upon completion of the WTP, the tap water tariff will possibly be

increased. But the specific tariff standard is not yet determined, possibly requiring further negotiation with the APs. Survey shows that the water tariff acceptable to the APs is in the range of CNY 0.5 to CNY 1.0. Therefore, if the finalized water tariff is higher than CNY 1.0, the APs may be affected and the vulnerable groups, in particular, will be in the face of nonneglegible challenges. The Project may result in increased cost of living for the vulnerable groups.

Table 7.7-1 Schedule of key social risks, mitigation measures, improvement measures and stakeholder participation plan, implementation and monitoring of the Project

		Key risks	Specific measures in the Social Management Plan	Fund source	Implementation entity	Monitoring indicator
Measures for risk mitigation	Pre-construction	Land acquisition	Land compensation; Income restoration measures;	LA plan	LRB, LSSB, CAB, Town Government	Monitoring indicators identified during resettlement external monitoring
		House demolition	Developing compensation standard in strict accordance with the replacement price, providing reasonable compensation and proper resettlement; adequate participation and consultation.		LRB, LSSB, CAB, Town Government	Monitoring indicators identified during resettlement external monitoring
	During construction	Tomb relocation	Carrying out prior and adequate communication and negotiation with the relatives of the tomb owner and making compensations according to the policy and respecting the will of the relatives to the best possibility.		LRB, town government, village committee	Satisfaction degree of APs Complaints and appeals, resolution
		Temporary land occupation	Reasonable compensation and restoration to original state		Construction contractor, LRB, village committee	Monitoring indicators identified during resettlement external monitoring Conflicts with construction teams due to temporary land occupation (frequency, cause, resolution)
		Impacts of	Measures such as construction	EMP	Construction contractor,	Monitoring indicators identified in the

Table 7.7-1 Schedule of key social risks, mitigation measures, improvement measures and stakeholder participation plan, implementation and monitoring of the Project

		Key risks	Specific measures in the Social Management Plan	Fund source	Implementation entity	Monitoring indicator
		construction works	management, site environmental protection, etc.		EPB, county/city PMO	EIA report and the EMP
	During operation	Environmental impacts	Gas, noise, WWTP effluent discharge and landfill seepage risks		Construction contractor, EPB, county/city PMO, local community	Monitoring indicators identified in the EIA report and the EMP
		Impacts of wetland construction	Site enclosure and eco-environment restoration		EPB, environmental and sanitary station, town government	Local EPB is responsible for environment monitoring after enclosure.
		Water source protection	Eco-compensation mechanism		EPB, district WAB, AB, town government departments	Impacts on sources and amount of income of residents after water source protection;
Measures for enhanced benefits		WTP	Water source protection awareness education			Frequency, number of participants and content of environmental education
			Implementation of NPS pollution control at the water sources			Project investment Number of reduced pollution sources
			Construction of eco-agriculture at the water source areas			Effectiveness of eco-compensation; Status of development of eco-agriculture (type, input and output)

Table 7.7-1 Schedule of key social risks, mitigation measures, improvement measures and stakeholder participation plan, implementation and monitoring of the Project

		Key risks	Specific measures in the Social Management Plan	Fund source	Implementation entity	Monitoring indicator
			Strengthening water supply service and management	Subproject overhead	IA	
		WWTP	Strengthening technical and management of WWTP and maintenance of pipeline network to achieve the best effect in a limited environmental facility	Subproject overhead	IA	Whether the design treatment capacity is met
		Common	Subsidy on tap water tariff and garbage treatment tariff for vulnerable groups		County/city government	
			Employment of local labor in construction and operation stages		Contractors, project IA and EA	Local labor employed in the construction stage (job type, gender-based quantity and vulnerable group quantity) Number of local workers employed in the operation stage
			Use of local materials			Types, quantity and amount of local materials used in the construction stage and the operation stage

Table 7.7-1 Schedule of key social risks, mitigation measures, improvement measures and stakeholder participation plan, implementation and monitoring of the Project

		Key risks	Specific measures in the Social Management Plan	Fund source	Implementation entity	Monitoring indicator
Public participation plan			Public participation plan for LAR affected persons	RAP	LRB, LSSB, CAB, Town Government	Relevant monitoring indicators identified in the resettlement monitoring Frequency and content of public participation Status of complaints and appeals
			Public participation plan for beneficiaries			
			Public participation plan for local residents			
			Public participation plan for tariff increase	Project operation and management fee	County PMO, DRB, PB, CAB, tap water company, sanitation and environment station	Number of public hearings; change of prices; subsidy to vulnerable groups

8. Alternative Analysis

8.1 Without-project analysis

The efforts of integrated management of small watersheds under the Project will effectively facilitate adjustment of forest structure, improvement of forest health and forest resource quality and promotion of the forest ecological and environmental benefits and sustainability of ecological functions and increase of biodiversity in the project area. The efforts of agricultural NPS pollution control will contribute to reduction of the use of pesticides and chemical fertilizers and discharge of agricultural pollutants, such as nitrogen and phosphorus, into Qiandao Lake. In addition, river rehabilitation, dredging and garbage clearing and revetment construction along rivers flowing into Xin'an Lake, as a part of the small watershed improvement subproject will improve the flood control capacity and river ecological environment of the rivers in the region and thus improve the water quality in Qiandao Lake. In the without-project scenario where the status quo will be maintained, it will be unlikely to address the existing problems of the forest system and the agricultural NPS pollution and significant environmental risks will undoubtedly be brought to the face of Qiandao Lake Watershed. Although certain environmental impacts will be generated in the construction stage of the Project, these environmental impacts in the construction stage are temporary and can be avoided and mitigated if corresponding measures of environmental protection are taken. In contrast, the implementation and operation of the Project will generate long-term and lasting social and environmental benefits and will, in particular, play a positive role in protecting and improving the water quality and ecological environment of Qiandao Lake Watershed. Therefore, from the perspective of facilitating socioeconomic development and protecting natural environment, the with-project scenario is better than the without-project scenario, making necessary the construction of the Project.

Table 8.1-1: With-project and Without-project Comparison

Subproject	With-project alternative	Without-project alternative
Drinking water safety improvement	1. Assuring quality and volume of rural water supply and facilitating long-term improvement of rural drinking water safety; 2. Assuring reasonable revenue of water tariff and facilitating the long-term management of rural water supply facilities through commercialized operation and professional management; 3. Significantly increasing the water supply assurance rate, reducing disputes of rural water intake and consumption and facilitating rural harmony and serving as an important safeguard to rural socioeconomic development; 4. Reducing water intake pollution, protecting water environment of the entire watershed and enabling water tariff to play its role of economic leverage through collection of water tariff to reduce waste of water resources and achieve the final goal of protection and effective utilization of water resources; powerfully facilitating the protection and utilization of water resources; 5. Certain environmental impacts will be generated in the construction stage, which are temporary and may be eliminated as the construction works end. 6. Water intake will generate impacts on the hydrological regime of the water sources and power generation of the hydropower stations, but such impacts are insignificant. 7. The service area of this project involves 188 administrative villages of 18 townships and towns in Chun'an County and 62,300 newly connected users and a new service population of 218,100 persons. The project will involve a highest daily water consumption of 37,600m^3/d and an additional water supply capacity of 38,400m^3/d.	1. Without the project, the rural water supply in Chun'an County will remain as it is where there are multiple small water supply enterprises operating in a decentralized way and constructed according to low standard and water sources are polluted, water supply is inadequate and water intake is not assured. In addition, the treatment processes and facilities in the WTP are backward and simple. Except some individual WTPs having filter tanks, the others simply rely on dosing and cannot meet the national standards on drinking water. Water supply pressure in the WTPs is also inadequate. In some villages, the villagers extract groundwater or water from small ponds in the mountains and rarely have their domestic water sent for quality test. Problems of poor water quality, poor water supply security and difficulty in assuring water volume will persist. 2. Without the Project, it will be unlikely to achieve full promotion and improvement of the rural drinking water facilities in Chun'an County and thus unlikely to address the problems of poor assurance of both quality and volume and poor benefits of rural water supply in Chun'an County. 3. Construction of water supply facilities will remain in the vicious cycle of poor benefits and short service life.

Table 8.1-1: With-project and Without-project Comparison

Subproject	With-project alternative	Without-project alternative
Dike construction and other waterworks construction	1. Construction (reconstruction or reinforcement) of dikes and revetments will further improve the flood control pattern and promote the soil erosion prevention capability of the watershed and correspondingly promote the flood control standards of the riverbank areas, thus reducing secondary wastewater pollution arising from flood overflow and facilitating protection of water quality in the flood season; 2. Construction (rehabilitation or repair) of cofferdams will contribute to a certain extent to the rise of water level so that a certain water area can be created in the low-water season to effectively adjust water area and prevent dry-up of rivers in low-water season; thanks to the dilution action from increased water area, the capacity of aquatic environment will be increased to benefit the improvement of water quality of rivers in the region. 3. River dredging reduces river sediments, cuts endogenous release in the rivers and further increases the water environment capacity of the rivers, thus favorable to improvement of river water quality and flood passage in the watershed; 4. Designed to “assure water security, rehabilitate water ecology, integrate water landscape and enrich water culture”, the ecological water landscape subproject fully manifests harmonious coexistence of human and nature and will facilitate improvement of watershed environment. 5. The greening measures taken for the slopes in the dike and revetment improvement subproject will play the important role of a barrier, a front reservoir and a sedimentation tank to control pollution of water bodies by pesticides and chemical fertilizers and reduce pollution of nitrogen and phosphorus. In particular, such measures will contribute remarkably to the degradation and absorption of organic pollutants and absorption of toxic and hazardous substances and can reduce inflow of pollutants and facilitate water quality improvement. 6. Certain environmental impacts will be generated in the construction	1. The flood control system is not well developed and soil erosion is relatively serious; 2. With a water depth of around 10cm, the river nearly disappears in low-water season and the aquatic organisms can hardly survive; 3. Some rivers are seriously silted and with poor flood capacity; the existing landscape aquatic environment is poor; 4. The aged and damaged cofferdams make it unlikely to use the cofferdams to raise the water level of the river to divert water for crop irrigation. As a result, irrigation of some crops becomes difficult, restricting the high yield of agriculture. 5. There will be no environmental impacts in the construction stage of the Project.

Table 8.1-1: With-project and Without-project Comparison

Subproject	With-project alternative	Without-project alternative
	stage, which are temporary and may be eliminated as the construction works end.	
Forest restoration system	1. In this subproject, necessary artificial improvement measures, such as thinning, tending and replanting, will be taken following the law of alternation of vegetation communities, the law of forest growth and the principle of forest ecology; Eulalia hill afforestation will be carried out under the subproject and forest operation activities and measures compatible with the site conditions and harmonious with the natural environment will be taken to transform the ecologically degraded or unstable pure coniferous forests into mixed forests with excellent community stability and more favorable to the environment so as to adjust the forest structure, improve forest health and forest resource quality and enhance the ecological and environmental benefits and sustainability of ecological functions of the forests and increase their biodiversity. In the meanwhile, sustainable forest operation will be achieved by not only improving forest health, but also safeguarding the interests of forest farmers. 2. Upon the completion of the Project, forest structure and forest quality will be improved and the multiple functions and benefits of forests will be fully manifested to increase the ecological functions and biodiversity of forests in the project area and slow down and control forest degradation and prevent soil erosion. 3. Certain environmental impacts will be generated in the construction stage, which are temporary and may be eliminated as the construction works end. 4. Upon completion, the project will involve an increase of annual forest water storage by 67,862,112 tons, forest water purification by 6,411,820 tons, forest soil retention by 23,286 tons, forest fertilizer retention by 4,233	1. Without the Project, the forest ecosystem will stay as it is now with simple stand structure, complicated forest health problems, periodical occurrence of pine caterpillar hazards, forest stands subject to disease and pest hazards, stagnated growth, dead trees, landscape deterioration and eco-function degradation. 2. Centralized and continuous existence of artificial coniferous forests tend to lead to soil degradation and result in decrease of forest productivity and ecological function in the long run. 3. Eulalia vegetation is perennial herbal vegetation with poorer ecological and environmental functions compared with the high and large forest vegetation. 4. Forest fire will easily become a significant hazard bringing unsafe and unstable factors to the forest ecosystem. 5. There will be no environmental impacts in the construction stage of the Project.

Table 8.1-1: With-project and Without-project Comparison

Subproject	With-project alternative	Without-project alternative
	tons, forest CO2 absorption by 33,592 tons, forest O2 release by 24633 tons, forest SO2 absorption by 339 tons and forest dust retention by 45,831 tons, forest nutrient accumulation by 555 tons.	
Agricultural NPS pollution control	1. Upon completion, the subproject will be favorable to the reduction of application of chemical fertilizers and pesticides, increase of fertilization efficiency, and effective quality improvement of regional arable land and contribute significantly to integrated utilization and zero discharge of feces and wastewater from the livestock and poultry breeding farms. Thanks to the construction of the Project, agricultural NPS pollution will be mitigated and the water environment in the project area and its downstream areas will expect quality improvement. 2. Upon completion, the subproject will achieve a reduction of chemical fertilizer application per unit area by 10%, TN discharge by more than 930.35 tons, TP discharge by more than 930.35 tons and reduction of regional pesticide and chemical fertilizer usage and reduction of pollutants flowing into the rivers and reservoirs.	Agricultural NPS pollution is the key source of NH3-N pollutant and the key pollution factors of agricultural NPS pollution are pollutants generated by planting, livestock and poultry breeding and soil erosion. Without the Project, IPM, pesticide bottle recovery, liquid fertilizer distribution and organic fertilizer promotion and livestock and poultry breeding management in the watershed for the purpose of agricultural NPS management will be unlikely. Chemical fertilizers and pesticides will remain the mainstay in the project area for fertilization and pest management in the project area and green prevention and control measures will be absent, feces and wastewater treatment facilities will stay aged and in poor condition, the awareness of beneficial reuse will remain poor and, as a result, agricultural NPS pollution will remain as serious as it is now.
Wastewater treatment and Hangtou Wetland Construction	1. Upon completion, the subproject will increase regional wastewater treatment capacity and rate and reduce discharge of pollutants into Shouchang River. 2. After Phase I expansion works of Jiande City Shouchang WWTP is put into operation, industrial wastewater and domestic sewage of Shouchang Town, Shouchang Economic Development Zone (Aviation Town) and Hangtou Town will be treated in Shouchang WWTP to the respective standard before discharge to reduce the inflow of COD, BOD, SS, NH_3-N and TP by 638.75t/a, 219t/a, 346.75t/a, 45.63t/a and 4.56t/a respectively. 2. Hangtou Wetland is capable of treat approximately 2000 tons of farmland backwater every day and will be able to achieve high-efficiency	1. Without the project, the WWTP capacity will be inadequate and, as a result, wastewater will be directly discharged into and affect water quality of Shouchang River. 2. Farmland backwater of Nanba Village will remain as it is now and be directly discharged into Shouchang River.

Table 8.1-1: With-project and Without-project Comparison

Subproject	With-project alternative	Without-project alternative
	purification of farmland backwater from Nanba Village in the vicinity. As a result, nitrogen and phosphorus in the water bodies in the subproject area and other trace toxic pollutants will be efficiently reduced and effectively removed, with an annual average removal rate of 15% to 20% for nitrogen and10% to 20% for phosphorus and an estimated TN and TP removal of 0.219t/a~0.365t/a and 0.029t/a~0.058t/a respectively	

8.2 WTP Alternatives

1. Yejia WTP

1) Alternative I: construction of Yejia

With Alternative I that involves the construction of a new Yejia WTP, the water supply capacity can be assured. In addition, the new pipelines to be constructed can be easily connected with the existing ones to facilitate full use of the existing water supply facilities and pipelines of Yejia Water Supply System. To be constructed at a relatively high altitude, the new Yejia WTP can achieve full gravity supply of water in the service area of Yejia Water Supply System. However, compared with Alternative II for pipeline extension of Weiping WTP, Alternative I requires simultaneous operational management of two WTPs, implying a relatively complexity in operational management.

2) Alternative II: pipeline extension of Weiping WTP

Qiandao Lake is the water source of Weiping WTP and is known for its excellent water quality and abundant water supply. It is therefore feasible to extend the pipelines of Weiping WTP to supply water to Yejia area. However, since Yejiang is located far away from Weiping WTP and at a high altitude, secondary boosting is required, implying high energy consumption and involving heavy load of construction and significant difficulty of implementation with the long water transmission pipelines. In addition, as the land parcel preserved for expansion of the existing Weiping WTP only meets the needs of a water supply capacity of 2500m^3/d, further increase of the capacity of supplying water to Yejiang area will be unlikely.

Table 8.2-1: Alternative Comparison for Yejia WTP

Type / Items of comparison		Alternative I (construction of Yejia WTP, recommended)	Alternative II (pipeline extension of Weiping WTP)	Pros and Cons
Scale	Quantity	Small	Large	With Alternative I, the existing water supply facilities and pipelines can be utilized; secondary boosting is not needed and the quantity of construction works is small; however,
	Land occupation	1450 m^2	758 m^2	
	Earthwork	15,500m^3 each for earthwork excavation and fill	21,300m^3 each for earthwork excavation and fill	

Table 8.2-1: Alternative Comparison for Yejia WTP

Items of comparison \ Type		Alternative I (construction of Yejia WTP, recommended)	Alternative II (pipeline extension of Weiping WTP)	Pros and Cons
				a new WTP is needed and involves a relatively large area of land occupation. Alternative I is in general better than Alternative II, which has a limited expansion capability and is unable to meet the needs of water supply capacity.
Technology	Construction difficulty	Easy	The extension works needs to connect the existing facilities and expansion difficulty is relative high.	With Alternative II, it is necessary to construct, operate and manage two WTPs, implying greater difficulty of O&M than Alternative I.
	Construction period	2.5 years	1.5 years	
	O&M	Complicated	Simple	
Environment	Environmental sensitivity	No sensitive targets	No sensitive targets	Both alternatives have no environmentally sensitive targets. Alternative I involves a smaller soil erosion, thus is better.
	Soil erosion impact	19t	24t	
Society	Resettlement	Nil	Nil	Alternative I is better in general.
	Area of occupied arable land	2 mu	Nil	
	Beneficial population	8400 persons	4000 persons	

Table 8.2-1: Alternative Comparison for Yejia WTP

Type / Items of comparison		Alternative I (construction of Yejia WTP, recommended)	Alternative II (pipeline extension of Weiping WTP)	Pros and Cons
Cost	Construction investment	CNY 13,872,000	CNY 20,990,000	Alternative II, which requires secondary boosting and higher energy consumption, thus worse than Alternative I.
	Operational cost	CNY 743,400/year	CNY990,100/year	

Based on the aforesaid comparison and analysis of the two alternatives, construction of Yejiang WTP will facilitate full use of the existing water supply facilities and, as a result, the construction cost will be low and gravity intake is realizable for most of the time and gravity water supply realizable in the full process, with little energy consumption and low cost of operation. In the meanwhile, with the pipelines of Yejiang WTP and Weiping WTP interconnected, both WTPs will back up each other in Weiping Town for improved safety of water supply. Therefore, Alternative 1 for construction of Yejia WTP is selected.

2. Zitong No. 2 WTP

1) Alternative I: expanding Zitong Town WTP; adding a water source; supplying water from one single WTP.

Besides supply water for the rural areas in the project area, Zitong Town WTP needs to meet the water demand of Zitong Industrial Park of 500m^3/d. Therefore, it is proposed to expand its water supply capacity to 2500m^3/d. With this alternative, gravity water supply can be achieved for the villages in the southwestern part. Due to the small pipe size of the existing water distribution pipelines and the big water head loss along the route, it is unlikely to supply water to the eastern villages fully relying on gravity and secondary boosting is needed. Since the existing water source of Zitong Town WTP can only supply raw water at a rate of 500m^3/d in low-water season, the gap of raw water is as big as 2000m^3/d. In order to assure the volume of water supply, new water intake floating ship will be constructed to take water from Xin'anjiang Reservoir and a new DN250 raw water pipeline will be constructed to transmit raw water to the raw water plant.

2) Alternative II: construction of Zitong No. 2 WTP; taking Xin'anjiang Reservoir as its water source; supplying water from the new WTP only.

In this alternative, Zitong Town WTP is totally abandoned and the new Zitong No. 2 WTP will be constructed in the vicinity of Xin'anjiang Reservoir not only to consider rural water supply in the project area, but also to meet the water demand of Wutong Industrial Park of 500m^3/d. Therefore, the designed water supply capacity of the new WTP is 2500m^3/d. The new WTP can assure the required water intake fully relying on Xin'anjiang Reservoir and the water intake method is boosting intake with floating ship. The new WTP is located in the vicinity of the Xin'anjiang Reservoir and the required raw water pipeline is relatively short. In this alternative, water supply will be carried out through full-process boosting with a boosting water head of 20 to 100m in the water supply area. Since the water users are mainly concentrated in the southwestern area, which is of a higher altitude, and the existing water distribution pipelines are of a smaller diameter, the water head loss along the route is high and secondary boosting is needed.

3) Alternative III: construction of Zitong No. 2 WTP, combined water supply from both WTPs

In Alternative III, Zitong No. 2 WTP will be constructed and then supply water together with Zitong Town WTP. The two WTPs need to supply water for the rural areas and Zitong Industrial Zone in the project area (at a capacity of 500m^3/d) and the total water supply capacity will reach 2500m^3/d. Since the water source of Zitong Town WTP can only assure a raw water capacity of 500m^3/d, its effective water supply capacity is only 500m^3/d. in order to meet the need of water supply, the water supply capacity of Zitong No. 2 WTP to be constructed needs to reach 2000m^3/d. Zitong No. 2 WTP will take Xin'anjiang Reservoir as its water source and will use floating ship for water intake. The site is located in the vicinity of Xin'anjiang Reservoir. Zitong No. 2 WTP will directly supply 900m^3/d to the eastern land parcel and 1100m^3/d to the original Zitong WTP and uses the clean water tank and water distribution pipelines of the original Zitong WTP for water supply.

