

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY

FOR

**HEZHOU URBAN WATER INFRASTRUCTURE AND
ENVIRONMENT IMPROVEMENT PROJECT**

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INTRODUCTION

1.1 Background

The Hezhou municipality (Hezhou) is located in the northeastern Guangxi Zhuang Autonomous Region (Guangxi) which is the least developed of the western provinces in China.

The city has abundant surface water resources and a complex water system. The He River flows through Hezhou from northwest to southeast, and runs into the Xi River system in Guangdong Province, which is a major upstream tributary of the Pearl River.

According to the urban plan and development strategy for Hezhou to become a new tourism city and the northeast hub of Guangxi, the He River has become more important to the city. However, urban flooding and water pollution have constrained the socio-economic development in Hezhou due to the poor conditions of urban water infrastructure and the direct discharge of untreated wastewater into the He River basin.

In this context, the Hezhou Urban Water Infrastructure and Environment Improvement Project was initiated. In 2016, this project has been included into National alternative projects (2016-2018) financed by the World Bank (the Bank), with the aim of improving flood risk management, reducing water pollution and strengthening water resources planning in Hezhou. The location of the project is shown in Annex 1.

This Executive Summary is developed on the basis of the documents for the project, including the Environmental Assessment (EA) Report, the Environmental and Social Management Plan (ESMP), the Social Assessment (SA) Report, the Resettlement Action Plan (RAP), the Report for the Safety of Dams, and the Feasibility Study (FS). The EA report and ESMP were prepared in accordance with Bank policies and guidelines. All of the reports mentioned above have been made locally available to the public before each round of public consultation, respectively in April 2016, February 2017, June 2017 and October 2017, and the full EIA and ESMP were disclosed at the external website of the Bank on Oct. 24, 2017.

1.2 Environmental Assessment Process and Legal

Framework

A full EA was carried out in accordance with Chinese environmental impact assessment law and relevant regulations and the Bank environmental safeguard policies. During the EA process, the team conducted scoping on the basis of field investigations and consultation with stakeholders. Then, a baseline survey and analysis were carried out. Through collaboration with the SA and FS teams, analysis of alternatives and preferable engineering and technical options were recommended and assessed in the EA. Impacts of this project on the environment, ecosystem, and socio-economy at both construction and operation phases were forecasted and analyzed, and mitigation measures were developed. Public participation and information disclosure were carried out during this

process. Notably, because of the active interaction among the EA, SA and FS teams during the EA process, more environmentally friendly designs have been adopted in the FS.

This project triggered the following World Bank Policies: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Physical Cultural Resources (OP/BP 4.11), Involuntary Resettlement (OP/BP 4.12), and Safety of Dams (OP/BP 4.37). Compliance with these policies, and the Bank's EHS Guidelines, is summarized in Table 0-1. The project is also in full compliance with environmental policies and regulations in China, as summarized in Table 0-2.

Table 0-1 Compliance with World Bank Safeguard Policies

Safeguard Policies	Actions
Environmental Assessment (OP/BP 4.01)	Category A project. Full EA and ESMP have been prepared.
Natural Habitats (OP/BP 4.04)	<ul style="list-style-type: none"> - Survey on aquatic and terrestrial ecosystem conducted and no critical/sensitive natural habitat identified; - Assessment of ecological impacts conducted and the impacts are generally positive.
Physical Cultural Resources (OP/BP 4.11)	<ul style="list-style-type: none"> - Cultural resources survey conducted through consultation with relevant authorities; - Design the project to avoid physical cultural resources (PCR); - Engineering measures developed to protect the PCRs on site; - Chance-find procedures developed in ESMP.
Involuntary Resettlement (OP/BP 4.12)	The Resettlement Action Plan (RAP) has been prepared.
Safety of Dams (OP/BP 4.37)	The Report for Safety of Dams has been prepared.
Consultation	<ul style="list-style-type: none"> - A combination of opinion surveys and consultation meetings held during preparation of the EA and RAP - EA documents disclosed locally and at the external website of the Bank.
WBG EHS Guidelines: General EHS Guideline; EHS Guideline for Waste Management Facilities; EHS Guideline for Water and Sanitation	<ul style="list-style-type: none"> - Incorporated in the EA and ESMP.