Table 8.2-2: Alternative Comparison for Zitong No. 2 WTP

Item of comparison \ Type		Alternative I: expanding Zitong Town WTP; adding a water source; supplying water from one single WTP	Alternative II: construction of Zitong No. 2 WTP; taking Xin'anjiang Reservoir as its water source; supplying water from the new WTP only	Alternative III (recommended): construction of Zitong No. 2 WTP, combined water supply from both WTPs	Pros and cons
Scale	Works quantity	Small	Large	Medium	Alternative I is better
	Land occupation	2000 m^2	5000 m^2	4250 m^2	
	Earthwork	3400m^3 for excavation and earth fill each	11,500m^3 for earthwork excavation and bacifill^3	8,200m^3 for earthwork excavation and backfill;	
Technology	Construction difficulty	Average	Easy	Easy	Alternative II is better
	Construction period	1 year	2.5 years	2 years	
	O&M	Simple, 1 WTP	Simple, 1 WTP	Complicated; joint water supply by two WTPs	
Environment	Environmental sensitivity	Having no condition for expansion; difficult to handle by policy	Nil	Nil	Alternative III is better
	Soil erosion impacts	10t	23t	22t	
Society	Resettlement	25 HHs	Nil	Nil	Alternative II and III are better
	Occupation of arable land	Nil	Nil	Nil	
	Beneficiary persons	12100 person	12100 person	12100 person	
Cost	Construction investment	CNY 29,000,000	CNY 30,800,000	CNY 24,700,000	Alternative III is better
	Operational cost	CNY1,220,000/year	CNY1,320,000/year	CNY 1,060,000/year	

Based on the comparison and analysis of the 3 alternatives, Alternative III is selected for its low cost of investment and operation, high safety of water supply and simple procedure of policy processing.

Table 8.2-3 Site Alternative Comparison for Wangbu WTP

Type / Item of comparison		Wangbu WTP Site 1	Wangbu WTP Site 2 (recommended)	Pros and Cons
Scale	Work quantity	Small	Large	Site No. 1 is close to Yanjia Reservoir and the required raw water pipeline is shorter; site layout design is the same.
	Land occupation	3518 m^2	3518 m^2	
	Earthwork	9700m^3 each for excavation and fill	12,300m^3 each for excavation and fill	
Technology	Construction difficulty	Same	Same	Same
	Construction period	2 years	2 years	
	O&M	Simple	Simple	
Environment	Environment sensitiveness	Nil	Residents within a distance of 50m	Site 1 is better.
	Soil erosion impact	20t	20t	
Society	Resettlement	Nil	Nil	Located on a land parcel belonging to basic farmland, Site No. 1 **cannot be used for WTP construction.**
	Occupation of arable land	5.2mu, occupation of basic farmland	5.2mu	
	Beneficiary population	13,300 persons	13,300 persons	
Cost	Construction investment	CNY 24.80 billion	CNY 24.80 billion	Same
	Operational cost	CNY 1,160,000/year	CNY 1,160,000/year	

Analysis reveals that Site No. 1 is located relatively closer to Yanjia Reservoir and requires shorter pipelines. However, since the land parcel belongs to basic farmland, WTP construction is unlikely. Therefore, Site No. 2 which is located slightly farther is recommended finally as the site for WTP construction.

3. Wubu WTP

On a slope land to the south of Yinchenxi Village and a hill to the northeast of Yanjia Village (belonging to Xinhe Village), there are two areas with appropriate altitude, respectively assigned as the Site No. 1 and Site No. 2 of Wangbu WTP.

4. Xiashan WTP

Xiashan WTP has two proposed sites. Site No. 1 is located on the tea garden on the east of Lingjiao Natural Village belonging to Xiashan Village while Site No. 2 is located on the slope land to the southwest of Xiangjia Natural Village belonging to Xiashan Village.

Both sites can achieve gravity intake and gravity water supply to most of the natural villages, with only three natural villages belonging to Xiashan Village requiring boosting.

Site No. 1 has a more gentle terrain with a natural elevation of 220m to 230m and the design elevation of the WTP is approximately 225m. Able to achieve earthwork balance and located in a relatively independent and safe place on the edge of the village, Site No. 1 requires a relatively short access road and involves little land occupation and a gentle slope. However, most of the land parcel is classified as farm field for preservation and the Site involves a difficult policy procedure.

Site No. 2 has a steep terrain with a natural elevation of 220m to 245m and the design elevation of approximately 225m. Involving a high slope for excavation and a large volume of excavation, Site No. 2 can hardly achieve earthwork balance. Located close to the village center, safety is more of a concern and the facilities at the hill foot are exposed to artificial damages, making the usable area of the site largely discounted. Due to the large elevation difference, this Site involves a longer access road, larger land occupation and steeper slopes. However, this Site has an easier policy procedure.

Table 8.2 -4 Site Alternative Comparison for Xiashan WTP

Type / Item of comparison		Xiashan WTP Site No. 1	Xiashan WTP Site No. 2 (recommended)	Pros and Cons
Scale	Work quantity	Small	Large	With a steeper terrain, a higher slope for excavation of a larger volume and a longer access road, Site No. 2 more disadvantageous
	Land occupation	4100 m^2	4503 m^2	
	Earthwork	5,000 m^3 each for excavation and fill	9,500 m^3 each for excavation and fill	
Technology	Construction difficulty	Gentle terrain, less difficult	Steep slope for excavation, more difficult	Site No. 1 is better.
	Construction period	1.5 years	2 years	
	O&M	Same	Same	
Environment	Environment sensitiveness	Nil	With residents in the vicinity with a distance of approximately 40m	Site No. 1 is better.
	Soil erosion impact	20t	23t	
Society	Resettlement	Nil	Nil	Site No. 2 involves an easier policy procedure, thus is better in general.
	Occupation of arable land	6mu, protected farmland	Nil	
	Beneficiary population	13300 人	13300 persons	
Cost	Construction investment	CNY 19,000,000	CNY 21,360,000	Site No. 1 is better.
	Operational cost	CNY 1,110,000/year	CNY 1,110,000/year	

With the various factors taken into consideration, Site No. 2, although disadvantageous since it is closer to villages and has a steeper terrain, is recommended as the site for WTP construction for its easier policy procedure.

5. Pingmen WTP

Pingmen WTP has two proposed sites. Site No. 1 is located on the slope land on the north of Hepuqiao Village while Site No. 2 is located on the slope land to the east of Hepuqiao Village.

Site No. 1 has a higher natural elevation of 220m to 210m and the design elevation of the WTP is approximately 200m. Located in a relatively independent and safe place, Site No. 1 requires a relatively long access road with a gentle slope. It can achieve gravity flow of raw water and also gravity water supply to villages requiring water distribution.

Site No. 2 has a lower natural elevation of 170m to 180m and the design elevation of the WTP is approximately 175m. Located in a relatively independent and safe place, Site No. 1 requires a relatively short access road with a gentle slope. It can achieve gravity flow of raw water, but requires boosting for water supply to villages requiring water distribution.

Table 8.2-5 Site Alternative Comparison for Pingmen WTP

Item of comparison \ Type		Pingmen WTP Site No. 1 (recommended)	Pingmen WTP Site No. 2	Pros and Cons
Scale	Work quantity	Same	Same	Substantially same
	Land occupation	2318 m^2	2318 m^2	
	Earthwork	11,200 m^3 each for excavation and fill	11,200 m^3 each for excavation and fill	
Technology	Construction difficulty	Gentle terrain, easy	Gentle terrain, easy	Site No. 2, with a lower elevation, requires boosting for water supply, thus more disadvantageous than Site No. 1.
	Construction period	1.5 years	1.5 years	
	O&M	Slightly difficult, boosting required for villages of water distribution	Easy, gravity water supply	
Environment	Environment sensitiveness	No environmentally-sensitive sites in the vicinity	No environmentally-sensitive sites in the vicinity	Substantially same
	Soil erosion impact	14t	14t	
Society	Resettlement	Nil	Nil	Substantially same
	Occupation of arable land	3.4 mu	3.4 mu	
	Beneficiary population	4500 人	4500 人	
Cost	Construction investment	CNY 18,510,000	CNY 19,200,000	Site No. 2, with a lower elevation, requires boosting for water supply, thus more disadvantageous than Site No. 1.
	Operational cost	CNY 630,400/year	CNY 754,400/year	

With all the aforesaid factors taken into consideration, Site No. 1, with a higher site elevation allowing gravity water supply, is capable of achieve full-process gravity water intake and supply and produces remarkable benefits on energy conservation. Although the initial construction cost of this alternative is slightly higher than the alternative using boosting pumps for water supply, it is easier to manage, consumers less energy and involves a lower cost of O&M after put into operation and the total cost of the full life cycle is also lower. Therefore, Site NO. 1 with higher elevation and using gravity water supply method is selected as the recommended site for Pingmen WTP in the current stage.

6. Baima WTP

Baima WTP has two proposed sites for selection. Site No. 1 is located on the slope land 300m northwest of Guanchuan Power Station while Site No. 2 is located on the flat land 200m southeast of Guanchuan Power Station.

Site No. 1 has a higher ground elevation in the range of 520m to 530m and can achieve gravity supply of raw water in the full length. Located at a farther place from the village, Site No. 1 is independent and safe and has a land parcel of adequate size, which is currently a forest land involving relatively less difficulty in terms of land acquisition. However, this land parcel has a slope terrain requiring site leveling and is located far from Daguan Highway, a major local highway, thus requiring the construction of a new access road with a length of 150m.

Site No. 2 has a slightly lower ground elevation of 495m and can achieve gravity supply of raw water to the WTP. All the villages in the service area, except Shanglipeng and Guanchuan, the two natural villages located closer to the water source requiring boosting, can achieve gravity supply of water. Located at a farther place from the village, this site is independent and safe. With a flat terrain and located closer to Daguan Highway, this site enjoys easy transportation access. However, with relatively smaller area for use and classified as farmland, this site involves more difficulty in terms of land acquisition; with a larger distance from the water source and the raw water pipeline having to run across Daguan Highway, the Site involves a greater difficulty of construction.

8.3 Alternative Comparison for Wastewater Treatment Process

Here described as follows in Table 8.3.1 and Table 8.3.2 are comparison of the alternative treatment processes for Shouchang WTP.

Table 8.2-6 Site Alternative Comparison for Baima WTP

Item of comparison \ Type		Baima WTP Site No. 1 (recommended)	Baima WTP Site No. 2	Pros and Cons
Scale	Work quantity	Larger	Smaller	Site No. 1 is better.
	Land occupation	4624 m^2	2704 m^2	
	Earthwork	7,600 m^3 each for excavation and fill	4,800 m^3 each for excavation and fill	
Technology	Construction difficulty	Slope land, requiring road construction	Flat, easy accessibility, but pipeline needs to run across Daguan Highway	Site No. 2 requires partial boosting for water supply and the raw water pipeline needs to run across the existing highway, thus more disadvantageous than Site No. 1.
	Construction period	2 years	2 years	
	O&M	No boosting	Partial boosting	
Environment	Environment sensitiveness	Nil	Nil	Site No. 1 is better.
	Soil erosion impact	15t	15t	
Society	Resettlement	Nil	Nil	Site No. 1 is forest land while Site No. 2 is farmland; Site No. 1 is thus better.
	Occupation of arable land	Nil	4 mu	
	Beneficiary population	3700 人	3700 人	
Cost	Construction investment	CNY 11,210,000	CNY 10,190,000	Site No. 1 is better.
	Operational cost	CNY 320,000/year	CNY 450,000/year	

With all the aforesaid factors taken into account, despite of the location on hill slope and requirement of a new access road and relatively large investment, Site No. 1 is selected as the recommended site for Baima WTP for its high elevation that enables gravity intake and water supply in full process, simple O&M management, and low operational cost that is favorable to long-term and efficient operation of the rural water supply facility.

Table 8.3-1 Comparison of Biological Nitrogen and Phosphorus Removal Process

Content of comparison		Alternative 1	Alternative 2	Alternative 3
		Inverted A/A/O Process	**Improved oxidation ditch process**	**MSBR Process**
Technology	Technological characteristics	The inverted A / A / O process is a process comprising of anaerobic / anaerobic / aerobic process and achieves simultaneous nitrogen and phosphorus removal using biological treatment technology. Its working mechanism consists of two parts: phosphorus removal and nitrogen removal. It uses carbon sources in raw sewage to reduce the input of carbon sources.	As the deformation of the conventional activated sludge method and classified as a process of delayed aeration, this process uses closed ditch aeration tank where the mixture of sewage and activated sludge is circulated at an internal circulation flow several times higher than inflow. Therefore, this process has a very strong anti-impact load capacity and stable operation and requires no initial settling tank.	As a deformation of SBR process, the MSBR tank is usually jointly constructed and comprises of Tank A1 (pre-anoxic tank), Tank A2 (anaerobic tank), Tank A3 (anoxic tank), main aeration tank and a SBR tank on the left and on the right.
	Equipment	Aeration system, mixture backflow system, residual sludge discharge system, mixture blending system。	Aeration system, mixture backflow system, residual sludge discharge system, mixture blending system	Aeration system, mixture backflow system, residual sludge discharge system, mixture blending system, air weir system
	O&M	Moderate level of equipment maintenance; conventional O&M	High level of equipment maintenance; conventional O&M	High level of equipment maintenance; higher requirement of automation; more complicated in O&M.
	Construction and installation cost	CNY 2,580,000	CNY 2,605,000	CNY 2,650,000

Table 8.3-1 Comparison of Biological Nitrogen and Phosphorus Removal Process

Content of comparison		Alternative 1	Alternative 2	Alternative 3
		Inverted A/A/O Process	**Improved oxidation ditch process**	**MSBR Process**
	Operational cost	CNY 0.46/ton-day	CNY 0.45/ton-day	CNY 0.47/ton-day
Environmental impacts	Water environment impact	Easy maintenance and stable effluent.	Easy maintenance and stable effluent.	With higher requirement of automation in operation and maintenance; stable effluent.
	Odor impact	Fully-enclosed water tank; odor collected and removed through deodorant process.	Fully-enclosed water tank; odor collected and removed through deodorant process.	Fully-enclosed water tank; odor collected and removed through deodorant process.
	Noise impact	Blower noise; noise-insulating hood is recommended for noise reduction.	Blower noise; noise-insulating hood is recommended for noise reduction.	Blower noise; noise-insulating hood is recommended for noise reduction.
	Sludge generation	Moderate, sludge reduction and stabilization achievable through sludge dewatering.	Less, sludge reduction and stabilization achievable through sludge dewatering.	Moderate, sludge reduction and stabilization achievable through sludge dewatering.
Social impacts	Land occupation	Moderate land occupation	Large land occupation	Small land occupation
Key Pros and Cons		Advantages: (1) Allowing separate setting of the anoxic, anaerobic and aerobic sections in the process for easy control of the dissolved oxygen concentration in each section and maintain the special living	Advantages: (1) Stable treatment effect leading to better water quality. (2) simple process, lower capital costs, less stringent self-control requirements, easy operation and management. (3) longer hydraulic retention time and sludge age	Advantages: (1) greater savings on land occupation; (2) higher automation requirements. Disadvantages: (1) high idle rate. (2) very stringent requirements on the process operation and

Table 8.3-1 Comparison of Biological Nitrogen and Phosphorus Removal Process

Content of comparison	Alternative 1	Alternative 2	Alternative 3
	Inverted A/A/O Process	**Improved oxidation ditch process**	**MSBR Process**
	environment required for anoxic, anaerobic and aerobic microorganisms and ensure the effect of treatment in each section. (2) having strong impact resistance. (3) Allowing maximum use of the carbon source in the wastewater for de-nitrification to reduce the dosage of carbon source. Disadvantages: (1) The removal efficiency of denitrification is directly dependent on the internal backflow rate of the mixed solution (100% -300%) . The higher the backflow rate, the better the denitrification effect and the larger the power consumption.	and allowing more complete simultaneous removal of suspended organic matters and dissolved organic matters. Therefore, the residual sludge treated by the oxidation ditch is less and stable and anaerobic digestion is not needed. (4) the push-flow circulation of oxidation ditches lead to strong resistance to impacts on water quality and water volume. Disadvantages: (1) Surface aeration involves the disadvantages of lower oxygen rate, larger installed power, higher power consumption, increased operating costs. (2) The denitrification effect is weaker relative to the A / A / O process due to unclear functional zoning.	equipment control; complicated programming required for operation control and heavy work load involved in commissioning of the control system. (3) Weaker resistance to impacts on water quality.
Conclusion	**Alternative 1, Inverted A/A/O Process, is recommended.**		

It can be seen from the above comparison that the inverted A / A / O process has stronger resistance to water quality impacts and can adapt to greater fluctuation of water quality, and is advantageous in its easy control, convenient management and low operation cost, etc. With a similar arrangement of operation and management as Phase I, overall operation is convenient. Therefore, **the inverted A / A / O process is recommended as the biological phosphorus and nitrogen removal process**.

Table 8.3-2： Alternative Comparison for Deep Treatment Process

Content of comparison		**Alternative 1**	**Alternative 2**	**Alternative 3**
		Active sand filter	**D-type filter**	**Fiber rotary cloth filter**
Technology	Technological characteristics	Excellent treatment effect; quartz sand is easy to purchase; mature technology.	Excellent treatment effect; comet filter not as extensively applied as the other two alternatives; mature technology.	Excellent treatment effect; extensively applied; mature technology.
	Equipment	Quartz sand filter, water distribution device, air compressor system and PLC control.	Comet filter, water and gas distribution devices, backwash system and PLC control.	Filter cloth (rotary), self-cleaning system and PLC control.
	O&M	Easy, PLC automated control	Easy, PLC automated control	Easy, PLC automated control
	Construction and installation cost	CNY 1,860,000	CNY 1,900,000	CNY 1,900,000
	Operational cost	CNY0.04 / ton-day	CNY0.042 / ton-day	CNY0.04 / ton-day
Environmental impacts	Water environment impact	Waste liquid will be generated, accounting for 5% to 10% of treatment volume and may be led to the sludge thickening tank system.	Waste liquid will be generated, accounting for 5% to 10% of treatment volume and may be led to the sludge thickening tank system.	Waste liquid will be generated, accounting for 5% to 10% of treatment volume and may be led to the sludge thickening tank system.
	Odor impact	Nil	Nil	Nil
	Noise impact	Nil	Involving noise from backwashing fan	Nil

Table 8.3-2： Alternative Comparison for Deep Treatment Process

Content of comparison		**Alternative 1**	**Alternative 2**	**Alternative 3**
		Active sand filter	**D-type filter**	**Fiber rotary cloth filter**
	Sludge generation	Nil	Nil	Nil
Social impacts	Land occupation	Small	Moderate, 10% - 20% higher than the other two alternatives	Small
Key Pros and Cons		Advantages: Allowing continuous filter operation, backwashing in operation, high efficiency. Small footprint, simple management, excellent effluent water quality; easy equipment improvement and expansion. Disadvantages: requiring regular supplement of filters. Due to the small treatment capacity of a single active sand tank, there is the problem of water distribution for a large-scale WTP.	Advantages: stable system and mature technology; unique interception technology to ensure that the filter will not be lost in the backwash. Disadvantages: requiring a larger area of land occupation than the other two alternatives; relatively higher operating cost and more backwash equipment. Management is relatively troublesome.	Advantages: Allowing continuous filter operation, backwashing in operation, high efficiency. Small footprint, simple management, excellent effluent water quality; easy equipment improvement and expansion. Disadvantages: belonging to mesh filters (rotary) and excessively high influent SS tending to cause frequent clogging; therefore, the influent SS is usually required to be less than 20mg / L.
Conclusion		**Alternative I, active sand filter, is recommended.**		

It can be seen from the above comparison that the active sand filter has excellent effluent water quality, smaller land occupation, simple and compact structure, short construction period and greater savings' on operational cost and easy operation and management. Therefore, t**he active sand filter is recommended as the process for deep treatment section.**

9. Public Participation and Information Disclosure

9.1 Purpose and Significance of Public Participation

The purpose of public participation is to improve the quality of EIA, to provide more information and advice, and to make the EIA process more open and public so as to enable all the people with direct or indirect connection with the Project to participate in the EIA process to ensure transparency and credibility of the EIA results and to bring forward their own views and opinions to make the EIA process better and fairer.

Public participation is an important part of EIA process and an effective way to improve scientific decision-making. Public participation for construction projects is an important means of enhancing the two-way communications between project IAs, EIA consultants and the public. Through extensive public participation, the public directly or indirectly affected by the construction project can have a full understanding of the potential environmental impacts, mitigation measures and the economic and social benefits brought by the project construction, and can provide feedback opinions and actively offer suggestions to jointly find a solution to potential problems. Thus the impact of project implementation on the environment can be minimized, potential pollution induced conflicts can be avoided, and environmental protection and economic development can be better coordinated. The main purposes of public participation include:

(1) Summarizing and analyzing public opinions, so that they can be included in the environmental protection measures. Public opinions should also be used as the work guidelines in the implementation stage of the Project.

(2) Conducting two-way communication between the public and the IA, introducing project overview, potential pollution, control measures, EIA prediction results, etc., to the public in detail and collecting public opinions and suggestions, etc. and giving feedback to the IA so that the project design can be properly modified to bridge the public and the IA for mutual understanding.

(3) Soliciting, through public participation, public views and opinions of the Project, finding a basis for safeguarding public interest, fully adopting the feasibility suggestions in the EIA process to ease public concerns induced by lack of communications between the IA and the public, and mitigating as much as possible the adverse impacts on and making necessary compensation for public interests.

(4) The post-EIA assessment mainly relies on public supervision. Public participation is an important part of environmental management mechanism, which is conducive to protecting the ecological environment, improving the environmental and economic benefits of the Project, and improving

environmental quality, and ensuring the implementation of sustainable development strategies.

9.2 Scoping and stakeholder identification

Implementation of the Project will facilitate improvement of the ecological environment in Qiandao Lake Watershed, mitigation of pollution and improvement of forest ecological environment in Qiandao Lake Watershed in Zhejiang Province and enhance the efficiency and sustainability of watershed management and ecological environment protection. However, during project construction and operation, there will be some environmental impacts on the surrounding area concerning the personal interests of local people. Such impacts will cover individual residents and organizations within the red lines and in the affected areas of the Project.

In the project-affected area, all individuals or organizations that are directly or indirectly benefiting from or adversely impacted by the Project are the stakeholders of the Project. At the same time, project-related government agencies or experts in the related disciplines are also stakeholders. Stakeholders of the Project are identified based on the subprojects defined in the feasibility study report and are summarized in Table 9.2-1.