Table 0-2 Compliance with Chinese Laws and Regulations

Chinese Laws and Regulations	Actions
Environmental Protection Law (amended in 2014)	The EA is prepared according to relevant laws/regulations and technical guidelines; Mitigation measures are developed in the ESMP and incorporated into the project design, to be implemented and supervised during the construction and operation phases.
Environmental Impact Assessment Law (amended in	A full EA report was prepared for Hezhou Project Management Office (PMO) by the Guangxi Zhengze

Chinese Laws and Regulations	Actions
2016)	Environmental Protection Technology Co., Ltd.. The Chinese EA reports for subprojects of this project will be reviewed and approved by Hezhou Environmental Protection Bureau (EPB).
Notice on Strengthening EIA Management for Construction Projects Funded by Loans from International Financial Institutions	EA and ESMP are prepared in compliance with World Bank OP4.01.
Solid Waste Pollution Prevention and Control Law (amended in 2016)	Different types of solid wastes generated from construction must be treated and disposed as planned in the ESMP. The sludge from wastewater treatment plant (WWTP) during operation phase will be treated in according with the Chinese regulations.
Water Pollution Prevention and Control Law (2008)	Mitigation measures are developed in the ESMP.
Air Pollution Prevention and Control Law (amended in 2015)	Odor Pollutants Discharge Standard (GB14554-93) was applied in the EA and mitigation measures were incorporated into the ESMP
Noise Prevention and Control Law	Noise Limits at Construction Site Boundary (GB12523-2011) were applied in the EA and mitigation measures were incorporated into the ESMP.
Soil and Water Conservation Law (amended in 2011)	A Soil and Water Conservation Plan was developed and mitigation measures were incorporated into the ESMP.
Law on Protection of Cultural Relics	Consultations with local authorities of cultural heritage were held. Chance-find procedures will be followed.
Public Participation Measures of Environmental Protection (2015)	Public consultation was conducted following the requirements during the preparation of the EA.

1.3 Scope of EA and Sensitive Receptors

1.3.1 Scope of EA

During the scoping stage, the EA considered not only China's technical guidance but also the Bank's safeguard policies. The area of influence (AOI) of this project covers: 1) areas directly and indirectly affected by the project, e.g. construction sites and permanent facilities like the three hydropower stations and Jiangnan Wastewater Treatment Plant (WWTP); 2) areas affected by induced activities, e.g. dewatering of dredged materials, construction camps and roads, borrow areas and spoil disposal sites; and 3) areas influenced by associated facilities, e.g. lakes in the upstream and downstream of the channels or tributaries to be rehabilitated in this project, and the Hezhou Sludge Treatment Center, Hezhou Waste landfill and Hezhou WWTP, etc.

1.3.2 Sensitive receptors

Six types of sensitive receptors were identified during the EA on the basis of field investigation and consultations with the communities, experts, and authorities,

including:

- Surface water affected by construction in the water: the He River and its tributaries and channels.
- Terrestrial ecosystem: 15 ancient and valuable trees near the construction sites (not in the construction sites but in the area of influence).
- Receptors affected by dust, odor, and noise during either construction or operation phase: 65 villages and communities, four schools, and other four organizations.
- Physical cultural resources (PCR): the former site of the Babu Branch of Chinese Communist Party (CCP); ancient buildings in the Xiyue Historic and Cultural Street (Xiyue Street) (Some buildings are in the construction sites while some are in the area of influence).
- Railway facilities: Guiguang high speed railway and Hezhou Railway Station.
- Irrigation areas affected by the rehabilitation of Fanglin hydropower station: about 1.06km².

PROJECT DESCRIPTION

The Project Development Objective is to improve flood risk management, reduce water pollution and strengthen water resources planning in Hezhou. With this objective, three components are proposed in this project, i.e. Component 1: Improving Flood Risk Resilience of He River; Component 2: Improving Urban Drainage and Wastewater Management; and Component 3: Institutional Strengthening, Capacity Building and Project Management. The details of subprojects under each component are presented in Table 0-1 and the map is showed in Annex 2.

Table 0-1 Description of the project

No.	Components & Subprojects	Description of activities	Schedule (Year)	Investment (1000 RMB)
1	Improving Flood Risk Resilience of He River			67,729.63
A-1	He River rehabilitation (Huangshi Hydropower Station - Guangming Bridge)	The 12.66km-long main stream will be rehabilitated in light of 50-year flood standard, including widening dikes and building new flood dikes and walls.	2019; 2020	23,515.46
A-2	He River rehabilitation (Guangming Bridge - Lingfeng Bridge)	The 2.1km-long main stream will be rehabilitated in light of 50-year flood standard, including widening dikes and building new flood dikes and walls. The old spans of Babu Bridge will be demolished and replaced by new ones.	2019; 2020	17,321.87
A-3	He River rehabilitation (Lingfeng bridge- Xiadao hydropower station)	The 6.9km-long main stream will be rehabilitated in light of 50-year flood standard, including widening dikes and building new flood dikes and walls.	2018; 2019	6,692.30
A-4	Dong Main Channel rehabilitation and connection between the main channel and Mawei river	The 9.88km-long main channel and 2.69km-long branch channel connecting the main channel and Mawei River will be rehabilitated in light of 20-year flood standard.	2022	12,743.21
A-5	Upgrade of Xiadao Hydropower Station (6,000kW)	The façade of the main building will be rebuilt and the 4km-long dikes at the upstream will be heightened.	2019; 2020	305.10
A-6	Upgrade of Fanglin Hydropower Station (575kW)	1) Buying back the Fanglin/Hejiang hydropower stations and upgrading the facades; 2) demolishing the river barrage; 3) keeping the Fanglin Bridge and heightening the dikes upstream; 4) building 4 pumps for irrigation.	2018; 2019	1,631.30
A-7	Upgrade of Huangshi Hydropower Station (1000kW)	The concrete overflow weirs will be demolished and 13 new openable spill gates will be constructed.	2020	2,008.01
A-8	He River dredging	Dredging 3.0km-long section of He River. The total dredged materials volume is estimated 33.25*10 ⁴ m ³ (wet sludge: 15.69*10 ⁴ m ³).	2018; 2019	2,512.38
2	Improving Urban Drainage and Wastewater Management			152,486.9
B-1	Huang'ansi pumping station	The designed pumping flow is 6.0m ³ /s.	2018; 2019	1,095.00
B-2	Shizigang pumping station	The designed pumping flow is 36m ³ /s.	2018; 2019	8,145.00
B-3	Lining River rehabilitation	The 6km-long river sections (including Lining River and Guangming branch	2022	8,380.20

No.	Components & Subprojects	Description of activities	Schedule (Year)	Investment (1000 RMB)
		channel) will be rehabilitated in light of 20-year flood standard.		
B-4	Changlong River rehabilitation	4.90km-long river section will be rehabilitated in light of 20-year flood standard.	2022	9,659.84
B-5	Huangtian Branch Channel rehabilitation	The 6.20km-long channel section will be rehabilitated in light of 20-year flood standard. The total dredged materials volume is 7,440 m ³ . The 600m-long sewage collection pipeline will be built.	2021	2,811.91
B-6	Gupo Mountain Flood Diversion channel rehabilitation	The 3.93km-long channel section will be rehabilitated in light of 20-year flood standard. The total dredged materials volume is 3,540m ³ . The 50m-long sewage collection pipeline will be built.	2021	1,476.42
B-7	Dongwu Branch Channel rehabilitation	The 8.39km-long channel section will be rehabilitated in light of 20-year flood standard. The waterway of this river will be redirected to the He River at the Zhanqian Avenue.	2023; 2024	6,822.45
C-1	Huang'ansi Flood Discharge Channel rehabilitation	The 1.23km-long channel river will be rehabilitated in light of 20-year flood standard. The total dredged materials volume is 8,800m ³ . The 1,900m-long sewage collection pipeline will be built.	2018; 2019	1,997.94
C-2	Shizigang Flood Discharge Channel rehabilitation	The 3.72km-long channel section will be rehabilitated in light of 20-year flood standard. The total dredged materials volume is 3,300 m ³ . The 6,000m-long sewage collection pipeline will be built.	2018; 2019	12,342.70
C-3	Jiangnan Wastewater Treatment Plant (WWTP)	A WWTP will be newly built with capacity of 15,000 m ³ /d. The A ² /O micro-aeration oxidation ditch will be applied. The associated pipelines will be 5.384km long and a 5.56km-long new road will be constructed.	2018; 2019	21,099.99
D-2	Central green corridor	Build boulevard and special water street on the basis of the connectivity of five lakes and four rivers as well as roads.	2021	11,640.71
3	Institutional Strengthening, Capacity Building and Project Management (Technical Assistance (TA))			5,483.58
E-1	River chief mechanism + Internet intelligent system	Build flood early warning system; improve the hydrological stations in the He River and build hydrological stations in tributaries.	2019- 2024	874.51
E-2	Water environmental monitoring, alerting and management system in the He River basin	Build auto-water quality monitoring stations at the He River and its tributaries. Standardize the municipal environmental monitoring station in light of national standards. Build water quality alarm system.	2018; 2019	4,609.07