Table 9.2-1 Summary of Key Project Stakeholders

Subproject	Stakeholders
Chun'an County Small Watershed Integrated Improvement	Village committees and residents along the Wuqiangxi Stream Basin (Changbao Village, Mugua Village, Zhaxi Village, Zhangcun Village, Lijiacun Village, Fenkou Village, Yecunxi Village, Weishan Village, and Shixia Village); Village committees and residents along the Yuchuanxi Stream Basin (Shuangxikou Village, Fuban Village, Shenban Village, Zhangcun Village, Guocun Village, Yijiawu Village, Xiawu Village, Fulin Village, Zhuangyuan Village, Yinfeng Village, Xiashe Village, Xinqiao Village, Muwang Village, Huangcun Village, Chicheng Village); Village committees and residents along the Liuduyuan River Basin (Hecun Village, Chahe Village, Tashitan village, Yangjiaban Village, Hongjian Village, Sanzhou Village, Dongyuan Village, Chahe Village, Xianmao Village, Anchuan Village, Shaozhai Village, and Yejiayuan Village) ; Village Committees and Residents along Shangwuxi Stream (Hongshanqiao Village, Fanjia Village, Huangjiayuan Village, Wulong Village); Village committees and residents along Zitongyuan River (Bingfeng Village, Jiemeng Village, Changning Village); Relevant departments and experts: Chun'an County Water Conservancy and Hydropower Bureau, Environmental

Table 9.2-1 Summary of Key Project Stakeholders

Subproject	Stakeholders
	Protection Bureau, Agriculture Bureau, and the feasibility study design unit.
Chun'an County Rural Drinking Water Safety Improvement	Water supply beneficiaries: village committees and residents of towns and townships and villages along the river; Power generation impacts: Yanjia Reservoir, Yejiayuan Reservoir, Fengshuling Reservoir and Baima WTP; FS Unit: Zhejiang Design Institute of Water Conservancy and Hydro-electric Power Competent authorities of infrastructures involving possible intersection: Chun'an County Transportation Bureau, Telecommunication Bureau, Agriculture Bureau, Forestry Bureau, Housing and Urban-Rural Development Bureau, Power Supply Company, Construction Group, Water Supply Company, Environmental Protection Bureau, Water Resources Bureau
Chun'an County Dike Reinforcement and River Rehabilitation	Towns, townships, village committees and residents along the project rivers; Relevant departments and experts: Chun'an County Water Conservancy and Hydropower Bureau, Environmental Protection Bureau, Agriculture Bureau and FS design unit
Chun'an County Agriculture NPS Pollution Control	Chun'an County Agricultural Technology Extension Center and Plant Protection and Soil Fertilization Station, 43 agricultural material shops, liquid fertilizer producers and delivery units, organic fertilizer producers and farmers and planting enterprises of the six towns and townships involved in the river basin rehabilitation, Hangzhou Qiandao Lake Wuxi Agriculture Development Co., Ltd., Hangzhou Qiandao Lake Tianping Agriculture Development Co., Ltd., Chun'an County Weizheng Family Farm, Hangzhou Lijia Environmental Service Co., Ltd., Chun'an County EPB, Agriculture Bureau and FS design unit
Chun'an County Forest Eco-system Restoration	Villages and residents involved in the forest form improvement and forest farms, agricultural material shops, towns and townships, forest fire station, Forestry Bureau and forestry experts and FS design unit involved in the project implementation
Jiande City Water Conservancy Facility Rehabilitation	6 towns and townships (communities) of Lijia, Datong, Hangtou, Shouchang, Genglou and Xin'anjiang, village committees and residents involved in the subproject Relevant departments and experts: Jiande City Water Conservancy and Hydropower Bureau, EPB and FS design unit
Jiande City Landscaping Afforestation and Forest Form	Hangtou Town, Shouchang Town, Datong Town, Xin'anjiang Community, Shouchang Forest Farm, Jiande City Forest Fire Station, Forestry Bureau and forestry experts, Agriculture Bureau, FS design unit

Table 9.2-1 Summary of Key Project Stakeholders

Subproject	Stakeholders
Improvement	
Jiande City Municipal Engineering	Datong Town, Hangtou Town, Xin'anjiang Community, Yangxi Community, Lovers' Valley Scenic Area, Wulong Village of Hangtou Town, Jiande City Forest Farm, WWTP and local residents Relevant departments and experts: Chun'an County Forestry Bureau, Environmental Protection Bureau and FS design unit.
Jiande City Agricultural NPS Pollution Control	Hangtou Town, Shouchang Town, Datong Town, Agriculture Bureau, 19 livestock and poultry breeding farms to be rehabilitated; FS design unit

9.3 Public consultation

According to the requirements of Chinese laws and regulations for environmental protection and the World Bank Safeguard Policy (OP4.01), two rounds of public participation were carried out for the Project. The first round was in the preparation phase, or during the preparation of the EIA outline; the second round was after the draft EIA report was finalized. The public participants mainly include people affected by or living in the neighborhood of the construction sites of the Project and representatives and experts from government agencies related to the Project.

The first round was conducted in the project preparation phase or during the preparation of the EIA outline. The main purpose was to introduce the basics of the Project so that the public could have a basic understanding of the Project and make comments or suggestions for project implementation.

During this round, the EIA consultant solicited comments and suggestions from the public through poster disclosure, interviews, questionnaires survey and seminars. Such comments and suggestions were delivered as feedbacks to the Project EA and feasibility study designer to provide references for the project design and this EIA.

The second round of public participation was implemented after the first draft of the EIA Report was completed. The main purpose was to provide feedbacks on comments and suggestions solicited during the first round, and solicit comments and suggestions on the proposed mitigation measures.

In the 2nd round, the EIA consultant solicited comments and suggestions from the public through poster disclosure, interviews and seminars. At the same time, the draft EIA report was made available at places of public accessibility including offices of the PMO, EPB, relevant village committees, or street committees, relevant towns and townships and via online disclosure, etc.

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
Chun'an County Rural Drinking Water Safety Improvement	February 15 to February 27, 2017	Wangbu Township, Zitong Township, Fenkou Township, Anyang Township, Dushu Township, Langchuan Township, Jieshou Township, and Pingmen Township	Site visit and seminar	Project-related government agencies, village committee leaders and villager representatives, WTP representatives.	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Overall: supportive for the project and expecting early implementation of the Project. Some villagers raised questions and comments: (1) some water users are concerned whether the water price will increase; (2) Xiashan Village representatives consider building a WTP behind their village is ominous and will destroy their Fengshui of the village.	1. Timely communicate with the IA. According to the social survey, villagers are more concerned with drinking water safety and appropriate increase of the water price is acceptable. 2. With consideration of local customs and that villages and townships cannot reach an agreement, the design institute conducted site selection again and adjusted the project site.
Chun'an County Small Watershed Integrated Improvement	January 12 to January 25, 2017	Zhongzhou Township, Fenkou Township, Weiping Township, Jiangjia Township, Langchuan Township, Anyang Township, Zitong Township.	site visit and questionnaire survey	Project-related government agencies, village committee leaders and villager representatives	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Support the project and hope the project can be implemented as soon as possible. Try not to impact on water intake from the rivers and residents' daily water use.	Timely communicate with the FSR design institute and provide the feedbacks to the design institute. During construction, temporary measures with PVC pipes will be used to ensure residents' water use and agricultural water use. These requirements and measures will be integrated in EMP.

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
Chun'an County Dike Reinforcement and River Rehabilitation	February 15 to February 27, 2017	Wangbu Township, Zitong township, Fenkou Township, Anyang Township, Dashu Township, Langchuan Township, Jieshou Township, Pingmen Township	site visit and seminar	Project-related government agencies, village committee leaders and villager representatives	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Support the project and hope the project can be implemented as soon as possible. Try not to impact on water intake from the rivers and residents' daily water use.	Timely communicate with the FSR design institute and provide the feedbacks to the design institute. During construction, temporary measures, such as temporary cofferdams and soft pipes, will be used to ensure residents' water use and agricultural water use. These requirements and measures will be integrated in ESMP.
Chun'an County Forest Ecosystem Rehabilitation	February 17 to March 2, 2017	Qiandao Lake Township, Fenkou Township, Shilin Township, Dashu Township, Jiangjia Township, Zitong Township, Zhongzhou Township, Wenchang Township, Fengshulin Township, Linqi Township, Weiping Township, Lishang Township, Langchuan Township,	site visit seminar	Project-related government agencies, village committee leaders and villager representatives, and forest farm representative	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Main concern is the tree species to be planted.	Timely discuss with FSR design institute and pass them the feedback from the residents. Suggest that below are taken into consideration when selecting trees species : (1) Select local tree species to avoid biological intrusion and ecological system imbalance. (2) Consider economic tree species to increase the income of local people. In the project FSR, 49 tree species are selected.

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
		Anyang Township, Songcun Township, Jiukeng Township, Zuokou Township, Jinfeng Township, Fuwen Township, Jieshou Township, Fenkou Forest Farm, Xianshan Forest Farm.					
Chun'an County Agricultural NPS Pollution Control	Feb. 17 to March 2, 2017	Zitong Town, Weiping Town, Anyang Township, Jiangjia Town, Zhongzhou Town and Fenkou Town Government	site visit seminar	Heads of townships and towns and local villages, breeding farm owners	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	The public are supportive to the project and willing to participate in NPS pollution control; not adequately aware of agricultural NPS pollution control and desiring to get technical supports.	Training plan for pest management has been developed to strengthen technical training on agricultural NPS pollution control in the project area.
Jiande City Agricultural NPS Pollution Control	July 5, 2017	JDRC	seminar	Project-related government agencies in Hangtou Town, Shouchang Town and Datong Town, village committee leaders and villager	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	1. Add specialized staff to focus on project implementation. 2. Provide specialized training or introduce specialized talents when lacking specialized knowledge.	1. A PMO has been established in Jiande City to take lead in facilitating project implementation. 2. Training plan is already propose in in the ESMP.

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
				representatives			
	July 8, 2017	Subproject involved villages	site visit and questionnaire survey	Major farming practitioners	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	1. Apply for government subsidy; 2. Improve the distribution system; 3. Apply for technical support.	1. Major farms that will purchase organic fertilizer, soil testing equipment and insecticidal lamp will be subsided by the government. The villages encourage the talented people to develop leadership and negotiate with other villagers to apply for bulk sale discount from the township. 2. Use village as base unit. The company will deliver to the villages where further allocation will be arranged. 3. Staff from JAB and township agencies will organize training course or on-job training for major farms.
	July 10 to July 12, 2017	Livestock and poultry farms sites	site visit and questionnaire survey	19 farms involved	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Technical and financial support is needed from the government.	According to the Jiande Site-Specific Fertilizer and Commercialized Organic Fertilizer Promotion Implementation Rules, subsidy will be applied and paid. Professionals and government will provide technical support and financial subsidy, at the

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
							same time, farm owners will also take up some responsibility, and regulate the operation by means of propaganda, inspection, rewards and punishments mechanisms.
	July 15, 2017	JAB	Site interview	JAB staff	Consult the qualifications needed to enter the livestock farming industry. Provide technical support to the project implementation.	Provided Jiande Ecological Livestock Farming Development Plan; Fully cooperative in the project implementation and hold activities like specialist seminars, agricultural promotion personnel site demonstration, etc.; improve the farmer feedback mechanism (hotline, short text, anonymous mailbox, etc.)	Jiande Ecological Livestock Farming Development Plan was reviewed. The farms involved in the project are not located in the forbidden zone
	July 16, 2017	JEPB	Site interview	EPB approval division staff		1. Provide the environmental approval information. Farms without proper approval need to apply for such approval timely. 2. Jiande City Yitian Microbial Organic Fertilizer Co., Ltd. has not received any	Farmers having not fulfilled the procedure of approval of environmental protection are fulfilling the online registration formalities as required.

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
						public complaint since put into production and the various measures are substantially implemented and pollutant discharged according to the respective standards.	
	August 15, 2017	Jiande City	seminar	FSR Design Institute representative	Consult the disposal of manure.	Confirm that the manure will be collected and transferred to Jiande Yitian Microbial Organic Fertilizer Company for processing.	It has been confirmed that Jiande Yitian Microbial Organic Fertilizer Company will provide the comprehensive processing and disposal. It has been confirmed that the company has fulfilled the procedure of environmental protection approval and is capable of handling manure from the Project.
Jiande City Water Conservancy Facility Rehabilitation	July 5, 2017	JDRC	seminar	Project-related government agencies in Lijiazheng Township, Hangtou Township, Shouchang Township, Datong Township, Genglou Street, Xin'anjiang Community,	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Hoping that the project progress is accelerated; concerned about the environmental impacts in the construction stage of the project.	ECOP for River rehabilitation is developed to mitigate environmental impacts in the construction stage.

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
				village committee leaders and villager representatives			
Jiande City Landscaping Afforestation and Forest Form Improvement	July 5, 2017	JDRC	seminar	Project-related government agencies in Hangtou Town, Shouchang Town, Datong Town, Xin'anjiang Community, village committee leaders and villager representatives	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	1. Farmers are not proactive. Insufficient understanding on the project; 2. Some small farm might remove the ecological forest seedlings and replace with economic plants due to limited direct economic benefits. If their operation is not continuous or the labor shifted to other places, the land might be deserted again.	1. Village committee will further promote the project at its bulletin. If necessary, the village officers will visit households to coordinate. 2. Using methods of informing or training, provide the villagers information regarding functions of tree species matching, i.e. fire-fighting purpose. Relevant agencies will regularly inspect the forest management and maintenance personnel's work in terms of patrolling and conservation, and enhance performance evaluation.
	August 2, 2017	JFoB	seminar	FoB, Shouchang Forest Farm, Xin'anjiang Forest Farm	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Carefully select the tree species. Take integrated consideration of ecological functioning, landscaping and economic benefits.	Tree species selection should follow the principles of local, high-value and arbor priority. The local species should be mainly used. Without costing the ecological functioning, more high-value tree

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
							species should be used. Arbor species should be used when applicable. Considering the detailed ecological requirement in this project, the species selected include: Liquidambar formosana, Schima superba, Zhejiang camphor, Phoebe bournei, Zhejiang persimmon, Zelkova schnideriana, Sassafras, Betula luminifera, White oak, Csclerophylla, Michelia chapensis, Manglietia Manglietia, Slash Pine, Machilus pauhoi, Machilus leptophylla, Phoebe sheaneri, machilus thunbergii, Ilex micrococca, Mchella liliflora, Magnolia, Ginkgo and Pecan.
	August 3-5 , 2017	Datong Village Futang Village, Laocun Village, Datangbian Village, Hangtou Village	site visit and questionnaire survey	Affected villagers	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	Most surveyed villagers are willing to participate. However they have concerns on sapling cultivation and pest control. Some small part of villagers think they do not have labors to be used in here.	Project townships (forest farms) will establish construction service office, to provide coordination. If a pest issue occurs, will provide technical guidance through technical meetings. Tree planting will be conducted by

Table 9.3-1 Summary of comments and feedbacks for the first round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
							specialized contractors.
Jiande Municipal Engineering	July 5, 2017	JDRC	seminar	Project-related government agencies in Hangtou Town, Shouchang Town, Datong Town, village committee leaders and villager representatives	Introduction of project basic information and potential environmental impacts, and solicitation of public opinions and comments.	1. The project site selection should avoid acquisition of farm land and forest land; 2. The O&M issues for the wetland to be built.	1. Forest fire-fighting emergency pathway (Xin'anjiang Street to Yangxi Street section) is in place. This project will focus on upgrading the existing pathway in the woods. The Bailingkeng Reservoir climbing road in Hangtou Township will be aligned with the ridge. Therefore the existing elevations should be taken into consideration to avoid large amount of cutting and filling. 2. Upon completion, Hangtou Town Government will be responsible for management of the wetland and 2 personnel will be assigned to manage the wetland. Plants with long frost-free period and long growth period will be selected and special personnel will be assigned to harvest wetland plants and remove sediments on a periodical basis.

WRB: Water resource bureau; EPB: Environmental Protection Bureau; AB: Agricultural Bureau; FoB: Forestry Bureau; HCB: Housing and Construction Bureau; TCB: Telecommunications Bureau; JDRC: Jiande Development and Reform Commission

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
Chun'an County Rural Drinking Water Safety Improvement	September 13 to 15, 2017	Fenzhongzhou Township, Fenkou Township, Weiping Township, Jiangjia Township, Langchuan Township, Anyang Township, Zitong Township	seminar	Existing water treatment plants; affected hydropower station, Townships along the project area.	To understand the environmental approval status, sludge handling and disposal, sewer treatment and discharge in existing water treatment plants, the power generation of affected reservoir, and the fishery farms.	1. Affected hydropower stations think their power generation are affected by the water intake in this project, therefore request compensations. 2. The reservoirs involved has no freshwater fishery farming.	The IA negotiated with stakeholders and will compensate the power generation loss by paying for water resource at a price based on power generation cost.
	July 12, 2017	Chun'an Qiandao Lake Hotel	Seminar	Representatives from townships along the alignment, municipal WRB, EPB, AB, FoB, HCB, TCB, power company, water company and Pingshan WTP.		TCB: the pipeline alignment is long. During the design and construction, protection of underground cables should be taken into consideration. Power company: In Weiping Township the power cables have been moved to underground. During excavation, protection on the power cables should be taken into consideration. HCB: Qiandao Lake project does not involved any gas supply lines. Fuwen Township: Pingshan WTP pipeline extension project involves the county road (X704) and the provincial road (S06) which are planned to be retrofitted this year. It is suggested to pre-bury some	1. Protection on underground utilities: the design institute has discussed with different agencies and townships and collected information on the layout of different utilities including power, telecommunication, sewer and gas supply. During construction protection measures will be taken. 2. Traffic management during construction: the pipelines will cross provincial roads S06 (2 places), and S05 (3 places) using culvert with pipe jacking method. This is a trenchless method. When the pipelines cross county roads or township roads, temporary access roads will be used for detour. After construction is completed, the

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
						pipes during road retrofit to avoid frequent excavation. Pingmen Township: The raw water pipeline from Qiuyuanxi Weir to Pingmen WTP will go through some villages. It is suggested to integrate their water supply needs in this project. The pipeline will pass by County Road X727, where there is a tourism spot (Jiupaojie Scenery Area). During construction measures should be taken to avoid impact on traffic. Jieshou Township: The Jieshou WTP pipeline extension will involve Qianfeng Highway which has power cables under it. Cautions are needed. Fenkou Township: sewer pipelines are already in place for the villages. Cautions are needed during pipe laying. Zhongzhou Township: the power cable has been moved to underground. At the same time, sewer pipelines have been in place. During construction cautions are needed. Fengshuling: the Baima WTP pipeline is along the Daguan road which is going to be overhauled in the next years. It is suggested to integrate the	sites will be promptly restored to avoid impact on traffic. 3. Coordination between pipeline construction and road construction: will discuss with transportation authorities to synchronize the construction and avoid frequent excavation. 4. Jiupaojie Scenic Area: The construction contractor is required to make reasonable construction schedule to avoid peak hours of the scenic area and bypass road with adequate width should be provided during construction to allow large vehicle passage. Where bypass is unlikely, prior communication should be made with the scenic area and plans for temporary pick-up and delivery of tourists should be developed. Construction of the respective road section should be accelerated to minimize traffic impacts. 5. Early communication with transportation authority is required to realize integration of the subproject and the overhaul of Da-Guan Highway, the county highway (X704) and the provincial highway (S06) to avoid multiple excavations.

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
						construction to avoid frequent opening excavation.	
Chun'an County Small Watershed Integrated Improvement	September 13 to 15, 2017	Fenzhongzhou Township, Fenkou Township, Weiping Township, Jiangjia Township, Langchuan Township, Anyang Township, Zitong township	Site visit and seminar	Environmental, hydraulic and agricultural specialists, townships representatives, residents near the project area.	Dredging waste disposal; project construction impact on ecological system.	Support the project and hope the project can commence as soon as possible. Embankment subproject can help protect the environmental condition in the river channel.	
	October 31 to November 2, 2017	Zhongzhou Township, Yecunxi Village, Changgeng Village, Weishan Village, Sixia Village, Jiangjia Township, Zhangcun Village, Guocun Village, Yinfeng Village, Yejia Village, Muwang Village, Huangcunqiao Village, Fulin Village, Chicheng Village,	Site interview and questionnaire survey	Township governments for Zhongzhou Township, Jiangjia Township, and Weiping Township, village committee and villagers from Yecunxi Village, Changgeng Village, Weishan Village, Sixia Village, Zhangcun Village, Guocun Village, Yinfeng Village, Yejia Village, Muwang Village, Huangcunqiao Village, Fulin	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project and proposed mitigation measures.	1. The public is supportive to the project and approves the proposed environmental measures; 2. The design and construction of dike and embankment should take into consideration of local cultural and ecological sustainability. 3. The embankment and dike should match surrounding environment and material. The disposal should be handled together to avoid random piling which can induce soil erosion.	1. The environmental protection measured in the EMP will be strictly implemented. 2. The Embankment will adopt "slope" form, "gravity" form and "combined" form, which can present an ecological and water-front effect. The dike design will incorporate various typical features including "Long March Route", "stone house", "water", "plant", and "pebble", etc., to represent the local "red-culture", residential characteristics and life elements. 3. While excavated soil will be used in the dike and embankment construction, other materials will be acquired from

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
		Weiping Township, Sanzhou Village, Yejiayuan Village, Yangjiafan Village, Hongqi Village		Village, Chicheng Village, Sanzhou Village, Yejiayuan Village, Yangjiafan Village, and Hongqi Village			local market. The disposal will be stored at the designed disposal site. At the same time, the IA retained relevant parties to develop a soil erosion control plan.
Chun'an County Dike Reinforcement and River Rehabilitation	July 12, 2017	Chun'an Qiandao Lake Hotel	Seminar	Representatives from townships along the alignment, municipal WRB, EPB, AB, FoB, HCB, TCB, power company, water company and Pingshan WTP.	Public consultation on the key contents and conclusions of the EIA draft report to obtain their understanding and supports to the construction of the Project and the mitigation measures to be taken.	1. Ecologic environment will be take into consideration in dike reinforcement and river rehabilitation. 2. Disposal will be handled properly. Considering that the cost of shipping out will be high, it is suggested to be disposed locally.	1. In the design of main works, ecological design of dike and revetment is fully considered in terms of dike alignment and dike type selection. 2. Waste spoil is identified in the main works and water and soil conservation plan and stockpiled around the construction area with respective protection measures to minimize soil erosion in the project area. Soil erosion control measures are incorporated into the ESMP of the Project.
	September 13 to 15, 2017	Zhongzhou Township, Fenkou Township, Weiping Township, Jiangjia Township, Langchuan Township, Anyang	site visit	Residents near the project area.	Project impact on the infrastructure facilities on both sides of the river; handling of disposals; project impact on ecological system.	The residents in the surrounding area are supportive for the project and hope the project can be implemented as soon as possible. They also think dike reinforcement and river rehabilitation can help protect the river environment.	/

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
		Township, Zitong township, Fengshuling Township, Dashu Township, Linqi Township					
	October 30, 2017	Fenkou Township Government, Longyao Village, Longquan Village, Langchuan Township Government, Baojia Village and Huiyuan Village	questionnaire survey	Government staff, Village staff, and residents near the project area.	Survey on potential impacts on water environment, ambient air environment, sound environment, and traffic.	Survey results suggest that the local government and residents near the project are very supportive for the project and consider it positive facilitator to local economic development and environmental protection. At the same time, some suggestions are raised including that the disposal can be handled by the contractors, that local labor can be hired as construction worker, the dike or embankment design should integrate the local features and match the surrounding environment, etc.	1. The soil erosion control plan has confirmed the disposal handling plan, which is to be stored near project area with protection measures to control runoff. 2. It is suggested that contractors can hire some local labor as construction workers after proper training to increase the project social benefits. 3. The design of alignment and dike forms has taken into consideration actual river conditions. The designed embankment can combine the flood control function with landscaping function, reflect the harmonious relationship between human and nature by avoiding concrete structure, and integrate some water front function.
Chun'an County Forest Eco-system Restoration	August 28 to September 8, 2017	Fenkou Township, Dashu Township, Jiangjia Township, Zitong	Site interview, phone interview and questionnaire survey	Project involved government leaders, village committee leaders, villager representatives, forest farm leaders,	Conduct consultation on key contents and findings of the EIA draft to solicit comments and suggestions from	FoB: 1. In terms of technique, (1) herbicide is not allowed in forest; the forest biodiversity should be restored to keep ecological balance. (2)	Adopted. 1. In terms of technique, the EIA proposes: (1) Herbicide or other pesticides not allowed by the nation are forbidden.