ENVIRONMENTAL AND SOCIAL BASELINE

1.4 Physical Environment

Location: The project city, Hezhou, is located in the northeastern Guangxi covering an area of 11,822 km². Most of the subprojects of this project are located in Babu District (the city center), while some subprojects, like the rehabilitation of He River main stream and dredging, are located in Pinggui district which lies in the northwest of Hezhou.

Topography: Hezhou is part of the Nanling hilly region and Liangguang hilly region. Only 1,420 km² of land area is the plain. Gupo Mountain is the main one in Hezhou. Regarding Babu District, its terrain is high in the north and low in the south with mountains from northeast to southwest, and five small basins in the district. Pinggui District has diverse topography including plains, hilly regions, basins, and mountainous areas.

Climate and weather: The climate of Hezhou is subtropical monsoon climate. It has four seasons and the climate varies a lot through the year in terms of cold and hot weather, as well as drought and flood. The prevailing wind is northwest. The rainfall concentrates from April to August, which accounts for 67.5% of annual rainfall.

Hydrology: Hezhou has abundant surface water resources and complex water system. In the project area, it includes the main stream of He River and its tributaries, as well as irrigation and/or flood diversion channels in the north catchment of He River. Two tributaries and six flood diversion channels are directly included in the subprojects. There are two other tributaries and two channels in this region. The major river in Hezhou is the He River, a first-class tributary of the Xi River with a length of 3,573km. The maximum and minimum flow rate of the He River are 1,500 m³/s and 16.2 m³/s, respectively. The multi-year mean flow rate is 80.3 m³/s.

1.5 Socio-economic Context

Hezhou was previously as a county, and in 2002 was upgraded to Hezhou Municipality. Hezhou includes the Babu District and Pinggui Administration District, along with three other counties. The most developed urban area in this region is Babu District, where the old town lies, and where several flood diversion channels and tributaries of He River run. The total population of Hezhou is 2.42 million, 0.89 million of which is urban population (data from the end of 2016). The gross domestic product was RMB 51.8 billion in 2016 with a growth rate of 8.1% compared to 2015.

Hezhou also has 2000-years of history, and has significant cultural heritage resources. The 100-year old Xiyue Street is one of the official approved historical and cultural streets, and consists of ancient buildings, bridges, and other immovable physical cultural resources. Xiyue street is located downstream of the Huang'ansi channel rehabilitation subproject. The former site of the Babu Branch of CCP is located in Xiadao Primary School, which is a modern historic building reconstructed after 1980.

In addition, there is a lot of natural scenery in Hezhou, although none of these sites are

located within the project area. The rich natural and cultural resources have become important elements attracting tourists and promoting tourism and economic development in Hezhou.

1.6 Ecological Environment

The project area is located in the Babu-Hejie basin. The major land uses are urban construction land, farmland, and rural residential land. Thus, the major types are urban-agricultural ecosystem, and forest ecosystem with secondary and planted vegetation; and without any native terrestrial ecosystem in the project area. The main plants in the EA scope landscaping-related, e.g. bamboo and willow, and crops in farmlands. Fifteen (15) ancient trees were discovered in the AOI. As for animals, there are a few species of hydrophilic birds in this area.

Regarding the aquatic ecosystem, there are no critical natural habitats, i.e. no wintering area for fish, big spawning or feeding areas in He River. There is no fish migration due to decades of river development. In addition, no rare or valuable aquatic species have been discovered in the He River, and the major fish species are all commercial species.

Babu District is a sensitive area for soil erosion prevention and control in Guangxi. The accepted soil erosion amount is $500\text{t}/(\text{km}^2 \cdot \text{a})$. The current soil erosion in the project area is classified as micro-mild erosion, with a baseline soil erosion modulus of $317\text{t}/(\text{km}^2 \cdot \text{a})$.

1.7 Environmental Quality

Ambient air quality: Generally, the air quality in Hezhou is excellent. The Air Quality Index is at good levels, and can meet the Ambient Air Quality Standard (GB3095-2012) Class II. The major air emissions of this project will be ammonia (NH_3) and hydrogen sulfide (H_2S) missions from the operation of the WWTP, as well as odors from the dredging of the He River and flood diversion channels. Therefore, NH_3 , H_2S and odor were monitored in this EA at places where the targeted subprojects are proposed.

The results show that the NH_3 and H_2S at the proposed WWTP site can meet the threshold for residential areas; as required by the “Hygienic Standards for the Design of Industrial Enterprises” (TJ36-79). The odor concentrations at residential areas near the proposed dredging sections of Huang’ansi and Shizigang channels exceed the Class II of the “Odor Pollutants Discharge Standard” (GB14554-93). The results reflect the severe water pollution in the two channels because of discharge of untreated wastewater.

Water quality: The water quality of the He River and its tributaries is generally satisfactory and can meet the Class III standards in the Surface Water Environmental Quality Standard (GB3838-2002). Several pollutants, including ammonia nitrogen, total nitrogen, total phosphorus, and fecal coliform, exceeded the applied Class IV of the above-mentioned standards, in one tributary and five channels. The water quality is worse than Class V, which results from pollution due to the direct discharge of domestic

and agricultural wastewater and the low flow rates.

Acoustic environmental quality: The results of the monitoring show that the acoustic environment quality in the project area is good during both daytime and nighttime, and meets the respective standards.

Soil quality: Eight soil samples were collected at the banks of the sections of the He River proposed for dredging, and tested in order to get a baseline of soil quality in the project area. Heavy metals, i.e. cadmium (Cd), arsenic (As) and/or mercury (Hg) in seven of the eight samples exceeded the Class III standard for “Soil Quality Standards”(GB15618-1995). The results indicate a high baseline concentration in the soil in this region, which is consistent with two previous investigations carried out by government agencies.

River sediment: Monitoring of sediment was conducted at the sections of the He River and the channels proposed for dredging in order to inform the treatment and disposal requirements for the dredged materials. According to the results, for every channel, there is at least one pollutant (Cd, As, Hg, and zinc (Zn)) exceeding the Class III of “Soil Quality Standards”. Cd and As in samples collected from different depths of the He River sediment exceeded the Class III standards. The reason of heavy metal pollution in sediments is due to high baseline concentrations and many years of wastewater discharge from the mining sector in the catchment. This has lead to the concentration of metals in the sediments. In a further leachate testing for lead, Cd, As, Hg, and hexavalent chromium in the sediment, it was confirmed that the sediments are not hazardous wastes, and can be disposed of as general industrial waste.

ANALYSIS OF ALTERNATIVES

1.8 With and Without Project

Comparison of the alternatives with and without the project were conducted. In the “without project” scenario, no land acquisition or resettlement is needed, the flood dikes are not completed, and the capacity of flood diversion channels is low. Untreated domestic wastewater is discharged into channels directly. Hezhou city would continue to face the risks of flooding and water pollution in this scenario.

It is clear that although the “with project” scenario could induce some adverse environmental impacts (mainly during the construction phase) and social impacts (e.g. land acquisition and resettlement) which can be mitigated or compensated through appropriate measures. These issues notwithstanding, the “with project” scenario has significant environmental and social benefits. The “with project” scenario can avoid an area of 13.10 km² being flooded in a 50-year flood (with economic loss of RMB 2,044 million), or a flooded area of 3.1 km² in a 20-year flood (with economic loss of RMB 248.74 million). This scenario can reduce the discharge of 1,259.25t of COD and 147.83t of NH₃-N per year, and 15,000m³ of wastewater along channels will be collected to reduce 1,888.88t of COD and 221.75t of NH₃-N discharged into He River every year.

To conclude, the benefits of the “with project” alternative will greatly outweigh those adverse impacts. Thus, this project is necessary.

1.9 Alternatives for Dredging

Four dredging methods were compared as alternatives for the project, including: cutter suction dredger, grab dredger, manual/machinery dredging, and suction dredging. Depending on the advantages of different methods, they should be applied to different rivers or channels.