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
		township, Zhongzhou Township, Wenchang Township, Fengshuling Township, Linqi Township, Weiping Township, Lishang Township, Langchuan Township, Anyang Township, Jiukeng Township, Zuokou Township, Jinfeng Township, Fuwen Township, Jieshou Township, Fenkou Forest Farm, Xianshan Forest Farm		FoB, and forestry specialist.	residents, village committee, FoB and Forestry specialists	promote use of low-toxicity low-residue and high-efficiency biomimetic product; (3) pesticide use should be target-oriented instead of random application. 2. In terms of management, (1) strengthen technical training to improve farmers' knowledge on pesticide; (2)promote joint prevention and treatment to improve performance; (3) recycle pesticide containers to reduce pollution sources.	(2) Promote use of bio-pesticide and low-toxicity low-residue and high-efficiency chemical pesticide. The details can be referred to the List of recommended pesticide in Pest Management Plan. (3) For different tree species and different pest types, different pesticide should be selected. The details can be referred to the List of recommended pesticide in Pest Management Plan. 2. In terms of management, the EIA proposes: (1) Technical training should be strengthened. Technical training of the respective contents is already proposed in the ESMP of the Project. The content training should include but not limited to the selection of forestry pests identification and pesticide selection, the safe use of pesticides, the emergency response, Joint prevention and treatment, etc.; training forms can include training courses, night schools and on-job training. (2) Joint prevention and control is an effective means of controlling pests and forestry diseases. Local forestry administrations should

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
							strengthen the monitoring and early warning system for pests and diseases, further solidify the monitoring network and technical service to promote joint prevention and control; (3) Combined with the initiative of harmless handling of pesticide packaging material promoted by the agricultural authorities to actively promote the recovery and harmless treatment of pesticide containers.
						Forestry specialists: 1. Considering the ecological functions of different types of vegetation, the objectives of the upgrade should be mainly evergreen broad-leaved mixed forests, and evergreen coniferous evergreen broad-leaved mixed forest. 2. Considering site-specific species. Different sites might fit for different tree species. Replanting under the pine forest should also consider the sunlight conditions and the stand closing situation. 3. Consider biodiversity. Currently, the existing broad-leaved regeneration species under pine forests are mainly Fagaceae species, Schima superba and Dalbergia	Adopted. 1. According to the current vegetation types and the succession of vegetation in Chun'an County, the upgrade objectives are mainly evergreen broad-leaved mixed forests and evergreen coniferous evergreen broad-leaved mixed forests. Tree species to be selected are mainly arbor (such as Liquidambar, Liriodendron chinensis formosum, Schima superba, Ruyuan Manglietia, camphor, etc.) 2. According to the characteristics of local soil water and fertilizer, the project selected Keteleeria cyclolepis, Chinese fir, Saucer magnolia, Ruyuan manglietia, Michelia figo, Machilus pauhoil, Phoebe chekiangensis, Litsea,

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
						davidiana. During the upgrade, attention should be paid to distinguish the existing regeneration species and make sure the replanting should be different from regeneration. 4. Replanting density. the number of trees for replanting, regeneration and thinned pine trees should generally exceed 100 per mu, to ensure that the broad-leaved tree canopy can close as soon as possible, and to achieve the effect of stratum afforestation . 5. Forest cleanup. With consideration of the uniformity of replanting and convenience for inspection and acceptance test, horizontal strip cleaning should be used, and the cleaning strength should not exceed 50% to facilitate the vegetation restoration. 6. When thinning the public interest forest, the strength should follow relevant regulations. 7. Some placed can only be access by boats; therefore the transportation cost of lumber or seedlings should be calculated differently. 8. The upgrade near tourism spot or major roads should also	Cinnamomum camphora, Csclerophylla, Castanopsiseyrei soapnut, holly and other tree species. 3. It is suggested that the FSR design institute further optimize the tree species selection, especially the replanting species under the pine tree should be different from the regeneration species.

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
						take into consideration of landscaping effect. 9. To avoid the spread-out of pine wilt disease, priority can be given to those areas bordering other counties in order to slow down the spread of the disease.	4. Based on the nature of existing trees at different places, the number of trees of replanting, regeneration and thinned pines is more than 95 per mu, largely meeting the requirements. 5. The EIA suggest horizontal strip cleaning with strength below 50% is used when conducting cleaning, so as to facilitate the vegetation restoration and keep the ecological balance. 6. The EIA requires that the public interest forest upgrade should follow relevant requirements in Measures for the Administration of Forest Harvesting and Regeneration, Measures for the Administration of Public Interest Forests in Zhejiang Province, and Forest Law of the People's Republic of China . 7. It is suggested that the transportation cost should be considered when the design institute and IA are developing the project cost budget. 8. The forest upgrade along lakes in the project should take consideration of overall landscaping effect to further improve the landscaping

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
							resource and tourism experience in Qiandao Lake Scenery Area. 9. The EIA suggest forest management agencies in Chun'an County should work closely with neighboring cities and counties to promote cross-county joint prevention and control.
						Village committee: select tree species with better economic benefits.	Adopted. During the FSR design, the economic tree species have been considered. For the Mangganshan upgrade, some feasible land will be upgraded with economic tree species. The selected species include pecan, camellia, tea, bayberry, ginkgo, and Chinese mahogany.
						Townships: Strengthen knowledge training	Adopted. According to previous questionnaire survey and site visit, there is not much training available on forestry pest control. The local people are proactive in participating such trainings. PMP has proposed trainings on pest control and pesticide application.
Chun'an County Agricultural NPS Pollution Control	August 25 to September 7, 2016.	Zitong township, Weiping Township, Anyang Township, Jiangjia	questionnaire survey	Project-related government agencies, village committee leaders and villager representatives.	Introduce project basic information and potential environmental impacts, and solicit public comments and	1. The public are supportive for the project and are willing to participate in the NPS Pollution Control. 2. The awareness of NPS is not sufficient, therefore	1. Adopted. Will implement as soon as possible. 2. Adopted. The project design will include training for pesticide application and safety. 3. Adopted. The FSR design

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
		Township, Zhongzhou Township and Fenkou Township Governments			suggestions.	technical support is needed. 3. Farmers hope the project coverage can be expanded so that more villagers can benefit from the project. 4. Agricultural material shop raised that the hazardous waste unit do not timely collect the pesticide package waste and keep it stored for long time. Surrounding residents are not happy with it. 5. Farmers hope the subsidy can be increased to reduce burden on farmers and increase the benefits they can get from the project. 6. Base level agricultural technicians are over-aged and understaffed. 7. Farmers raised that the quota of 1 tons per mu is too low, especially for the new claimed land and newly opened wasteland. For the subsidy, the qualification threshold should be lowered. The usage should be increase no matter it is formula fertilizer or organic fertilizer. 8. Suggest the government to give priority to local fertilizer manufacturing enterprises in the procurement. 9. The project will involve many household, thus the	has expanded the scope of soil erosion control by lowering the threshold of contiguous orchid and tea garden from 50 mu or above to 30 mu. 4. Adopted. The FSR design will enhance this are by improving the policy development and management organization development. 5. Adopted. The FSR design increased the subsidy for soil erosion control from 100 RMB/mu to 130 RMB/mu. 6. Adopted. For the village level agricultural technology promotion, the task force should include village level forest technician. If no new personnel can be included, the current forest technicians will be subsided and included in the cost budget. 7. Not adopted. The dosage should be based on the site-specific testing and safety usage. 8. Adopted. Priority has been given to local enterprises. 9. Adopted. The design will include village level agricultural technology promotion task force development. 10. Not adopted. Agricultural film is not hazardous waste. It is suggested to collect and handle

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
						workload is very heavy. The staffing should be adjusted based on work load. 10. For agricultural waste recycling and harmless treatment, in addition to pesticide and fertilizer package waste, agricultural film should also be included. 11. It is suggested to increase the popularization and application of grass mowing and covering technology in orchard and tea garden. 12. The public raised that the organic fertilizer has low efficiency, slow performance, large usage, low subsidies; therefore they are not excited about it.	as general waste. 11. Adopted. The soil erosion control plan has already included promotion of measures including mowing (manual or machine-driven) and mowing waste returning, and "grass for grass control", etc. 12. Adopted. By strengthening organize fertilizer supervision, use public campaigns to guide farmers' opinion and behavior change.
Jiande City Agricultural NPS Pollution Control	November 1, 2017	Subproject involved villages	site visit and questionnaire survey	Major farming practitioners	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project and proposed mitigation measures.	1. The public is supportive to the project and approves the proposed environmental measures; 2. Hope the qualification requirements can be lowered to expand the project scope.	The EIA has proposed relevant environmental mitigation measures. In the next stage these measures will be strictly implemented. It is encouraged to use village as base unit to apply together for discount from townships.
	November 2, 2017	Livestock and poultry farms sites	site visit and questionnaire survey	19 farms involved	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project	1. The public is supportive to the project and approves the proposed environmental measures; 2. Hope there is a feedback mechanism to solve technical issues that might emerge	1. Strictly implement environmental protection measures. 2. During project implementation, village level information management personnel will collect comments

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
					and proposed mitigation measures.	during operation.	and transfer to stakeholders such as the township agricultural technology department and FoB for feedback.
	October 28, 2017	JAB	Site interview	JAB staff	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project and proposed mitigation measures.	1. The public is supportive to the project and consider the project necessary; 2. The public approves the proposed environmental measures.	Strictly implement environmental protection measures.
Jiande City Water Conservancy Facility Rehabilitation	November 2, 2017	Villages along the river basin	site visit	Villagers from the villages along the river basin	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project and proposed mitigation measures.	1. The public is supportive to the project and approves the proposed environmental measures; 2. Suggest to speed up construction and try complete as soon as possible.	1. Strictly implement environmental protection measures. 2. Try to commence as soon as possible and strictly follow design requirements and construction method design to implement pollution control measures and to complete the construction in one take instead of repetitive attempts. Complete and put into operation of the facility as early as possible.
Jiande Municipal Engineering	Sept. 10, 2017	Lovers' Valley Scenic Area	Site interview	Lovers' Valley Scenic Area	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project and proposed mitigation measures.	Reduce the impact on tourist during construction.	Reasonably arrange construction schedule to avoid rush hours at the tourism spot, install temporary access road to ensure smooth traffic at the tourism spot.
	September 11, 2017	Hangtou Bailingkeng Water Company	Site interview	Hangtou Bailingkeng Water Company		1. Avoid impact on the water quality in Bailingkeng Reservoir during construction; Make reasonable alignment	1. Detailed measures in construction include: (1) Construction site should have pipeline or ditches to

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
						assessment for the climbing road by strictly following the Drinking water source protection zone pollution prevention and control regulations.	collect different wastewater. Special sedimentation tank and oil separation tank should be used to treat the wastewater before being reused. (2) Material storage should be kept away from water bodies. Lime and cement should not be exposed and should have cover to avoid being washed away by runoff. Intercepting ditch should be arranged surrounding the storage site. 2. Alignment adjustment. The adjusted alignment will not involve the Class I protection zone of the water source protection area.
	Aug. 12, 2017	Jiande City	seminar	FSR Design Institute representative		1. Will adopt temporary access bridge for villager's travel use during construction. For the A2O tanks, use containment with manhole for O&M use. Use collection pipes to convey the odorous air to the odor removal system. For the sludge condensing tank, cover will used on the tank. The waste air will also be sent to the odor removal system, and then be discharged through stack. Biological methods will be used for odor removal.	Adjusted the climbing road alignment to avoid the Class I protection zone of the water source protection area.
	September	Panshan Village,	site visit and	Affected villagers		1. How to handle residents'	1. Install temporary access

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
	15, 2017	Qingtan Village, Chaoyang Village, Futang Village, and Zhenyuan Village	questionnaire survey			travel issues during construction; 2. Reduce the construction duration as much as possible to reduce impact on daily life; 3. Compensate on temporary land acquisition.	bridge for villages' travel use; 2. Speed up the construction progress and reduce the duration. Reasonably arrange the construction schedule and forbid construction activities between 11PM and 6AM the next day. Spray water to quench flying dust. When possible avoid exposure of piled lime and sand. 3. Pay compensation fee for temporary land use according to national policy.
	October 25, 2017	Hecun Village	site visit and questionnaire survey	Hecun Villager		Support the development of WWTP. Measures should be taken to handle the odors problem.	For the A2O tanks, use containment with manhole for O&M use. Use collection pipes to convey the odorous air to the odor removal system. For the sludge condensing tank, cover will used on the tank. The waste air will also be sent to the odor removal system, and then be discharged through stack. Biological methods will be used for odor removal. The project boundary and Hecun Village odor concentration will be able to meet relevant standards.
	November 1, 2017	Panshan Village, Qingtan Village, Chaoyang Village, Futang Village and Zhenyuan Village	site visit	Affected villagers		1. The public is supportive to the project and approves the proposed environmental measures; 2. Strengthen management of contractors to ensure engineering quality.	1. Strictly implement environmental protection measures. 2. Carefully select contractors for the project from those with good reputation and high quality. During construction strengthen

Table 9.3-2 Summary of comments and feedbacks for the second round of public consultation

Subproject Name	Time	Location	Consultation method	Objects	Content	Public comments/opinions	Feedback to public comments
							supervision.
	November 1, 2017	Nanba Village	site visit	Villagers from Nanba Village	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project and proposed mitigation measures.	1. The public is supportive to the project and approves the proposed environmental measures; 2. Arrange designated personnel to conduct O&M to avoid stinking odor from decomposed plants.	1. Strictly implement environmental protection measures. 2. Hangtou Town Government will be responsible for the wetland and assign 2 special personnel to be responsible for wetland management and regularly harvest wetland plant and remove sediments to eliminate odor.
Jiande City Landscaping Afforestation and Forest Form Improvement	2017.8.12	Jiande City	Seminar	Responsible persons of FS consultant	Conduct consultation on key contents and findings of the EIA draft to seek understanding and support from the public on the project and proposed mitigation measures.	Native, precious and arbor species should be selected in the FS.	/
	2017.9.2	Jiande City Forest Fire Protection Station	Site interview	Key responsible persons and sector specialists		Concerned about the selection and matching of tree species and whether a fire belt is formed. Concerned about whether a forest fire alarm system is constructed.	1. Fire-resistant trees, such as Schima superba, Liquidambar, camphor, are to be planted and a fire belt should be excavated in the afforestation site. 2. A GIS forest fire interactive commanding, control and alarm system and fire protection reservoirs will be provided.
	November 1, 2017	Datong Village, Futang Village, Laocun Village, Datangbian Village, and Hangtou Village	site visit	Affected villagers		The public is supportive to the project and approves the proposed environmental measures;	Strictly implement environmental protection measures.

9.4 Information Disclosure

According to requirements in the Interim Measures for Public Participation in Environmental Impact Assessment, the Environmental Information Disclosure Measures (Trial) and the World Bank OP / BP4.01 (Environmental Assessment), BP 17.50 (Information Disclosure), the Project disclosed relevant information by means of online disclosure and field posters, and distributed the EIA report and EMP report at places with easy public access, including the PMO office, the EPB, the EIA consultant, and the concerned towns / townships. See detail in Table 9.4-1.

Table 9.4-1 Time, Location and Methods of Information Disclosure

Round	Subproject	Method	Time	Location	Content of disclosed information
Round 1	Chun'an County Rural Drinking Water Safety Improvement	Poster	12 January to 25 January, 2017	Street offices and administrative villages of local towns and townships in the subproject area	Content: (1) Project overview; (2) EIA procedure and content; (3) Channels and deadlines for public access to the ESIA report; (4) Deadlines for public comments; (5) Contact information, including mailing address, postal code, phone number, fax number, contact person and email address etc. for the IA and the EIA consultant.
	Chun'an County Small Watershed Integrated Improvement	Poster	12 January to 25 January, 2017	Zhongzhou Town, Fenkou Town, Weiping Town, Jiangjia Town, Langchuan Township, Anyang Township, Zitong Town and the related administrative villages	
	Chun'an County Dike Reinforcement and River Rehabilitation	Poster	12 January to 25 January, 2017	Street offices and administrative villages of local towns and townships in the subproject area	
	Chun'an County Forest Eco-system Restoration	Poster	24 February to 9 March, 2017	Qiandaohu Town, Fenkou Town, Shilin Town, Dashu Town, Jiangjia Town, Zitong Town, Zhongzhou Town, Wenchang Town, Fengshuling Town, Linqi Town, Weiping Town, Lishang Township, Langchuan Township, Anyang Township, Songcun Township, Jiukeng Township, Zuokou Township, Jinfeng Township, Fuwen Township, Jieshou Township, Fenkou Forest Farm and Xianshan Forest Farm, etc.	
	Chun'an County Agricultural NPS Pollution Control	Poster	17 February to 2 March, 2017	Tong Town, Weiping Town, Anyang Township, Jiangjia Town, Zhongzhou Town and Fenkou Town governments	

Table 9.4-1 Time, Location and Methods of Information Disclosure

Round	Subproject	Method	Time	Location	Content of disclosed information
	Jiande City Agricultural NPS Pollution Control	Poster	4 July to 15 July, 2017	Hangtou Town, Shouchang Town, Datong Town	
	Jiande City Water Conservancy Facility Rehabilitation	Poster	4 July to 15 July, 2017	Hangtou Town, Shouchang Town, Datong Town, Xin'anjiang Community	
	Jiande City Landscaping Afforestation and Forest Form Improvement	Poster	4 July to 15 July, 2017	Hangtou Town, Shouchang Town, Datong Town, Xin'anjiang Community, Jiande Forest Farm	
	Jiande City Municipal Engineering	Poster	4 July to 15 July, 2017	Hangtou Town, Datong Town, Xin'anjiang Community and Yangxi Community	
Round 2	Chun'an County Rural Drinking Water Safety Improvement	Poster	30 August to 12 September, 2017	Zhongzhou Town, Fenkou Town, Weiping Town, Jiangjia Town, Langchuan Township, Anyang Township, Zitong Town and the related administrative villages	Content: (1) Project background; (2) Potential environmental impacts; (3) Measure for avoiding or mitigating the impacts; (4) Main conclusions of EIA;
		Website	30 August to 12 September, 2017	http://www.zdwp.net/	
	Chun'an County Small Watershed Integrated Improvement	Poster	30 August to 12 September, 2017	Zhongzhou Town, Fenkou Town, Weiping Town, Jiangjia Town, Langchuan Township, Anyang Township, Zitong Town and the related administrative villages	
		Website	30 August to 12 September, 2017	http://www.zdwp.net/	

Table 9.4-1 Time, Location and Methods of Information Disclosure

Round	Subproject	Method	Time	Location	Content of disclosed information
	Chun'an County Dike Reinforcement and River Rehabilitation	Poster Website	30 August to 12 September, 2017	Street offices and administrative villages of local towns and townships in the subproject area	(5) Channels and deadlines for public access to the ESIA report; (6) Scope and items for public consultation; (7) methods for public comments; (8) Contact information; and (9) the full reports of the EIA and EMP.
			30 August to 12 September, 2017	http://www.zdwp.net/	
	Chun'an County Forest Ecosystem Restoration	Poster	28 August to 8 September, 2017	Qiandaohu Town, Fenkou Town, Shilin Town, Dashu Town, Jiangjia Town, Zitong Town, Zhongzhou Town, Wenchang Town, Fengshuling Town, Linqi Town, Weiping Town, Lishang Township, Langchuan Township, Anyang Township, Songcun Township, Jiukeng Township, Zuokou Township, Jinfeng Township, Fuwen Township, Jieshou Township, Fenkou Forest Farm and Xianshan Forest Farm, etc.	
	Jiande City Agricultural NPS Pollution Control	Poster	25 August to 7 September, 2016	Tong Town, Weiping Town, Anyang Township, Jiangjia Town, Zhongzhou Town and Fenkou Town governments	
	Jiande City Agricultural NPS Pollution Control	Poster	25 July to 5 August, 2017	Hangtou Town, Shouchang Town, Datong Town	
	Jiande City Water Conservancy Facility Rehabilitation	Poster	25 July to 5 August, 2017	Hangtou Town, Shouchang Town, Datong Town, Xin'anjiang Community	
	Jiande City Landscaping	Poster	25 July to 5 August, 2017	Hangtou Town, Shouchang Town, Datong Town, Xin'anjiang Community, Xin'anjiang Forest Farm,	

Table 9.4-1 Time, Location and Methods of Information Disclosure

Round	Subproject	Method	Time	Location	Content of disclosed information
	Afforestation and Forest Form Improvement			Shouchang Forest Farm	
	Jiande City Municipal Engineering	Poster	25 July to 5 August, 2017	Hangtou Town, Datong Town, Xin'anjiang Community and Yangxi Community	

9.5 Public Participation for Social Impact Assessment

9.5.1 Public participation activities already implemented

Since February 2017, a series of public participation and public consultation activities (involving a women participation rate of about 30%) have been carried out for the preparation of the Resettlement Plan by the resettlement consultants, Hohai University, and the World Bank experts and the project designer. Public participation activities already implemented under the Project are shown in detail in Table 9.5-1.

Table 9.5-1 Public participation activities already implemented under the Project					
Project component	**Time**	**Place**	**Participants**	**Issues raised in APs feedbacks**	**Measures**
Small watershed improvement	Feb. 2017 to July 2017	Chun'an County WRB	Chun'an County World Bank Loan Project Leading Group, survey agency staff, LRB, WRB, WRS and representatives of towns and townships, village leaders and APs	Compensation standard for permanent land acquisition and temporary land occupation; quality of reclaimed land	Timely disclosure of compensation standards for permanent land acquisition and temporary land occupation; centralized stockpiling and backfill of top soil in temporary land occupation; implementing the EMP strictly according to the requirements in the EIA report.
Dike reinforcement and river rehabilitation				Treatment of construction wastewater and solid wastes in the construction stage	Strictly requiring the construction teams to discharge construction wastewater according to the environmental protection requirements; removing construction wastes periodically and cleaning domestic solid wastes on a daily basis; implementing the EMP strictly according to the requirements in the EIA report.
Rural drinking water safety improvement	Feb. 2017 to July 2017	Chun'an County WRB	Chun'an County World Bank Loan Project Leading Group, survey agency staff, LRB, WRB, WRS and representatives of towns and townships, village leaders and APs	Young crop compensation standard; tomb relocation procedure and cost; temporary employment; quality assurance of reclaimed land; construction time	Timely disclosure of resettlement information booklet; Policy promotion by LRB and RP development agency; negotiating with APs on tomb relocation procedure; centralized stockpiling and backfill of top soil in

Table 9.5-1 Public participation activities already implemented under the Project					
Project component	**Time**	**Place**	**Participants**	**Issues raised in APs feedbacks**	**Measures**
					temporary land occupation; implementing the EMP strictly according to the requirements in the EIA report.
				Noise impacts in the construction stage	Strictly requiring the construction contractor to carry out construction works within the specified time frame; night construction is prohibited; construction behaviors affecting normal life of villagers must be put to an end; implementing the EMP strictly according to the requirements in the EIA report.
Municipal engineering facility construction	Feb. 2017 to March 2017	Jiande City DRC	PMO, Shouchang Town, Hangtou Town and Datong Town government, Xin'anjiang Community, APs, village leaders and technicians	Compensation standard for permanent land acquisition and temporary land occupation; quality of reclaimed land	Timely disclosure of compensation standards for permanent land acquisition and temporary land occupation; centralized stockpiling and backfill of top soil in temporary land occupation; Timely disclosure of compensation standards and complaint channel;
				Treatment of construction wastewater and solid wastes in the construction stage	implementing the EMP strictly according to the requirements in the EIA report. Strictly requiring the construction teams to discharge construction wastewater according to the environmental protection requirements; removing

Table 9.5-1 Public participation activities already implemented under the Project					
Project component	**Time**	**Place**	**Participants**	**Issues raised in APs feedbacks**	**Measures**
					construction wastes periodically and cleaning domestic solid wastes on a daily basis;
Water conservancy facility rehabilitation	Feb. 2017 to June 2017	Hangtou Town	Affected villagers	Young crop compensation standard; temporary employment and quality assurance of reclaimed land	Timely disclosure of resettlement information booklet; Policy promotion by LRB and RP development agency; centralized stockpiling and backfill of top soil in temporary land occupation; implementing the EMP strictly according to the requirements in the EIA report.

WRB = water resources bureau; LRB = land and resources bureau; WRS = water resources station; APs = affected p[persons; DRC= development and reform committee

9.5.2 Public participation plan during implementation

In order to address the difficulty and needs of resettlement of the APs in an appropriate and timely manner, public consultation will be conducted prior to the commencement of the construction works and implementation of the RP so that all the problems are addressed. The IA should make proper arrangements for meetings on the LAR issues. Each AP should have opportunity to negotiate about the matters in the compensation agreement with the resettlement implementation agency before such agreement is signed. Table 9.5-2 indicates the public consultation plan and process. Table 9.5-3 includes the community participation plan in the implementation stage of the Project. Table 9.5-4 includes the community participation plan in the monitoring stage of the Project.

APs are encouraged to participate in the various LAR activities in an active way so as to smoothly and successfully implement the RP. Construction of the Project will generate certain impacts on local residents. To assure that APs can benefit from the Project, the local residents and staff are encouraged to actively participate in the construction of the Project. It is necessary to consider the local residents and workers and provide them with necessary aids in terms of employment of labor.

Table 9.5-2: Public Participation Plan

Objectives	Method	Time	Unit	Participant	Issue
Safeguarding APs rights and interests	Villagers' conference	September 2017	Affected villages	Affected farmers	Setting up an organization to safeguard APs' rights and interests comprising of 3-5 representatives from the respective village; following the principle of self-will; women and senior citizen participation is required.
Publishing land acquisition announcement	Village bulletin board and villager meetings	October 2017	County/city PMO, survey agency staff, LRB and town/township, village leaders	All APs	Disclosing information on land acquisition area, compensation standard and resettlement approach, etc.
Verifying resettlement impacts	Site survey	February 2018	County/city PMO, survey agency staff, LRB and town/township, village leaders	All APs	1) Identifying gaps and confirming final impacts; 2) Developing the asset schedule to show the land acquisition and losses for the APs; 3) Preparing the basic covenants of the compensation agreement.
Publishing LAR compensation program	Village bulletin board and villager meetings	December 2017	County/city PMO, survey agency staff, LRB and town/township, village leaders; Project villager support team; bank responsible for fund disbursement	All APs	Compensation fund and disbursement method; issuing information manual; introducing project contents, commencement time and compensation standard, etc.
Introducing grievance redress mechanism	Villagers' representative meetings	December 2017	County/city PMO, LRB and township government, village committees	All APs	Introducing the grievance redress mechanism
Developing and implementing income restoration plan	Villager meetings (multiple)	Prior to implementation	County/city PMO, survey agency staff, LRB and town/township, village leaders	All APs	Discussing final income restoration program and compensation fund use plan;
Training plan	Villagers' conference	November 2017 ~ May 2018	IA, LSSB, town/township, village leaders	All APs	Discussing training needs
Monitoring	Meetings with villager participation	February 2018 ~ February 2019	External resettlement monitoring agency, town/township, village leaders	All APs	1) Progress and impacts of resettlement; 2) Disbursement of compensation fund 3) Information disclosure 4) Restoration of livelihood and production; resettlement of demolished houses

Table 9.5-3 Community Participation Plan in the Implementation Stage of the Project						
SN	Key activities	Contents	Method	Key participants	Responsible agency	Remarks
1	Establishing community project management team	Determining team members, electing responsible person, conducting and organizing training; selecting and managing construction workers participating in the Project, safeguarding social security on construction sites, coordinating stakeholders and giving feedbacks on villager opinions.	1. Community/village conference; 2. Community/villager representative meetings 3. Community project management team meeting (including representatives of poor households, APs, women and special groups)	1. All community members; 2. Community / village committee 3. Project owner 4. PMO 5. Community project management team	County PMO, project owner, community/village committee, community project management team	Assistance required from villages
2	Conducting training	1. Strengthening general training on national and local environmental indicators and environmental protection laws and regulations; 2. Conducting training on NPS pollution, forest form improvement, river rehabilitation, water fund, etc.; 3. Introducing to the public WWTP treatment technologies to relieve them from concerns on similar projects.	1. Community / village conference 2. Posters, brochures, radio, TV, slogans, leaflets	1. All community members; 2. project owner 3. County PMO; 4. EPB, AB, WRB, FB, etc. 5. Community project management team		Assistance required from publicity authority, education bureau, EPB, radio and TV bureau, newspaper office, community/town or township, residential committee / villages
		Occupational skill training for land-lost groups, women and poor population to enable them to participate in and get paid from the project construction.	Training workshops for special groups	1. Land-lost farmers; 2. Women; 3. Poor population; 4. Owner; 5. PMO;		

				6. LSSB; 7. CAB; 8. Community project management team		
3	Project construction	1. Making sure positions available from the project construction; 2. Determining the criteria for selection of construction workers, including AP, poor households, women; 3. Determining wages for participating in project construction; 4. Technical training and safety requirement training for project participants 5. Participating in project construction	1. Community member meeting 2. Community representative meeting 3. Participating in project construction	1. Members participating project construction, including APs, women, poor households; 2. PMO; 3. Project owner; 4. Project EA; 5. Community project management team		

Table 9.5-4 Community Participation Plan in the Monitoring Stage of the Project

SN	Key activities	Contents	Method	Key participants	Responsible agency
1	Village/community project monitoring team	1. Periodical environmental monitoring (monthly); 2. Monitoring of livelihood restoration of APs (monthly); 3. Monitoring of restoration of natural environment after project is completed (monthly).	1. Community/village conference 2. Community/villager representative meeting 3. Community project monitoring team (including poor families, APs, women and representatives of special group)	1. All community members; 2. Community / village committee 3. Project owner 4. PMO; 5. Community project monitoring team	PMO, project owner, community project monitoring team
2	Training	Monitoring and evaluation skill training (2 per quarter)	Village / Community project monitoring team	1. Village / Community project monitoring team 2. PMO 3. Project owner	
3	Comments and complaints	1. Printing and circulating “Project Complaint and Suggestion Sheets” to each villager group so that the villagers can express their opinions conveniently; 2. Opening complaint hotlines at county PMO; 3. Community monitoring team collects opinions and comments from farmers in the project area from time to time.	Project complaints and suggestions sheets, complaint phone calls	1. Village / Community project monitoring team 2. All community members; 3. PMO and project owner	Village / Community project monitoring team, PMO

10. Environment Management Plan

10.1 Environmental and Social Management System

Jiande Municipal Environmental Protection Bureau is responsible for the review and approval of Jiande Subproject while Chun'an County Environmental Protection Bureau is responsible for review and approval of Chun'an County Subproject according to the administrative authority stipulated in the Law of the People's Republic of China on Environmental Protection and the Regulations on Environmental Protection Management of Construction Projects. As the environment management agency of the respective subprojects, Jiande Municipal Environmental Protection Bureau and Chun'an County Environmental Protection Bureau are respectively responsible for proposing environmental protection requirements based on the contents of the EIA Report of the Project, coordinating the environment management work of the various departments and organizing the "three-simultaneousness" acceptance of the environmental protection facilities. The World Bank Loan Project Management Office is responsible for managing the implementation of the entire Project while the Project Owner is responsible for implementing the various specific activities under the general administration framework of the Project. In order to assure smooth implementation of the environment management activities of the Project, a number of full-time or part-time environment management personnel are assigned in the PMO, the Project Owner, the Contractor and the Operator to implement the Environment Management Plan.

10.1.1 Environment Management Agency

As the environment management activities of the Project in the construction stage are significantly different from those in the operation stage and such activities are either short-term or long-term in terms of their deadlines, the Contractor and the Operator should set up separate organizations to take the responsibility for different stages. As the construction stage ends, the management organization of the construction stage will be cancelled while that of the operation stage will start to operate, with a certain overlapping period allowed based on the progress of the specific management activities.

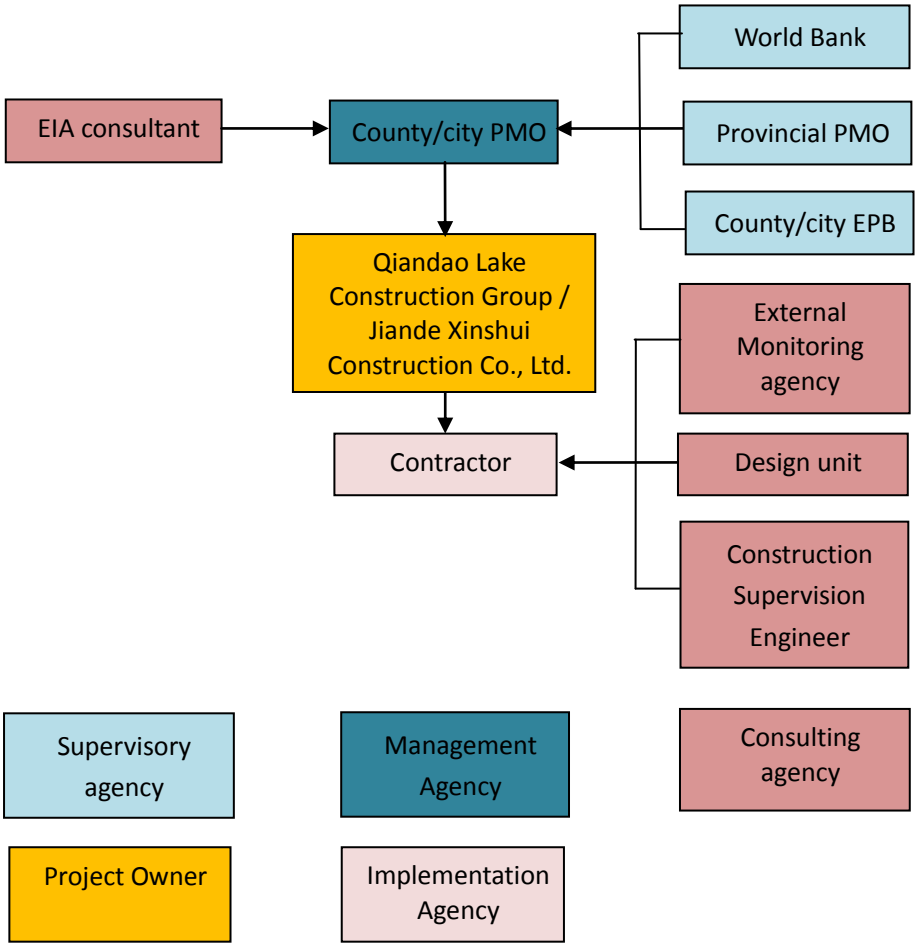


Figure 10-1: Schematic Diagram of the Environment Management Agencies in the Construction Stage of the Project

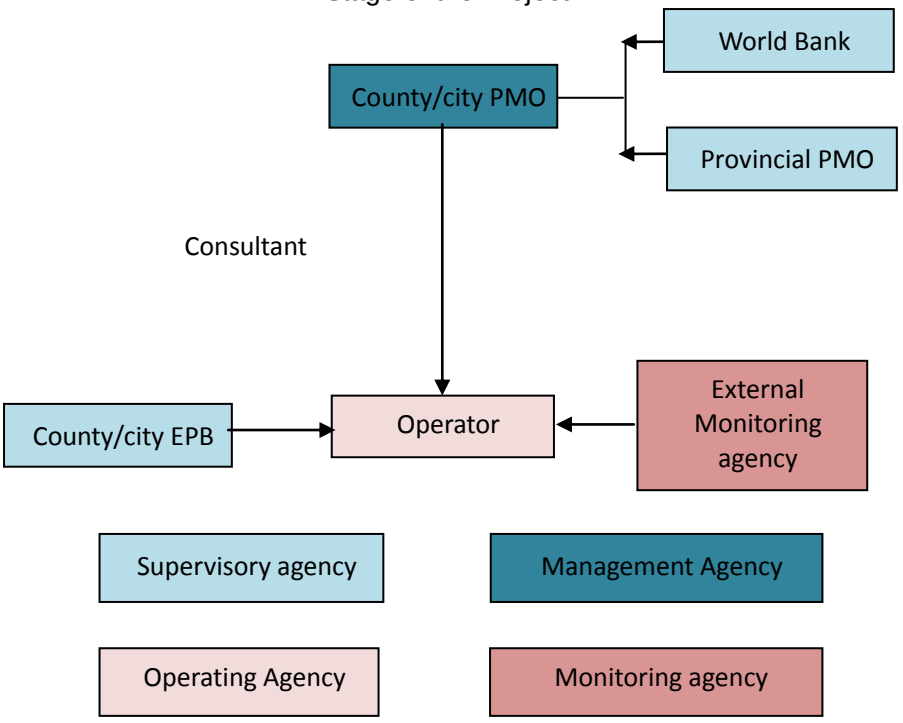


Figure 10.1-2: Schematic Diagram of Environment Management Agencies in the Operation Stage of the Project

10.1.2 Responsibilities and Contents of Environment Management

The contents of environment management in the construction stage are remarkably different from those in the operation stage of the Project and the EMP is implemented by different responsible departments. Table 10.1-1 shows the contents and staffing of each environment management agency for environment management work in different stages.

Table 10.1-1 Contents of Environment Management in Different Stages

Stage	Project stakeholders	Key Environment Management Responsibilities	Staffing
Design and preparation	County / city PMO	Contacting and coordinating with the competent government department of environment management for implementation of the environment management matters;	2
	Project Owner	1. Responsible for a series of environmental protection management work in the design and preparation stage of the Project; 2. Securing the fund needed for the environmental protection work; 3. Responsible for coordinating with the competent government department of environment management for implementation of the environment management matters; 4. Recruiting supervision engineer and collecting records.	3
	Designer	1. Incorporating the environmental protection measures into the design program and budget; 2. Incorporating the EMP mitigation measures into the technical specifications of the bidding documents.	3
	EIA consultant	1. Providing technical support to the environmental protection work included in the project design; 2. Preparing the EIA documents of the Project; 3. Development of EMP.	5
	County / city EPB	1. Responsible for review and approval of EIA Report of the Project; 2. Responsible for the routine environment supervision and management work of the Project.	2
Construction stage	Project Owner	1. Responsible for a series of environmental protection management work in the construction stage of the Project and securing the fund needed for the environmental protection work; 2. Managing and supervising the environmental protection work in the construction stage and investigating into and handling problems of public disturbance or pollution arising in the construction process; 3. Responsible for coordinating with the competent government department of environment protection for implementation of the environment management matters; 4. Following up with the execution status of the EMP and reporting on a periodical basis to the competent government department of the same level, the PPMO and the World Bank ;	3

Table 10.1-1 Contents of Environment Management in Different Stages

Stage	Project stakeholders	Key Environment Management Responsibilities	Staffing
		5. Accepting and handing public complaints.	
	Contractor	1. Preparing the Site Environment Management Plan based on the EMP to become part of the outcome based technical specifications of the contracts; 2. Implementing the environmental protection responsibilities under the contract (as specified in the Site Environment Management Plan), including the environmental, social and health and safety measures; 3. Accepting guidance and supervision by the environment management personnel of the Project Owner, the construction supervision engineer and the related government departments; 4. Accepting technical supports provided by the environmental protection consulting agency; 5. Implementing safety protection measures, e.g. erecting signs and fences on the boundary of construction sites, setting up channels of public communication and assuring construction safety.	3
	Construction Supervision Engineer	1. Supervising the contractor's execution of the contract and the Site Environment Management Plan and carrying out the environment mitigation measures in the construction contract; 2. Carrying out site supervision of the implementation status of the Contractor; 3. Assisting the EA in carrying out the environment management work; 4. Keeping records of and developing and submitting to the Project Owner on a periodical basis EMP execution status reports.	5
	Environmental Monitoring Agency	1. Carrying out the environmental monitoring work of the construction stage and operation stage of the Project based on the authorization of the Project Owner and the environmental monitoring plan included in this EIA report; 2. Conducting the monitoring activity under the authorization of the Project Owner in case of any abnormalities in the construction process.	Depending on the scope of authorized assignment
	County/city EPB	1. Supervising and inspecting the environmental protection measures of the Project Owner and the Contractor; 2. Receiving EMP execution reports submitted by the Project Owner and the PMO and performing the administration functions based on such reports; 3. Arranging emergency response actions in the event of any abnormal environmental conditions in the construction process; 4. Accepting and coordinating the handling process of public complaints.	2
	Technical Assistance / Consultant	1. Providing technical supports to the environmental protection work in the construction stage of the Project according to the authorization of the Project Owner and this EIA Report as well as the	Unlimited

Table 10.1-1 Contents of Environment Management in Different Stages

Stage	Project stakeholders	Key Environment Management Responsibilities	Staffing
		environmental protection design outcomes; 2. Providing the contractor with technical guidance on the environmental protection work and properly carrying out the environmental protection training work in the construction stage of the Project.	
Operation stage	Project Owner or Operator	1. Responsible for the post-operation management work of environmental protection and implementing the mitigation measures and monitoring of the EMP in the operation stage; 2. Responsible for contacting and coordinating with the competent government department about the implementation of the environment management matters; 3. Making emergency responses to environmental accidents; 4. Providing periodical staff training to enhance their competence and actively organizing activities for exchange of environmental protection technology and experiences to further improve the management work of environmental protection.	3
	Environmental Monitoring Agency	1. Carrying out the environmental monitoring work of the operation stage of the Project as authorized by the Project Owner and required in the environmental monitoring plan; 2. Carrying out the routine monitoring activities related to the Project on a periodical basis.	Depending on the scope of authorized assignment
	County/city EPB	1. Responsible for the final acceptance of the environmental protection work of the Project; 2. Managing and supervising the status of compliance with the environmental protection standards in the operation stage; 3. Carrying out routine supervision and inspection of the operation status of the built environmental protection facilities.	2
	Public or organizations	Public supervision	Not limited

10.1.3 Environmental protection supervision plan

Based on the characteristics of the Project, the implementation status of the environmental protection work of the Project is not only subject to the supervision of local EPB, but also the relevant department of the World Bank. Construction supervision engineers should be employed to assist the EA in site supervision and inspection in the construction stage of the Project and an environmental protection division should be set up to supervise the Project in the operation stage.

See Table 10.1-2 for the environmental protection supervision plan of the Project.