The cutter suction dredger is recommended for dredging the He River, as manual dredging or suction dredging is less practical than dredger vessel in such a large and deep river. In addition, the cutter suction dredger is more efficient, has less impacts on the water environment, and needs less time for dewatering compared the grab dredger, while the costs of the two methods are the same (about RMB 100-150 per cube meter of dry sediment).

Suction dredging is recommended for Huang’ansi channel and Shizigang channel, because the channels are too narrow for dredger vessels. In addition, the suction dredging would produce much less odor than manual dredging, although the cost of suction dredging is a little higher than manual dredging (RMB 100-120 versus RMB 60-100 per cube meter of dry sediment). As for Huangtian branch channel, Gupo Mountain channel and Dong main channel which are far from residential communities, machinery dredging plus suction dredgers could be considered.

1.10 Alternatives for Upgrading Small Hydropower

Stations

Different alternatives were developed for each of the three small hydropower stations to be upgraded in this project.

Huangshi Hydropower Station

Three alternatives were compared for upgrading Huangshi Hydropower Station, i.e. 1) upgrading, 2) buy-back and upgrading it as in alternative 1, and 3) buy-back and demolishing. Upgrading the hydropower station (Alternative 1 and 2) could improve flood management and water landscape at the upstream, and reduce economic loss of RMB 0.5million per year due to flood. A compensation of RMB 1.58million must be provided for ceasing electricity generation during the one-year construction period, but no worker would lose the job according to Alternative 1. Compared to this, the loss associated with demolishing the hydropower station (Alternative 3) would be RMB 1.58million every year in the future, and the workers would lose their jobs permanently without compensation, although its investment is the lowest- RMB 7million while that of Alternative 1 and 2 are RMB 24.03million and RMB 28.45million respectively. By comparing Alternative 1 and 2, the EA recommends Alternative 1 because the investment is lower than the buy-back plus upgrading scenario.

Fanglin Hydropower Station

Three alternatives were compared, i.e. 1) keeping the Fanglin Bridge and demolishing the board gates in the barrage; 2) demolishing the hydropower station and barrage, and rebuilding the Fanglin Bridge; 3) keeping the hydropower station, rebuilding the Fanglin Bridge, and demolishing the board gates in the barrage and rebuilding the barrage at the downstream.

The construction investment of Alternative 1 is the lowest due to the least construction activities, i.e. RMB 28.02 million compared to RMB 54.06 million for Alternative 2, and RMB 102.316 million for Alternative 3. In addition, no land acquisition is needed for Alternative 1. In Alternative 1 and 2, a new electric irrigation station would be built to meet the demand of water use for 1.07 km² of farmlands while there is no offset measure proposed in Alternative 3. As for Alternative 2 and 3, the safety risk of the Fanglin Bridge would be eliminated but the construction period would be long which would affect the local traffic and water quality. Based on comprehensive comparison, Alternative 1 is recommended.

Xiadao Hydropower Station

Six alternatives were compared, i.e. 1) keeping the existing hydropower station and heightening the upstream dikes; 2) buy-back and upgrading it as Alternative 1; 3) keeping the existing hydropower station and building new flood diversion channels; 4) buy-back and upgrading it as Alternative 3; 5) changing the openable spill gates to board gates; 6) buy-back and upgrading it as Alternative 5.

According to Alternative 1, heightening the upstream dikes is most practical and can meet the flood management requirements so that economic loss due to flood can be reduced. Its investment is the lowest, which is RMB 10.11million while that of Alternative 2-6 ranges from RMB 39.35million to 110.1million. Land acquisition is not needed for Alternative 1 while 47,360m² of land would be occupied for Alternative 3 or 4. In addition, adverse impacts on surface water caused by construction in the water can be avoided in Alternative 1 compared with Alternative 5 and 6. To conclude, Alternative 1 is recommended.

1.11 Alternatives for Wastewater Treatment Plant

The alternatives of siting, technology, and location of discharge outfall were developed and analyzed.

Siting

Two alternative sites for the Jiangnan WWTP were investigated and compared. The first site is at the west of Jiangnan area, south of the He River; while the second site is east of the Jiangnan area. The second site has three advantages: 1) this site is located at a lower elevation, so it is easier to collect wastewater; 2) no sensitive receptor is within 100m of the proposed site, while there are some sensitive receptors within 100m of the first site; and 3) this alternative would require less land acquisition than Alternative 1.

Although the investments of Alternative 2 is a little higher than that of Alternative 1 (RMB 0.9578million vs. RMB 0.8451million for discharge outfall pump; and RMB 1.164million vs. RMB 0.9874million for sewer), Alternative 2 is recommended because it would cause less environmental and social impacts.

Technology for wastewater treatment

The alternative technologies for Jiangnan WWTP include A²/O and MBR. Although A²/O occupies more land (1.65 hectare (ha) compared to 1.28ha for MBR), both its construction investment (RMB 36.0685million) and operation cost (RMB 1.414 per ton of wastewater) are lower than that of MRB (respectively, RMB 51.2855million and RMB 2.15 per ton of wastewater). In addition, of A²/O is easier to operate, and the sewage can more stably meet the standard compared to MBR. Thus, Alternative 1: A²/O technology is recommended.

Location of sewage outfall

The alternative locations for sewage outfall are: Jingyue Lake, and downstream of the He River. The pipeline laying must be deeper and longer if the sewage is discharged into the He River and the investment of Alternative 2 is a little higher (RMB 11.6406million versus RMB 9.8738million for Alternative 1), but the location for Alternative 2 is downstream of residential areas, and better for pollution dilution and self-purification than the Alternative 1 location. In addition, Alternative 2 would occupy less land than Alternative 1. Thus, Alternative 2 is recommended, considering its long-term environmental and social benefits.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT AND MITIGATION MEASURES

1.12 Impact Assessment and Mitigation Measures in

Construction Phase

The construction activities of this project mainly include excavation and transportation of earthwork, dike construction, dredging, upgrading of hydropower stations, and construction of Jiangnan WWTP and associated pipelines. The major adverse environmental and social impacts during the construction phase and the measures to mitigate those impacts are summarized in this section. In particular, the dredging will affect ambient air and surface water, so its impacts and proposed measures are discussed in a separate sub-section.

1.12.1 Soil Erosion

Soil erosion will be induced by construction activities, including site cleaning and construction of roads, pipeline and drainage system (excavation, earthwork stacking etc.). The rainfall splash erosion may get soil into the river if the construction by the river is not managed properly or the earthwork is not covered and transported in a timely fashion. Soil erosion can increase pollutants in the water and degrade the productivity

of the land and the ecosystem.

The total area to be disturbed by this project is 399.88ha and it is estimated that 294.38ha of soil protection facility will be damaged. During the construction phase, the total permanent soil earthwork will be 1,273,400m³. The new erosion will be increased by 136,787t compared to the current status. Thus, the construction phase is the key period for soil conservation and the key areas are also identified. For the four Class I soil erosion prevention areas, various prevention measures are summarized in the ESMP, including 1) engineering measures, e.g. piling the top soil at the temporary yard and building drainage ditches and sedimentation tanks at the construction sites, etc.; 2) greening, e.g. turf slope, planting vegetation, and landscape greening, etc.; and 3) temporary measures, e.g. covering the bare land and slopes with fine mesh net, and building temporary mud tanks.

1.12.2 Social impacts

Impacts of resettlement

The most significant social impacts of this project are the land acquisition and resettlement. After taking the protection measures, the total permanent land acquisition caused by this project will be 250.69ha. This will affect 759 households with population of 4,563. The total temporary land acquisition will be 69.71ha which will affect 307 households with population of 1,849. However, the government agencies will resettle and compensate the affected people and help resolve problems facing their new life. To address land acquisition and resettlement impact, a stand-alone Resettlement Action Plan (RAP) has been developed in accordance with national laws/regulations and the requirements of the Bank OP4.12 (see details in RAP). The detailed impacts and resettlement action plan are also summarized in Chapter 6.

Impacts on railway operation

The rehabilitation of Dongwu Branch Channel and Lining River will have potential impacts on Guiguang high speed railway and Hezhou Railway Station as they cross underneath the railway. The method of box-culvert jacking will be applied in order to minimize the impacts on railway safety and operation. The construction should not be started without Nanning Railway Bureau's approval.

Impacts on local traffic

The stockpile of earthwork, truck transportation and pipeline construction may potentially increase the traffic and induce jams. Especially, if the pipeline trench crosses the road and open trench excavation is applied, it would block the road and have adverse impacts on the traffic.