Table 10.1-2 Environmental Protection Supervision Plan of the Project

Stage	Agency	Content of Supervision	Purpose of Supervision

Table 10.1-2 Environmental Protection Supervision Plan of the Project

Stage	Agency	Content of Supervision	Purpose of Supervision
FS stage	County/city EPB, WB	1. Reviewing EIA Outlines; 2. Reviewing EIA Report; 3. Reviewing EAP	1. To make sure the EIA Report has complete content, well-selected topics and clear focus; 2. To make sure that any significant and potential issues likely to arise in the Project are reflected; 3. To make sure that a specific and feasible implementation plan is available for the mitigation measures of the environmental impacts.
Design and construction stage	County/city Government County/city EPB County/city WRB County/city Forestry Bureau County/city Agriculture Bureau County/city PMO	1. Reviewing the preliminary environmental protection design and EMP; 2. Inspecting the restoration of temporarily occupied land, and vegetation and environment affected by the construction works; 3. Inspecting measures for control of dust and noise pollution and deciding construction time; 4. Inspecting emission of air pollutants; 5. Inspecting discharge and treatment of domestic sewage and waste engine oil on the construction sites; 6. Inspecting restoration and treatment of waste disposal sites; 7. Inspecting and determining whether there any underground cultural relics.	1. To strictly enforce the “three-simultaneousness” policy of the Project; 2. To assure that all the construction sites satisfy the environmental protection requirements; 3. To reduce the impacts on the surrounding environment in the construction stage and enforce the relevant laws and regulations and standards of environmental protection; 4. To make sure that the water quality of the rivers and Qiandao Lake are not polluted; 5. To make sure that the landscape and land resources are not seriously damaged to avoid soil erosion; 6. To make sure that the wastes and debris are properly disposed; 7. To protect the cultural resources from damages.
Operation stage	County/city EPB	1. Inspecting the implementation of EAP in the operation stage; 2. Inspecting the implementation of the monitoring plan; 3. Inspecting sensitive sites where further environmental protection measures are needed (and where unanticipated environmental problems may arise); 4. Inspecting whether the environment quality at the environmentally-sensitive sites satisfies the requirements of the corresponding quality standard;	1. To implement EAP; 2. To implement monitoring plan; 3. To protect environment in the true sense; 4. To strengthen environment management and actually safeguard personal health; 5. To assure that the pollutant emission satisfies the emission standards.

Table 10.1-2 Environmental Protection Supervision Plan of the Project

Stage	Agency	Content of Supervision	Purpose of Supervision
		5. Strengthening supervision to prevent unanticipated incidents and developing emergency response plans so that the environmental risks can be eliminated in time in the event of any accidents.	

10.2 Environmental and social impacts and their mitigation measures

In accordance with the relevant laws and codes of China and Zhejiang Province and in association with the World Bank General Environment, Health and Safety (EHS) Guidelines, EHS Guidelines for Water Supply and Drainage, general and special countermeasures and mitigation measures are proposed for the design stage, the construction stage and the operation stage of different types of subprojects. For the general countermeasures and mitigation measures, four ECOPs and 2 MPs are developed as annexes to the ESMP, namely Annex 1: ECOP for Small Civil Works Construction, Annex 2: ECOP for River Rehabilitation, Annex 3: ECOP for Afforestation and Annex 4: Agricultural Pest Management Plan and Annex 5: Forestry Pest Management Plan and Annex 6: ECOP for Road Construction. Table 10.2-1 shows the ECOPs and MPs applicable to the respective subprojects while Table 4-2 of the ESMP presents a summary of the environmental and social impacts as well as the mitigation measures.

Table 10.2-1: ECOPs and MPs applicable to each subproject

Name of subproject	Applicable ECOP
Chun'an County Small Watershed Integrated Improvement	ESMP Annex 2: ECOP for River Rehabilitation
Chun'an County Rural Drinking Water Safety Improvement	ESMP Annex 1: ECOP for Small Civil Works
Chun'an County Dike Reinforcement and River Rehabilitation	ESMP Annex 2: ECOP for River Rehabilitation
Chun'an County Agriculture NPS Pollution Control	ESMP Annex 1: ECOP for Small Civil Works, ESMP Annex 4: Agriculture Pest Management Plan
Chun'an County Forest Eco-system Restoration	ESMP Annex 3: ECOP for Afforestation; ESMP Annex 5: Forestry Pest Management Plan
Jiande City Water Conservancy Facility Rehabilitation	ESMP Annex 2: ECOP for River Rehabilitation
Jiande City Landscaping Afforestation and Forest Form Improvement	ESMP Annex 3: ECOP for Afforestation; ESMP Annex 5: Forestry Pest Management Plan
Jiande City Municipal Engineering	ESMP Annex 6: ECOP for Road Construction;

	ESMP Annex 1: ECOP for Small Civil Works
Jiande City Agricultural NPS Pollution Control	ESMP Annex 1: ECOP for Small Civil Works, ESMP Annex 4: Agriculture Pest Management Plan

10.3 Environmental Monitoring Plan

10.3.1 Objectives of Environmental Monitoring

Environmental monitoring covers the construction stage and the operation stage of the Project and aims to acquire full and timely information on the pollution conditions of the proposed project, the degree of changes made and scope of impacts brought by the project construction to and on the environment quality of the project area as well as the status of environmental quality in the operation stage so as to give timely feedbacks to the competent authority and provide a scientific basis for the environment management work of the Project.

10.3.2 Environment Monitoring Agency

Environmental monitoring in the construction stage and the operation stage is undertaken by a qualified monitoring agency entrusted by and on behalf of the project contractor or operator. The undertaking agency should be certified in the national environmental quality certification program, have complete equipment and strong technical competence and are able to carry out the respective environmental monitoring task in a satisfactory manner.

Sensitive and concerned spots that probably involve significant pollution as shown in the prediction results of environment impacts are chosen as the monitoring spots to follow up with the pollution status of the monitored items in the construction stage and the operation stage. Noise, ambient air and surface water that involve significant environmental impacts are chosen as the monitoring contents. The monitoring factors are determined based on the pollution characteristic factors of the Project. The monitoring and analysis method for the respective items specified in the Technical Specifications on Environmental Monitoring promulgated by MoEP is chosen and the national standards confirmed in the EIA of each subproject are adopted as the assessment standard.

10.3.3 Environmental Monitoring Plan and Budget

The environmental monitoring plan and budget for the construction stage and operation stage of the Project is shown in ESMP Table 5-1 in detail. The requirements of the monitoring plan of the linked projects are shown in ESMP Table 5-2.

10.4 Capacity building and Training

10.4.1 Training objectives

In order to assure smooth and effective implementation of the environment management work, it is necessary to provide environment management training to enable the relevant staff to get familiar with the contents and procedures of environment management and promote their environment management competence to assure effective implementation of the various environmental protection measures. The key objects of environmental capacity building are the environment managers and construction supervision engineers, training for whom is one of the key component of technical supports under the Project. In addition, training for the construction contractor and the construction workers is also needed in the implementation process of the Project. Before the commencement of the construction works, all the IAs, management units and contractors must attend environment, health and safety training.

10.4.2 Personnel arrangement and proposed trainees

The PPMO and the 2 county/city subproject management offices should assign special personnel to be responsible for execution of the EMP, who should have the knowledge of environmental protection and be familiar with laws and regulations on environmental protection, the safeguard policies of the World Bank and the Environment Management Plan.

The proposed trainees to take part in the environment management training in the construction stage include personnel from the PPMO, the 2 county/city subproject management offices, the subproject IA, the supervision engineer, representatives of the environment monitoring agency, the engineering technology supervisor and full-time managers of the contractor.

The proposed trainees to take part in the environment management training in the operation stage mainly include the operational management personnel of each subproject.

10.4.3 Training Contents

Environment management training in the construction stage includes the following contents:

1. Laws and regulations, documents and requirements of the national government and Zhejiang Province on environmental protection and water and soil conservation in the management of construction projects;
2. World Bank requirements on environment management for construction projects; the environment management model of the World Bank and environment-related articles in the loan covenants of the World Bank;
3. Environmental protection measures proposed in the project design and the environmental protection requirements for the construction stage;

4. Environmental protection guidelines for the construction stage of the Project;

5. Training about the Environmental Management Plan (ESMP) of the Project provided by the PMO to the contractors and supervision companies prior to the commencement of the Project;

6. Responsibilities and their correlation for the environment management personnel, the supervision engineer and the contractor;

7. Preparation of the Environment Management Work Report, the Supervision Work Report, the Environment Monitoring Report and the contractor's monthly reports;

8. Training on NPS pollution.

Chief environmental protection designers of the EPB, the design institute, and experts from the EIA consultant and supervision and control agency and environmental specialist of the World Bank may invited to be the trainers for such training workshops.

Environment management training for the operation stage includes the following contents:

1. Laws and regulations, documents and requirements of the national government and Zhejiang Province on environmental protection in the management of construction projects;

2. Requirements on final acceptance of environmental protection and the "three simultaneousness management" for construction projects;

3. Operational management of WWTPs, WTPs, pump stations, pipeline networks, artificial wetland, forest form maintenance;

4. Operational management of relevant environmental protection measures in the operation stage.

Environmental protection specialists from universities, research institutes and operation and management units may be invited to give lectures or attend the short-term training workshops.

10.4.4 Personnel training plan

Fund needed for the training on the EMP in the construction stage will be included into the project budget while the fund for training in the operation stage will be included into the operation and maintenance cost. See Table 10.4-1 for the Schedule of Capacity building and Training.

Table 10.4-1 Schedule of Capacity building and Training

Training topic	Trainees	Training contents	No. of training sessions	No. of days per session	No. of persons per session	Budget (CNY10000)
Construction stage						
EP laws and policies	County/city PMO, project owner, construction contractor, monitoring agency, supervision agency	I. Laws and regulations on environmental protection	1	1	3	14
		II. Environmental policies and plans	1	1	3	
		Ⅲ. World Bank environment management	1	1	3	
EMP of construction stage	Construction contractor[5] Project owner	I. Responsibilities of environmental protection in the construction stage of a project	1	0.5	4	14
		II. Key assignments of environmental protection in the construction stage of a project	1	0.5	4	
		Ⅲ. Key contents of environmental protection in the construction stage of a project	3	0.5	4	
		Ⅳ. EMP (including ECOP)	2	0.5	4	
		Ⅴ. Improvements or amendments to EMP	1	0.5	4	
		Ⅵ. Internal monitoring methods; data collection and treatment, etc.	1	0.5	4	

Subtotal for the construction stage						28
Operation stage						
Environment monitoring and inspection, reporting	Project owner	EP facilities, ecological restoration, environmental quality monitoring, report preparation	2	1	2	14
EP facilities and measures	Project owner	Ⅰ. Rules and regulations and specifications on environmental safety	2	1	2	14
Control of NPS pollution	Project owner, county agriculture authority, project area farmer representatives	Training on use of low toxicity and harmless pesticides and integrated management of agricultural pests	2	1	A few	4.8
Subtotal for the operation stage						32.8
Total						60.8

Note 5: The PMO shall provide a training to the construction contractors on the ESMP before mobilization and the contractors shall develop their Site Environment Management Plan based on the ESMP training results and organize internal staff training respectively.

10.5 Reporting mechanism

10.5.1 Information exchange

Environment management requires necessary exchange of information among the PMO, the Project Owner, and the Contractor, the Operator and the different departments and jobs in the organization and also requires disclosure of relevant information to the external parties (stakeholders, general public, etc.).

Internal information exchange may be implemented in diversified forms, such as meetings, internal briefings, but at least 1 formal meeting must be organized each month. All information exchange should be recorded and archived. External information exchange is implemented on a half-year or one-year basis. For information exchange with the cooperative units, meeting minutes shall be developed and put into archives.

10.5.2 Record mechanism

In order to assure the effective operation of the environment management system, the organization must set up a sound record system and keep records in the following aspects:

（1） Laws and regulations;

（2） Government permits;

（3） Environmental factors and the relevant EIA documents and EMP reports;

（4） Training records;

（5） Records of inspections, calibrations and maintenance activities;

（6） Monitoring data;

（7） Effectiveness of corrective and preventive measures;

（8） Information of stakeholders; grievance redress procedure and records of results;

In addition, the aforesaid records shall be subject to necessary control, including identification, collection, cataloging, archiving, storage, management, maintenance, inquiry, retention life and disposal of records.

10.5.3 Reporting mechanism

The Contractor, the Operator, the Monitoring Agency, the construction supervision engineer and the PMO shall keep records of project progress, EMP execution status, environmental monitoring results throughout the implementation of the Project and report in a timely manner to the concerned departments. Monitoring records of the operation status of the solid waste landfills, hazardous waste accepting unit and WTPs involved in the linked projects and the due diligence study shall also be acquired and collected on a

periodical basis. The relevant requirements shall be incorporated into the monitoring plan, which mainly consist of the six aspects as follows:

（1） The construction supervision engineer of the Project shall keep detailed records of the execution status of the EMP on a monthly basis and submit the monthly report to the Project Owner and the PMO in a timely manner. The monthly reports should include information on the execution status of the environmental protection measures, and the progress and data of environmental monitoring.

（2） The Contractor and Operator shall keep detailed records of the progress of the Project and the execution status of the EMP on a monthly basis and submit a half-year report to the PMO, with a copy to the local EPB. Such requirement shall be explicitly specified in the Contractor’s contract documents.

（3） The Monitoring Agency shall submit the monitoring report to the Contractor (Operator) and the construction supervision engineer in a timely manner after the monitoring assignment is carried out.

（4） The Contractor and the Operator shall submit the Environmental Monitoring Report of the Project to the local EPB and PMO in a timely manner. The PMO shall submit the monthly report, the quarterly report and the yearly report on the progress and effectiveness of the execution of the EMP of the Project to the local EPB and the relevant organizations and, when necessary, to the World Bank.

（5） In the event of any specific non-compliances in terms of environmental protection, the construction supervision engineer and the PMO shall submit a report to the local competent authority of environmental protection and to the superior levels if necessary.

（6） 2 EMP Execution Reports should be submitted each year to the World Bank. The EMP Execution Report may include the following contents:

a. Project implementation progress, e.g. construction progress and length of sections completed in the dike construction works, the river rehabilitation works, the pavement works and the pipeline works;

b. Execution status of the environmental protection measures of the Project;

c. Implementation status and key results of environmental monitoring;

d. Implementation status of the training program;

e. Information of continuous public participation; public complaints and the records of key contents, solution and public satisfaction of such complaints, if any;

f. Existing problems and solutions;

g. EMP Execution Plan for the second half of the year.

10.6 Grievance Redress Mechanism

The grievance redress mechanism of the Project covers all stages of implementation of the Project, including resettlement, resident disturbance in the construction stage and supervision of the operation stage.

（1） Public grievances on resettlement: Any problems arising in the resettlement process may be appealed according to Section VII: Grievance Redress Procedure.

（2） Public grievances in the construction period: The Contractor of the Project and the PMO, the project owner and EPB shall follow up with the progress of the Project in a timely manner to learn about inconveniences brought to the local people in the construction of the Project. The construction contractor shall make public the responsible person’s name and contact information for the sake of public supervision and complaint. The PMO shall set up a special reception window and assign special personnel to collect the public opinions in a timely manner. Public opinion books should be provided so that records are kept of telephone calls or personal visits, including the name and contact information of the callers and visitors, impacts from project implementation and their opinions. Such records shall be archived and reported in a timely manner and questions raised by the public shall be replied within three working days and a solution shall be proposed and implemented within 10 to 15 working days depending on the level of difficulty. The final results of the process of implementation and coordination and resolution shall be added into the Public Opinion Book. If the complainant remains dissatisfied with the resolution made the PMO or EPB, he / she may, upon receipt of such resolutions, file a lawsuit at the local people’s court according to the Civil Procedure Law of the People’s Republic of China.

（3） Operation stage supervision: The public may raise any questions in the operation stage directly to the PMO or EPB (EP complaint hotline: 12369), which shall record, study and discuss and respond to such questions within 3 working days and propose and implement a solution within 10 to 15 working days depending on the level of difficulty. If the complainant remains dissatisfied with the resolution made the PMO or EPB, he / she may, upon receipt of such resolutions, file a lawsuit at the local people’s court according to the Civil Procedure Law of the People’s Republic of China.

The aforesaid channels of grievance redress shall be made public via meetings or by other means to enable the public to be fully aware of their rights to complain. In addition, the public media shall be utilized for extensive advertisement. The grievance redress institution shall handle the complaints

free of charge and all expenses incurred therefrom shall be disbursed as a part of the contingency fee by the PMO.

10.7 Investment Estimation for Environmental Protection

Table 10.7-1 shows the estimated investment required for the aforesaid additional environmental measures needed in the design stage, construction stage and operation stage of the Project.

Table 10.7-1: Investment Estimation for Environmental Protection of the Project

Table 10.7-1: Investment Estimation for Environmental Protection of the Project

SN	Stage	Cost description		Estimated investment (CNY10000)	Fund sources
1	Design stage	EIA		203	Provincial PMO
	Subtotal			**203**	
2	Construction stage	Additional environmental protection measures	Noise pollution control in construction stage	20.0	**Project construction cost**
			Disposal of domestic and production wastewater in construction stage	200	
			Dust pollution control measures in the construction stage	20.0	
			Removal of domestic solid wastes in the construction stage	10.0	
3		Additional water and soil conservation measures	Jiande City Water Conservancy and Road Construction	659.4	Project construction cost
			Chun'an County Rural Drinking Water Safety Improvement	521	
			Chun'an County Dike Reinforcement and River Rehabilitation	577.9	
			Chun'an County Small Watershed Rehabilitation	1257	
4		Water and soil conservation monitoring	Jiande City Water Conservancy and Road Construction	49.3	Project construction cost
			Chun'an County Rural Drinking Water Safety Improvement	58	
			Chun'an County Dike Reinforcement and River Rehabilitation	40.1	
			Chun'an County Small Watershed Rehabilitation	69.4	
		Temporary access bridge		12.0	**Project construction cost**
		Implementation of Dam Safety Action Plan		5956	Financial budget or special fund for water conservanc

Table 10.7-1: Investment Estimation for Environmental Protection of the Project

SN	Stage	Cost description		Estimated investment (CNY10000)	Fund sources
					y works
5		Environmental monitoring		7.0	**ESMP**
6		Operation of external monitoring agency		24	
7		Staff training in the construction stage		28	
	Subtotal			**9509.1**	
8	Operation stage	Final acceptance of environmental protection		80	**Project construction cost**
9		Training and monitoring of agricultural pests		229	ESMP
10		Training and monitoring of forestry pests		559.9	
		Noise pollution prevention and control measures	Shouchang WWTP	5.0	**Project construction cost**
			8 new WTPs	29.0	
		Underground domestic sewage treatment devices for 8 WTPs		80.0	
11		Environmental monitoring		212.56	Operation cost
12		Shouchang WWTP biological deodorization		200	Construction cost
		Cost of sludge and domestic waste removal for WWTP and WTPs		10	Operational cost
13		Operation of external monitoring agency		20	**ESMP**
14		Staff training in the operation stage		32.8	
	Subtotal			**1458.26**	
	Total			**11170.36**	

11. EIA Conclusions

Zhejiang Qiandao Lake and Xin'an River Basin Water Resources and Ecological Environment Protection Project proposes to utilize the World Bank loan in the integrated watershed management of 8 tributaries in Chun'an County and Jiande City, which will be helpful to reducing pollution and improve the forest ecological environment in Qiandao Lake Watershed of Zhejiang Province. Application of the experiences of effective integrated watershed management in the other watersheds will be helpful to improving the effectiveness and sustainability of watershed management and ecological environment protection.

The Project to be constructed complies with the requirements of environmental function zoning and the national industrial policies. Upon completion, the Project will generate excellent environmental and social benefits by reducing heavy load of pollutants and contributing significantly to improvement of river water quality, rural living environment and rural water supply safety in the construction area of the Project, thus effectively improving the ecological environment in Qiandao Lake Watershed. The negative impacts possibly arising from the Project will be controlled, in terms of the level and scope of impacts, within the range permitted by the national laws and regulations and standards and specifications. Therefore, the Project is feasible.

Annex Tables

Annex Table 3-2 Overview of Chun'an Cross-bridge Centralized Drinking Water Supply Project

SN	Name of project	Scope of water supply	Water supply capacity (m3/d)	Water source	Address	Treatment process	Water distribution pipeline
1	Wangfu WTP Water Supply Project	Wangfu Township: 10 administrative villages; current population: 12788 persons; designed population: 13265 persons	2200	Yanjia Reservoir	Hilltop northeast of Yanjia Village	Conventional water purification process "coagulation + sedimentation + filtering + disinfection"	Water distribution pipeline to be constructed: Total length: 24.25km; diameter: DN110~DN350。 Water distribution pipeline to be upgraded: Total length: 100.6km; diameter: DN25~DN110。
2	Yejia WTP Water Supply Project	Weiping Town: 8 administrative villages; current population: 8327 persons; designed population: 8467 persons	1400	Yejiayuan Reservoir	Slope land southeast of Zhuangjia Village		Water distribution pipeline to be constructed: Total length: 11.97km; diameter: DN110~DN160。 Water distribution pipeline to be upgraded: Total length: 58.2km; diameter: DN25~DN160。
3	Xiashan WTP Water Supply Project	Zhongzhou Town: 11 administrative villages; current population: 10675 persons; designed population: 11515 persons	2100	Wuqiangxi Stream (Huixi Stream)	/		Water Distribution Pipeline: Total length: approximately 19625m; diameter: DN110~DN315。 Water distribution pipeline to be upgraded: Total length: 75.05km; diameter:

							DN25~DN125.
4	Pingmen WTP Water Supply Project	Pingmen Township: 3 administrative villages; Linqi Town: 1 administrative village; current population: 4348 persons; designed population: 4536 persons	800	Qiuyuanxi Stream	Slope land north of Hepuqiao Village	Conventional water purification process “coagulation + sedimentation + filtering + disinfection”	Water distribution pipeline: Total length: approximately 14840m; diameter: DN110~DN200。 Water distribution pipeline to be upgraded: Total length: 29.5km; diameter: DN25~DN110。
5	Fengshuling WTP Water Supply Project	Fengshuling Town: 12 administrative villages; Dashu Town: 6 administrative villages; Anyang Township: 10 administrative villages; Lishang Township: 6 administrative villages; current population: 27374 persons; designed population: 28174 persons	5000	Tongshanxi Stream	Open land 1km northeast of Zhaikeng Village of Fengshuling Town		Water distribution pipeline: Total length: 140.20km; New pipeline to be constructed: Length: 69.48km; diameter: DN110~DN350。
6	Baima WTP Water Supply Project	Fengshuling Town: 6 administrative villages; current population: 3675 persons; designed population: 3705 persons	600	No. 3 open diversion canal of Guanchuan Power Station	Slope land 300m northwest of Guanchuan Power Station		Water distribution pipeline: Total length: 26.21km; diameter: DN110~DN250。 Water distribution pipeline to be upgraded: Total length: 38.75km; diameter: DN25~DN110。

7	Zitong No. 2 WTP Water Supply Project	Zitong Town: 12 administrative villages and industrial zone; current population: 11825 persons; designed population: 12043 persons	2000	Xin'anjiang Reservoir	Near Yujia Village		Water distribution pipeline to be constructed: Total length: 27.75km; diameter: DN315~DN110。 Water distribution pipeline to be upgraded: Total length: 79.5km; diameter: DN25~DN110。
8	Weiping WTP Expansion Project	Weiping Town: 18 administrative villages, current population:25273 persons; designed population: 26468 persons	Expansion works: 2500; total capacity: 5000	Xin'anjiang Reservoir			Water distribution pipeline: Total length: 55.72km; diameter: DN110~DN400。Water distribution pipeline to be upgraded: Total length: about 137.25km; Diameter: DN25~DN110。

Annex Table 3-3 Construction Scope of Chun'an County Dike Reinforcement Project

SN	Township/ town	Project entity	Name of River	Starting point	Ending point	Contents of construction		Objects of protection	
						Dike Reconstruction (m)	Dike reinforcement (m)	Farmland (mu)	Population (persons)
1	Langchuan Township	Lianhuan Village	Langchuan Stream	Taohuajing	Lianhuaxia Bridge	1064	0	500	1003
2		Baojia Village		Under Mashi Bridge	Baojia	1621	1158	1500	1462
3		Huiyuan Village		Linjiawu	Putaoban	873	0	120	956
4		Yangjia Village, Zhanjia Village		Neiyangjia	Taoyuan	586	274	300	2146
5	Fenkou Town	Shifeng Village	Longquan Stream	Shibi Village	Lingshan Village	1070	0	180	1028
6		Longquan Village		Lingshan Village	Luxiang Village	1032	0	300	1147
7		Xicun Village	Langchuan Stream	Xicun Bridge	Junction	686	0	60	1486
8		Longyao Village		Longyao Dam	Longyao Village	1276	0	300	793
9	Dashu Town	Dongwu Village	Fenglingang	Wulangwu	Dongkou	642	0	373	325
10		Sunjiaban Village		Sunjiaban	Gongshanjian	550	0	457	591
11		Dawu Village	Shangfang Stream	Waiyangjia	Yuxi	1030	0	356	810
12	Anyang Township	Waiban Village Tongchuan Village	Tongchuan Stream	Tongchuan	Waiban	1167	0	182	700

SN	Township/ town	Project entity	Name of River	Starting point	Ending point	Contents of construction		Objects of protection	
						Dike Reconstruction (m)	Dike reinforcement (m)	Farmland (mu)	Population (persons)
13	Lishang Township	Daye Village	Shangjiayuan River	Daye Village	Zixuwu River estuary	916	0	169	494
14		Yuquan Village		Huanghouping	Shangjiayuan River estuary	1015	0	270	528
15	Linqi Town	Yejiaban Village	Jinxianxi Stream	Entrance	Exit	0	1121	180	746
16		Lingqi Village		Hepu Cofferdam	Lingqi Bridge	2551	447	675	2846
17		Xikou Village	Fengchuan Stream	Hejia Bridge	Xieling Village Exit	408	0	60	1405
18	Jiangjia Town	Xiayuquan Village	Yuquan Stream	Zhonglingjiao	Longyu Village	1470	0	78	471
19		Sunjiawu	Longquan Stream	Zhengyan Bridge	Sunjiawu	937	237	145	442
20	Fuwen Township	Mochuan Village Jubi Village	Qingpingyuan River	Jubi Village	River junction	1465	0	250	
21		Fangjiaban Village		Fangjiaban	Houjiping	1590	0	150	
22	Pingmen Township	Jiangkeng Village	Jinxianxi Stream	Maoshanjiao	Jiangkeng Cofferdam	530	0	20	
23		Pingmen Village		Hepu Village Entrance	Hepu Village Exit	1670	0	100	
24	Weiping Town	Tangcun Village,	Qiduyuan River	Tangcun	Kengxia	1500	0	300	1100

SN	Township/ town	Project entity	Name of River	Starting point	Ending point	Contents of construction		Objects of protection	
						Dike Reconstruction (m)	Dike reinforcement (m)	Farmland (mu)	Population (persons)
		Kengxia		Village Exit					
25		Duchuan		Entrance	Exit	850	0	160	500
26	Zuokou Township	Zuokou Village	Shibaduyuan River	Zuokou Village	Fengxiang Village	791	0	372	733
27		Xianhou Village		Entrance	Exit	933	0	846	1353
28	Fengshuling Town	Shangjiang Village	Fengjiayuan	Tongshankou	Zhuyuanli	1803	0	849	1090
29	Wenchang Town	Wenchang Village	Wangjiayuan River	Nongkengkou	Luobushan	950	0	90	0
30	Yaoshan Township	Aiguo Village	Jinxianxi Stream	Tangwei Cofferdam	Aiguo Bridge	720	610	200	0
31	Wangfu Township	Xinhe Village	Yunyuangang	Maojia Village	Shaojiaping	1345	0	110	700
32		Wangfu Village		Wangfu Junior Middle School	Wangfu Junior Middle School	450	0	10	200
33	Songcun Township	Qingshankou Village Hujiaban Village	Yunyuangang	Qingshankou Village	Hujiaban Village	815	0	60	0
	Total					34306	3847	9722	25055

Annex Table 3-4: Project Scope of Chun'an County River Rehabilitation Project

SN	Township/ Town	Project entity	Name of river	Starting point	Ending point	Construction works			Objects of protection	
						Dike reconstruction (m)	Dike reinforcement (m)	River dredging and rehabilitation(km)	Farmland (mu)	Population (persons)
1	Jiangjia Town	Shankou Village Xiashe Village	Qingchuan Stream	Xinqiaoxi	Qingchuan Stream junction	465		3	75	1670
2		Shangyuquan Village	Yuquan Stream	Jiangtong	Zhonglingjiao	1200		4	100	930
3	Langchuan Township	Yuanfeng Village	Langchuan Stream	Wangjia Village	Hengkeng	790		2	60	394
4	Fenkou Town	Hongqi Village	Longquan Stream	Yejia	Tingchuankou	717		2	130	1496
5	Fengshuling Town	MUhuakeng Village	Fenglingang River	Muhuakeng	Nantangwu	270	670	2	63	339
6		Tongshan Village	Fenglingang River	Tongshan Dam	Yucun Village	320		1	644	1257
7		Xiacun Village	Fengjiayuan River	Zhuangqian	Xiacun Village	300		1	460	868
8	Dashu Town	Taolin Village	Shangfang Stream	Liumuta	Taolin	475		2	625	983
9		Linggan Village	Shangfang Stream	Lingdong	Shejiadian Dam	350		1	263	384
10		Taoyuanlingjia Village	Fenglingang River	Dashikeng	Jiangjiawu	100		1	603	813
11		Sunjiaban Village	Fenglingang River	Gongshanjian	Fenglin Bridge	100		1	457	591
12		Ruhong Village	Shangfang Stream	Yangheban	Ruhong	429		2	1028	1555
13		Laoling Village	Shangfang Stream	Dalubian Village	Banwukeng Village	1045	65	3	263	384
14	Lishang Township	Shiwan Village	Shangjiayuan River	Lingjiao	Shiwandi	1615		5	112	767
15		Jiangcun Village	Jiangcunyuan River	Tongshanling	Jiangcun Village	578		2	183	497
16	Wenchang Town	Langdong Village	Langdongyuan River	Zhongwuhou	Shejia	925		3	30	0
17		Shiban Village	Langdongyuan River	Jiangkengwu	Jiangkengkou	310		1	25	0
18		Wangjiayuan River Village	Wangjiayuan River	Zhongwuli	Chuping	240		1	30	0
19		Tantou Village	Wangjiayuan River	Shalingjiao	Shakengwu	595		2	20	0
20		Wenchang Village	Langdongyuan River	Hengkengkou	Xiaowuli	450		2	50	0
21	Linqi Town	Xiazhong Village	Jinxianxi Stream	Jicun Village	Xiazhong	1334		5	86	1516
22		Zuoyuan Village	Fengchuan Stream	Lizhongwu	Xiahe	1015	580	6	618	1476

SN	Township/ Town	Project entity	Name of river	Starting point	Ending point	Construction works			Objects of protection	
						Dike reconstruction (m)	Dike reinforcement (m)	River dredging and rehabilitation(km)	Farmland (mu)	Population (persons)
23		Youyuan Village	Fengchuan Stream	Yangtang	Kantou	757	50	3	300	1580
24		Shenlingjiao Village	Jinxianxi Stream	Shenfeng	Changpu	568		3	100	1244
25		Likou Village	Jinxianxi Stream	Shangguangtian	Xiaguangtian	1128	60	5	297	732
26		Xinxi Village	Jinxianxi Stream	Shangxinxi	Xiaxinxi	200		1	35	491
27		Banxia Village	Jinxianxi Stream	Baihelingjiao	Huangkengkou	2607		9	110	1530
28	Weiping Town	Pingcun Village	Qiduyuan River	Xiangyuan Village	Yangjiayuan	450		1.5	85	300
29		Duchuan Village	Qiduyuan River	Duchuan Village	Exit	400		1	65	330
30		Hefu Village	Qiduyuan River	Hefu Village Committee	Hill foot	250	200	1.5	120	980
31		Xinmao Village	Qiduyuan River	Liumuban	Zhangbian Village	620		2.5	150	800
32	Wangfu Township	Mashan Village	Yunyuangang	Entrance	Exit	643	480	1	30	0
33		Huaping Village	Yunyuangang	Entrance	Exit	100	350	1.5	80	1128
34	Zuokou Township	Cilongyuan River Village	Cilongyuan River	Tongjiahou	Niyuxinghou	835		3	241	822
35		Fangjia Village	Shibaduyuan River	Fangjia Village	Qiangli Village	277		1	251	508
36		Longyuanzhuang Village	Xialongyuan River	Jinzhuwukou	Longyuanzhuang Village Entrance	540		2	871	1884
37	Fuwen Township	Liulian Village	Qingpingyuan River	Liulian Village	Qiankengkou	240		1	12	0
38	Pingmen Township	Jiangkeng Village	Jinxianxi Stream	Xiawankou	Maoshanjiao	730		2	25	0
39		Kantou Village	Jinxianxi Stream	Kantou Village Entrance	Kantou Village	250		1	20	0
40		Folinghou Village	Jinxianxi Stream	Zhujiawu	Anzu	1390	50	4.5	130	0
41	Songcun Township	Xiashi Village	Zhaikengyuan River	Zhaikeng Village	Xiajiatianli Village	600		2	15	0
	Total					26208	2505	98.5	8862	28249

Annex Table 4.3-1 Water Quality Evaluation of Key Cross Sections in Qiandao Lake (2011-2013) (I)

Item		Water temperature	pH	DO	Permanganate Index	NH3-N	TP	TN	TC	TZ	Fluoride	Total Arsenic	Total Mercury	Total Cadmium	Cr6	Total lead	Cyanide	Volatile phenol	Petroleum	Anion	Sulfide	Fecal coliforms
Jiekou Cross Section																						
2011	Annual average	20.0	7.76	9.40	2.04	0.092	0.013	1.171	0.005	0.02	0.13	0.001	0.00002	0.00003	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	282
	Minimum	9.7	7.59	6.76	1.58	0.030	0.009	0.877	0.005	0.01	0.11	0.001	0.00002	0.00002	0.002	0.0000	0.002	0.0005	0.02	0.02	0.002	20
	Maximum	29.9	7.87	10.92	2.36	0.173	0.020	1.470	0.005	0.02	0.15	0.002	0.00002	0.00006	0.002	0.0004	0.002	0.0005	0.02	0.02	0.002	1100
	Noncompliance rate	-	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	Annual average	20.2	7.53	8.41	1.98	0.147	0.032	1.158	0.005	0.01	0.13	0.001	0.00002	0.00004	0.002	0.0004	0.002	0.0005	0.02	0.02	0.002	530
	Minimum	9.4	7.32	6.54	1.66	0.077	0.009	0.943	0.005	0.01	0.12	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	10
	Maximum	30.1	7.68	11.04	2.31	0.290	0.052	1.430	0.005	0.05	0.15	0.001	0.00002	0.00008	0.002	0.0008	0.002	0.0005	0.02	0.02	0.002	1700
	Noncompliance rate	-	0	0	0	0	67	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	Annual average	19.4	7.59	8.67	1.95	0.127	0.039	1.351	0.005	0.02	0.14	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0008	0.02	0.02	0.002	633
	Minimum	11.5	7.26	6.54	1.46	0.047	0.005	1.013	0.005	0.01	0.12	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0006	0.02	0.02	0.002	40
	Maximum	29.7	7.98	11.16	2.82	0.273	0.108	1.820	0.005	0.08	0.20	0.002	0.00002	0.00002	0.002	0.0002	0.002	0.0009	0.02	0.02	0.002	1700
	Noncompliance rate	-	0	0	0	0	50	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class II standard		-	6~9	6	4	0.5	0.025	0.5	1	1	1	0.05	0.00005	0.005	0.05	0.01	0.05	0.002	0.05	0.2	0.1	2000

Note:

Unit: mg/L; Water temperature: ℃; pH: dimensionless; Fecal coliforms: No/L; Noncompliance rate: %

Annex Table 4.3-2: Water Quality Evaluation of Key Cross Sections in Qiandao Lake (2011-2013) (II)

Item		Water temperature	pH	DO	Permanganate Index	NH3-N	TP	TN	TC	TZ	Fluoride	Total Arsenic	Total Mercury	Total Cadmium	Cr6	Total lead	Cyanide	Volatile phenol	Petroleum	Anion	Sulfide	Fecal coliforms
Before the Dam																						
2011	Annual average	20.0	7.70	8.91	1.40	0.012	0.005	0.793	0.005	0.01	0.12	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	72
	Minimum	11.1	7.39	7.12	1.07	0.012	0.005	0.617	0.005	0.01	0.11	0.001	0.00002	0.00002	0.002	0.0000	0.002	0.0005	0.02	0.02	0.002	10
	Maximum	29.7	8.13	11.20	1.74	0.012	0.005	1.117	0.005	0.02	0.14	0.001	0.00002	0.00003	0.002	0.0003	0.002	0.0005	0.02	0.02	0.002	220
	Noncompliance rate	-	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	Annual average	21.1	7.66	8.02	1.33	0.014	0.005	0.730	0.005	0.01	0.14	0.000	0.00002	0.00003	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	42
	Minimum	9.9	7.30	6.29	0.99	0.012	0.005	0.590	0.005	0.01	0.12	0.000	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	10
	Maximum	29.8	7.90	9.82	1.66	0.021	0.007	0.990	0.005	0.01	0.17	0.001	0.00002	0.00005	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	70
	Noncompliance rate	-	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	Annual average	20.6	7.76	9.45	1.06	0.017	0.005	0.930	0.005	0.02	0.15	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0007	0.02	0.02	0.002	102
	Minimum	11.5	7.49	7.38	0.84	0.012	0.005	0.837	0.005	0.01	0.12	0.000	0.00002	0.00002	0.002	0.0002	0.002	0.0006	0.02	0.02	0.002	20
	Maximum	29.8	8.02	10.97	1.28	0.034	0.005	1.063	0.005	0.08	0.19	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0008	0.02	0.02	0.002	170
	Noncompliance rate	-	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class II standard		-	6~9	6	4	0.5	0.025	0.5	1.0	1.0	1.0	0.05	0.00005	0.005	0.05	0.01	0.05	0.002	0.05	0.2	0.1	2000

Note:

Unit: mg/L; Water temperature: ℃; pH: dimensionless; Fecal coliforms: No/L; Noncompliance rate: %

Annex Table 4.3-3: Water Quality Evaluation of Key Cross Sections in Qiandao Lake (2011-2013) (III)

Item		Water temperature	pH	DO	Permanganate Index	NH3-N	TP	TN	TC	TZ	Fluoride	Total Arsenic	Total Mercury	Total Cadmium	Cr6	Total lead	Cyanide	Volatile phenol	Petroleum	Anion	Sulfide	Fecal coliform
Santandao																						
2011	Annual average	19.8	7.81	9.25	1.51	0.021	0.005	0.786	0.005	0.01	0.13	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	15
	Minimum	10.7	7.52	7.73	1.20	0.012	0.005	0.610	0.005	0.01	0.11	0.001	0.00002	0.00002	0.002	0.0000	0.002	0.0005	0.02	0.02	0.002	10
	Maximum	29.2	8.08	10.28	1.78	0.043	0.005	1.113	0.005	0.01	0.14	0.001	0.00002	0.00002	0.002	0.0003	0.002	0.0005	0.02	0.02	0.002	20
	Noncompliance rate	-	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	Annual average	20.7	7.78	8.96	1.42	0.023	0.008	0.744	0.005	0.01	0.13	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	18
	Minimum	9.6	7.16	7.58	1.08	0.012	0.005	0.543	0.005	0.01	0.11	0.000	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	10
	Maximum	29.2	8.13	10.68	1.69	0.031	0.014	0.993	0.005	0.01	0.15	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	50
	Noncompliance rate	-	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2013	Annual average	20.6	7.66	9.09	1.15	0.021	0.006	0.911	0.005	0.01	0.15	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0007	0.02	0.02	0.002	42
	Minimum	11.4	6.93	7.48	0.79	0.012	0.005	0.723	0.005	0.01	0.13	0.000	0.00002	0.00002	0.002	0.0002	0.002	0.0006	0.02	0.02	0.002	10
	Maximum	29.8	7.95	11.79	1.47	0.053	0.007	1.070	0.005	0.04	0.18	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0008	0.02	0.02	0.002	80
	Noncompliance rate	-	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class II standard		-	6~9	6	4	0.5	0.025	0.5	1.0	1.0	1.0	0.05	0.00005	0.005	0.05	0.01	0.05	0.002	0.05	0.2	0.1	2000

Note:

Unit: mg/L; Water temperature: ℃; pH: dimensionless; Fecal coliforms: No/L; Noncompliance rate: %

Annex Table 4.3-4: Water Quality Evaluation of Key Cross Sections in Qiandao Lake (2011-2013) (IV)

Item		Water temperature	pH	DO	Permanganate Index	NH3-N	TP	TN	TC	TZ	Fluoride	Total Arsenic	Total Mercury	Total Cadmium	Cr6	Total lead	Cyanide	Volatile phenol	Petroleum	Anion	Sulfide	Fecal coliforms
Maotoujian																						
2011	Annual average	20.2	7.90	9.21	1.51	0.017	0.005	0.763	0.005	0.01	0.13	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	23
	Minimum	9.6	7.62	7.94	1.36	0.012	0.005	0.450	0.005	0.01	0.11	0.000	0.00002	0.00002	0.002	0.0000	0.002	0.0005	0.02	0.02	0.002	10
	Maximum	29.1	8.35	10.99	1.74	0.040	0.005	1.060	0.005	0.01	0.14	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	50
	Noncompliance rate	-	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2012	Annual average	21.0	7.84	8.92	1.39	0.017	0.006	0.545	0.005	0.01	0.14	0.000	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	377
	Minimum	8.5	7.59	7.30	1.02	0.012	0.005	0.390	0.005	0.01	0.13	0.000	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	10
	Maximum	32.2	8.10	11.27	1.80	0.040	0.010	0.670	0.005	0.01	0.16	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0005	0.02	0.02	0.002	2200
	Noncompliance rate	-	0	0	0	0	0	67	0	0	0	0	0	0	0	0	0	0	0	0	0	17
2013	Annual average	21.0	7.73	9.64	1.27	0.015	0.010	0.772	0.005	0.01	0.15	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0007	0.02	0.02	0.002	123
	Minimum	11.6	7.49	7.33	1.10	0.012	0.005	0.470	0.005	0.01	0.12	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0006	0.02	0.02	0.002	10
	Maximum	29.6	8.03	11.52	1.50	0.030	0.021	1.230	0.005	0.01	0.18	0.001	0.00002	0.00002	0.002	0.0002	0.002	0.0009	0.02	0.02	0.002	330
	Noncompliance rate	-	0	0	0	0	0	83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class II standard		-	6~9	6	4	0.5	0.025	0.5	1.0	1.0	1.0	0.05	0.00005	0.005	0.05	0.01	0.05	0.002	0.05	0.2	0.1	2000

Note: Unit: mg/L; Water temperature: ℃; pH: dimensionless; Fecal coliforms: No/L; Noncompliance rate: %

Annex Table 4.3-5 Sediment Monitoring Results in Chun'an County

Item	Units	Sampling site (Serial No.)	Testing Result	Soil Class	Sampling site	Testing Result	Soil Class
pH	N/A	1 Fenglingang (Chen Village) (East longitude 118°40'40"North Latitude 29°12'55")	6.92	Class II	2 Fenglingang (Yanchang Village) (East longitude118°43'34"North atitude29°17'22")	7.9	Class II
Copper	mg/kg		26.0			23.5	
Total Chromium	mg/kg		46.8			43.7	
Zinc	mg/kg		22.5			163.0	
Nickel	mg/kg		44.4			34.9	
Lead	mg/kg		46.0			46.4	
Mercury	mg/kg		0.373			0.562	
Organics	mg/kg		13.2			13.3	
pH	N/A	3 Shangfangxi Stream (Linggan Village) (East longitude118°47'34" North atitude29°22'00")	7.12	Class II	4 Fenglingang (Houchuanyuan Village)(East longitude118°43'59"North atitude29°24'04")	7.36	Class II
Copper	mg/kg		35.0			31.6	
Total Chromium	mg/kg		62.2			52.2	
Zinc	mg/kg		176			107	
Nickel	mg/kg		32.4			29.7	
Lead	mg/kg		38.8			43.5	
Mercury	mg/kg		0.113			0.161	
Organics	mg/kg		41.7			28.9	
pH	N/A	5 Jinxianxi Stream (Yashanjiao) (East longitude: 119°03'32"North latitude:29°52'34")	7.7	Class II	6 Yaoshanxi Stream (Fuyancun) (East longitude: 119°03''12"North latitude:29°58''31")	7.74	Class II
Copper	mg/kg		24.9			36.8	
Total Chromium	mg/kg		65.1			49.2	
Zinc	mg/kg		112			117	
Nickel	mg/kg		32.5			48.5	
Lead	mg/kg		41.2			33.8	
Mercury	mg/kg		0.0481			0.0432	
Organics	mg/kg		8.28			23.6	
pH	N/A	7 Meiyuanxi Stream (Chakou Village) (East longitude: 119°12'04"North latitude:29°54'43")	6.51	Class II	8 Tantouyuan River (Xiapancun Village) (East longitude: 119°11'32"North latitude:29°45'47")	6.68	Class II
Copper	mg/kg		20			25	
Total Chromium	mg/kg		27.1			42.3	
Zinc	mg/kg		85.4			98.4	
Nickel	mg/kg		29.5			37.4	
Lead	mg/kg		25.3			19.3	
Merc	mg/kg		0.318			0.226	

Item	Units	Sampling site (Serial No.)	Testing Result	Soil Class	Sampling site	Testing Result	Soil Class
ury							
Organics	mg/kg		22.9			41	
pH	N/A	9 Langdongyuan River (Songban) (East longitude: 119°11'40"North latitude:29°43'52")	7.24	Class II	10 Fuwen Township (East longitude: 119°12'40"North latitude:29°39'04")	6.24	Class II
Copper	mg/kg		24.1			13.2	
Total Chromium	mg/kg		35.4			23.3	
Zinc	mg/kg		89.4			81.8	
Nickel	mg/kg		36.3			32.5	
Lead	mg/kg		23.4			18.9	
Mercury	mg/kg		0.0907			0.0817	
Organics	mg/kg		23.4			21.4	
pH	N/A	11Danzhu (East longitude: 119°14'32"North latitude:29°32'54")	6.49	Class I	12 Maolingjiao (East longitude: 119°00'59"North latitude:29°29'06")	7.39	Class II
Copper	mg/kg		14.3			27.7	
Total Chromium	mg/kg		37.2			57.2	
Zinc	mg/kg		92.3			114	
Nickel	mg/kg		37.3			44	
Lead	mg/kg		19			34.6	
Mercury	mg/kg		0.131			0.0799	
Organics	mg/kg		27.5			18.1	
pH	N/A	13Baimu Village (East longitude: 118°53'25"North latitude:29°27'21")	7.48	Class I	14 Shibi Village (East longitude: 118°35'04"North latitude:29°23'36")	7.35	Class II
Copper	mg/kg		8.24			15.8	
Total Chromium	mg/kg		19.7			21.6	
Zinc	mg/kg		72.2			63.2	
Nickel	mg/kg		8.59			19.6	
Lead	mg/kg		9.36			19.5	
Mercury	mg/kg		0.105			0.221	
Organics	mg/kg		5.68			11.4	
pH	N/A	15Songjialing (East longitude: 118°31'54"North latitude:29°31'14")	7.78	Class II	16 Fangwu Village (East longitude: 118°34'23"North latitude:29°31'00")	7.74	Class II
Copper	mg/kg		41			42.9	
Total Chromium	mg/kg		38.9			37.6	
Zinc	mg/kg		172			139	
Nickel	mg/kg		37.4			38	
Lead	mg/kg		38			37.7	
Mercury	mg/kg		0.299			0.339	

Item	Units	Sampling site (Serial No.)	Testing Result	Soil Class	Sampling site	Testing Result	Soil Class
Organics	mg/kg		38.3			44.4	
pH	N/A	17 Shankou Village (East longitude: 118°38'31"North latitude:29°30'02")	7.77	Class II	18Xiayuquan Village (East longitude: 118°40'45"North latitude:29°30'10")	7.9	Class II
Copper	mg/kg		33.5			41.3	
Total Chromium	mg/kg		29.4			35.7	
Zinc	mg/kg		150			137	
Nickel	mg/kg		38.1			35.1	
Lead	mg/kg		37.7			36.5	
Mercury	mg/kg		0.475			0.494	
Organics	mg/kg		13.6			37.6	
pH	N/A	19 Yaojia Village (East longitude: 118°46'57"North latitude:29°33'08")	7.94	Class II	20 Heban Village (East longitude: 118°47'38"North latitude:29°34'36")	8.11	Class II
Copper	mg/kg		92.9			41.7	
Total Chromium	mg/kg		37.8			25.7	
Zinc	mg/kg		228			135	
Nickel	mg/kg		39.1			35.1	
Lead	mg/kg		88.5			38.6	
Mercury	mg/kg		0.257			0.351	
Organics	mg/kg		30.2			37.6	
pH	N/A	21 Qinxi Village (East longitude: 118°45'16"North latitude:29°48'12")	8.02	Class II	22 Qingshan Village (East longitude: 118°46'55"North latitude:29°45'47")	7.48	Class II
Copper	mg/kg		43.7			19.1	
Total Chromium	mg/kg		39.9			16.8	
Zinc	mg/kg		133			90.5	
Nickel	mg/kg		45.2			26.1	
Lead	mg/kg		29			13.6	
Mercury	mg/kg		0.157			0.106	
Organics	mg/kg		35.3			33.8	
pH	N/A	23 Yinshanxia Village (East longitude: 118°52'48"North latitude:29°42'46")	7.7	Class II	24 Jinfeng Village (East longitude: 118°54'42"North latitude:29°40'54")	6.89	Class I
Copper	mg/kg		53.3			21.1	
Total Chromium	mg/kg		49.4			12.2	
Zinc	mg/kg		183			94.1	
Nickel	mg/kg		50.4			25.9	
Lead	mg/kg		52			15.4	
Mercury	mg/kg		0.13			0.0836	
Orga	mg/kg		22.5			15.4	

Item	Units	Sampling site (Serial No.)	Testing Result	Soil Class	Sampling site	Testing Result	Soil Class
nics							
pH	N/A	25 Zuokou Village (East longitude: 119°01’14”North latitude:29°45’35”)	7.58	Class II	26 Zhumingwu (East longitude: 119°04’27”North latitude:29°46’24”)	7.54	Class II
Copper	mg/kg		97.1			31.1	
Total Chromium	mg/kg		36.9			27.4	
Zinc	mg/kg		256			107	
Nickel	mg/kg		52.9			43.3	
Lead	mg/kg		56.9			16.9	
Mercury	mg/kg		0.186			0.067	
Organics	mg/kg		25.4			24.9	
pH	N/A	27 Huaping Village (East longitude: 118°54’58”North latitude:29°51’04”)	7.81	Class II	28 Zhangbian Village (East longitude: 118°52’01”North latitude:29°51’06”)	7.76	Class II
Copper	mg/kg		53.5			130	
Total Chromium	mg/kg		42.4			50.5	
Zinc	mg/kg		180			292	
Nickel	mg/kg		52.3			42.2	
Lead	mg/kg		68.3			88	
Mercury	mg/kg		0.0756			0.184	
Organics	mg/kg		24.5			14.6	
pH	N/A	29 Tanshang Village (East longitude: 119°00’32”North latitude:29°52’56”)	7.79	Class II	30 Xiazhong Village (East longitude: 119°09’37”North latitude:29°55’09”)	7.73	Class II
Copper	mg/kg		40.3			37	
Total Chromium	mg/kg		56.2			54.5	
Zinc	mg/kg		119			148	
Nickel	mg/kg		47.3			39.6	
Lead	mg/kg		28.1			29.4	
Mercury	mg/kg		0.136			0.173	
Organics	mg/kg		21.5			44.3	
pH	N/A	31 Xiaguangtian (East longitude: 118°08’29”North latitude:29°54’33”)	7.82	Class II	32 Kantou (East longitude: 119°09’14”North latitude:29°49’32”)	7.23	Class II
Copper	mg/kg		38.1			21.3	
Total Chromium	mg/kg		47.4			47.5	
Zinc	mg/kg		144			87.4	
Nickel	mg/kg		24.2			28.5	
Lead	mg/kg		25.4			22.5	
Mercury	mg/kg		0.148			0.178	
Organics	mg/kg		40.2			14.3	

Item	Units	Sampling site (Serial No.)	Testing Result	Soil Class	Sampling site	Testing Result	Soil Class
pH	N/A	33 Langdong Village (East longitude: 119°15'19"North latitude:29°44'21")	6.76	Class I	34 Zitongyuan 1 (East Longitude 118°42′58″ North latitude:29°34′36″	5.6	Class III
Copper	mg/kg		21.5			46.4	
Total Chromium	mg/kg		44.7			50.2	
Zinc	mg/kg		81.3			109	
Nickel	mg/kg		27.1			45.9	
Lead	mg/kg		22.5			26.6	
Mercury	mg/kg		0.144			0.0972	
Organics	mg/kg		12.6			25.8	
pH	N/A	35 Zitongyuan 2 (East longitude: 118°43′21″ North latitude:29°34′56″	5.39	Class III	36 Shangwuxi 1 (East longitude: 118°51′39″ North latitude:29°22′25″	5	Class I
Copper	mg/kg		43.6			13.7	
Total Chromium	mg/kg		43.8			30.2	
Zinc	mg/kg		106			72.2	
Nickel	mg/kg		42.5			27	
Lead	mg/kg		26.9			22	
Mercury	mg/kg		0.0987			0.074	
Organics	mg/kg		28.5			21.3	
pH	N/A	37 Shangwuxi 2 (East longitude: 118°51′53″ North latitude:29°36′06″	5.71	Class I	38 Shangwuxi 3(East longitude: 118°51′42″North latitude:29°26′09″	6.3	Class II
Copper	mg/kg		14.8			18	
Total Chromium	mg/kg		30.3			40.6	
Zinc	mg/kg		84.6			105	
Nickel	mg/kg		27.3			32.5	
Lead	mg/kg		19.9			24.9	
Mercury	mg/kg		0.0588			0.281	
Organics	mg/kg		18.1			22	

Annex Table 4.4-1 Surface Water Monitoring Results in Jiande City (I)

Unit: mg/L; except pH (dimensionless)

Item	Upstream of Laocunxi Stream (Class II)		Junction of Laocunxi Stream and Shouchang River (Class II)		Xin'an River (Class II)	
pH	7.81	7.77	8.19	8.23	7.46	7.4
DO	5.2	6.2	6.2	6.1	6.6	6.7
CODcr	10	12	12	13	11	11
BOD5	2.1	2.1	2.3	2.2	2.2	2.3
NH3-N	0.117	0.123	0.12	0.11	0.101	0.107
TP	0.042	0.055	0.032	0.048	0.042	0.033
Petroleum	0.02	0.02	0.02	0.01	0.03	0.03

Annex Table 4.4-2 Surface Water Monitoring Results in Jiande City (II)

Unit: mg/L; except pH (dimensionless)

Item	Upstream of Tongjiaxi Stream (Class II)		Junction of Tongjiaxi Stream and Shouchang River (Class II)		Upstream of Xiaojiangxi Stream (Class III)		Junction of Xiaojiangxi Stream and Shouchang River (Class III)	
pH	7.93	7.84	7.76	7.69	8.19	8.12	7.98	7.87
DO	9.4	9.3	7.2	7.1	8.6	8.6	8.2	8.1
CODcr	10	11	12	13	11	12	10	10
BOD5	2.1	2.4	2.7	2.2	2.3	2.1	2.2	2.3
NH3-N	0.117	0.123	0.120	0.117	0.107	0.110	0.101	0.104
TP	0.013	0.023	0.026	0.032	0.028	0.055	0.038	0.052
Petroleum	0.02	0.03	0.01	0.02	0.03	0.02	0.02	0.01

Annex Table 4.4-3 Surface Water Monitoring Results in Jiande City (III)

Unit: mg/L; except pH (dimensionless)

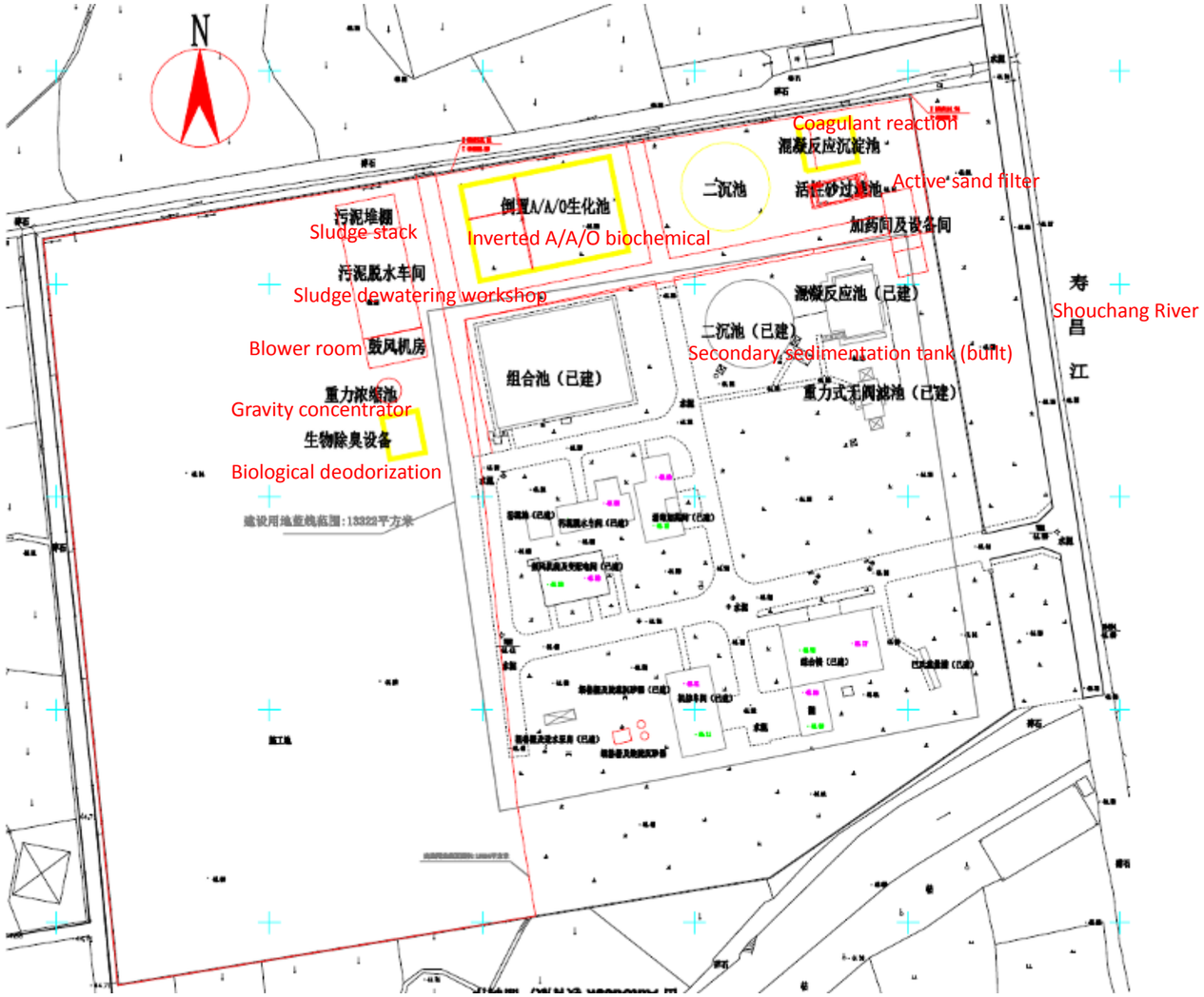
Item	Upstream of Datongxi Stream in Datong Town (Class II)		Upstream of Zhenyuanxi Stream (Wansheng Village) (Class II)		Junction of Zhenyuanxi Stream and Datongxi Stream (Class II)		Upstream of Qingtan Stream (Class II)	
pH	7.28	7.74	8.39	8.42	7.64	7.58	7.72	7.78
DO	8.7	8.6	8.6	8.7	6.5	6.6	8.1	8
CODcr	10	12	11	15	8	13	14	13
BOD5	2.2	2.6	2.3	3.1	2.1	2.6	3	2.7
NH3-N	0.132	0.135	0.169	0.172	0.138	0.144	0.147	0.154
TP	0.026	0.024	0.051	0.062	0.031	0.026	0.029	0.037
Petroleum	0.01	0.03	0.03	0.01	0.02	0.02	0.02	0.01
Item	Junction of Qingtan Stream and Datongxi Stream (Class II)		Upstream of Fengjia Stream (Class II)		Junction of Fengjia Stream and Datongxi Stream (Class II)		Junction of Datongxi Stream and Shoujiang River (Class II)	
pH	7.85	7.8	7.25	7.32	7.73	7.68	7.63	7.7
DO	8	8.1	7.1	7.2	6.7	6.7	6.6	6.8
CODcr	18	17	12	13	16	18	12	11
BOD5	3.6	3	2.5	2.8	3.5	3.4	2.8	2.3
NH3-N	0.15	0.157	0.23	0.218	0.166	0.163	0.135	0.138
TP	0.024	0.023	0.062	0.058	0.026	0.034	0.078	0.063
Petroleum	0.03	0.02	0.02	0.01	0.03	0.03	0.01	0.02
Item	Upstream of Wulongxi Stream (Class III)		Junction of Wulongxi Stream and Shouchang River (Class III)		Upstream of Shouchang River (Class III)		Shouchang River (Chengdong Community) (Class III)	
pH	7.26	7.31	7.22	7.28	8.42	8.46	8.56	8.51
DO	6.4	6.5	6.9	6.8	9.8	9.9	9.5	9.6
CODcr	18	17	12	13	10	11	11	12
BOD5	3.4	3.2	2.3	2.2	2.1	2.3	2.3	2.1
NH3-N	0.526	0.516	0.288	0.28	0.135	0.138	0.12	0.117
TP	0.074	0.068	0.053	0.034	0.025	0.052	0.034	0.046
Petroleum	0.06	0.07	0.04	0.05	0.02	0.03	0.03	0.01
Item	Upstream of Zhuyuanxi Stream (Jiangtou Village) (Class II)		Junction of Zhuyuanxi Stream and Datongxi Stream (Class II)		Upstream of Shangmaxi Stream (Class II)		Junction of Shangmaxi Stream and Datongxi Stream (Class II)	
pH	7.5	7.48	8.06	8.13	8.11	8.18	7.79	7.7
DO	6.1	6.2	8.2	8.1	7.4	7.5	7.3	7.3
CODcr	14	13	13	12	12	11	12	13
BOD5	2.7	2.1	2.4	2.3	2.3	2.2	2	2.4
NH3-N	0.117	0.12	0.135	0.138	0.117	0.123	0.117	0.12
TP	0.059	0.078	0.076	0.056	0.077	0.049	0.051	0.067
Petroleum	0.01	0.03	0.02	0.02	0.01	0.03	0.02	0.01

Item	Upstream of Datongxi Stream (Guancunqiao Village) (Class II)		Upstream of Xiaoxiyuan River (Class II)		Junction of Xiaoxiyuan River and Datongxi Stream (Class II)	
pH	7.94	7.85	7.78	7.71	7.5	7.62
DO	6.7	6.8	7.1	7	7	7.2
CODcr	18	17	12	14	10	12
BOD5	3.2	3	2.1	2.8	2.2	2.1
NH3-N	0.28	0.27	0.117	0.123	0.11	0.117
TP	0.02	0.037	0.028	0.046	0.025	0.032
Petroleum	0.03	0.03	0.01	0.01	0.02	0.02

Annex Table 4.4-4 Ambient Air Conventional Monitoring Results in Jiande City

2017-01-01 - 2017-01-31							
Date	Pollutant Concentration and IAQI						Air quality index level
	SO2 24-hour average	NO2 24-hour average	PM (≤10μm) 24-hour average	CO 24-hour average	O3 Max. 8-hour moving average	PM (≤2.5μm) 24-hour average	
	Concentration/(μg/m^3)	Concentration/(μg/m^3)	Concentration/(μg/m^3)	Concentration/(mg/m^3)	Concentration/(μg/m^3)	Concentration/(μg/m^3)	
2017-01-01	14	49	114	1	54	69	Fine
2017-01-02	19	52	130	1	40	80	Light pollution
2017-01-03	22	72	206	1.4	72	139	Moderate pollution
2017-01-04	17	92	214	1.4	34	132	Moderate pollution
2017-01-05	14	96	164	1.2	12	97	Light pollution
2017-01-06	6	31	24	0.6	21	12	Excellent
2017-01-07	8	30	25	0.8	9	14	Excellent
2017-01-08	6	12	18	0.7	62	10	Excellent
2017-01-09	14	26	72	0.9	86	52	Fine
2017-01-10	19	54	119	1.2	34	96	Light pollution
2017-01-11	10	42	49	1	42	43	Fine
2017-01-12	8	48	21	0.8	15	20	Fine
2017-01-13	9	30	36	0.8	70	24	Excellent
2017-01-14	16	37	82	0.8	91	52	Fine
2017-01-15	12	31	47	0.6	62	24	Excellent
2017-01-16	10	36	61	0.6	75	37	Fine
2017-01-17	10	42	60	0.7	34	40	Fine
2017-01-18	8	46	27	0.8	10	24	Fine
2017-01-19	8	30	22	0.8	32	20	Excellent
2017-01-20	14	12	60	0.8	88	37	Fine
2017-01-21	12	34	65	0.8	60	30	Fine
2017-01-22	12	27	64	0.8	84	38	Fine
2017-01-23	18	28	88	1.1	94	58	Fine
2017-01-24	12	20	64	1	104	40	Fine
2017-01-25	11	18	60	0.8	63	35	Fine
2017-01-26	8	18	56	1	64	36	Fine
2017-01-27	10	12	102	1.1	99	74	Fine
2017-01-28	12	10	156	1.2	75	106	Light pollution
2017-01-29	11	12	82	1	49	55	Fine
2017-01-30	6	6	58	1	76	36	Fine
2017-01-31	8	4	44	0.8	70	24	Excellent

Annex Figure



Annex Figure No. 1: General Layout Plan of Shouchang WWTP Expansion Works