Impacts on specific sensitive sites like four schools are analyzed. The roads or sidewalks in these subproject areas would be occupied and travels of students, their parents, teachers and other people working in the schools would be affected. The main measures for avoiding impacts on local traffic developed in the ESMP include: developing the construction schedule and coordinating with the transport authority;

informing the public about the construction schedule at the construction site and through the media; optimizing the construction plan to reduce the construction period; building temporary sideways and reducing the use of village roads; directing the traffic at rush hours; and setting temporary signs at specific sites near schools.

Impacts on existing underground pipelines and cables

The existing pipelines and cables underground will inevitably be affected by the excavation for the Shizigang pumping station and rehabilitation of rivers and channels. The related pipelines and cables are identified during the EA. If they were damaged, people's lives would be affected. However, the impacts can be minimized by coordinating with authorities/ owners, and developing detailed construction plans to avoid the pipelines or cables. Emergency plans should also be prepared. Relevant authorities/owners should be informed of construction site and schedule so that they could get prepared for any emergency.

Impacts of Fangling hydropower station on irrigation areas

To upgrade Fangling hydropower station, the gates of the barrage will be demolished so the water level upstream will decrease and it could not flow with gravity to the farmlands where corns, rice and vegetables grow in three villages. The total irrigation area to be affected is 1.07km². In order to ensure the irrigation, RMB 4million will be invested in building a new electric irrigation station, and three pumps will transfer the water from the He River to the existing irrigation channels.

Impacts of opening of covered channels

Some sections of Shizigang channel are currently covered, and the covering will be removed in this project to restore the natural stream. The opening of the channel will affect the small shops and the parking lot of the Land Use and Resources Bureau (LURB) which are currently located on the cover; but the traffic on main road in this region will not be influenced. Parking in LURB can be redirected to other parking lots nearby. New small bridges will be built across the three sections. Compensation to small businesses will be provided and is included in the RAP.

Community health

Among the 22 proposed construction camps, most of them will be built in suburban areas and far from residential communities, while only Shizigang #1 camp will be located in the city center. About 60-80 workers at most will be staying in each camp during peak periods. Accommodation will be provided in the camps which will be fenced so they are relatively isolated. In this way, the communications between the workers and local communities can be minimized and the health risk on communities is pretty low.

As this project will mostly rely on the local workforce, the labor influx will be limited and corresponding social risks (e.g. pressure on population or public services) are minor. China's laws on labor and crimes are comprehensive and enforcement is stringent. The public security in Hezhou is generally good with harmonious residential communities

in the city. To conclude, the negative impacts of workers in this project on the communities are minor.

The measures to assure community health and to prevent negative impacts on the communities are proposed in the EA report, including: building sanitation equipment in the camps and strengthening management to avoid disease transmission; controlling the scale of Shizigang 1# construction camp and keeping distance from communities; trying to hire local workforce; enhancing safety awareness and strengthening education for workers on relevant laws, public security and transport safety; providing health education to improve knowledge of communicable diseases like HIV; promoting individual protection by encouraging condom use; strengthening environmental education for workers and ensuring they dispose the wastes and wastewater according to the ESMP in order to avoid disease transmission.

1.12.3 Impacts of Dredging

Methods for dredging, dewatering and final disposal

As discussed in Section 4.2, cutter suction dredger will be applied in dredging for the He River. The dredged materials will be transported to #1 and #2 sites along the He River for dewatering. As for dredging in Huang'ansi channel and Shizigang channel, the suction dredgers will be applied. If the construction of wastewater sewer was finished and the space allowed temporally redirecting the channels, manual dredging could be adopted in the two channels. The dredged materials, with 95% moisture content, will be transported by suction truck to the #1 site. The dredged materials will be dried in the mobile integrated dewatering equipment to a sediment cake with 50% moisture content. The residual water will be treated and then discharged into the He River.

As for dredging in Huangtian branch channel, Gupo Mountain channel, and Dong main channel, the machine dredging and suction dredgers will be jointly adopted. The dredged materials will be dried in the nearby mobile integrated dewatering equipment, so no dewatering site would be required. The residual water will be discharged into the channels.

The dredged materials will be transported to Hezhou Waste Landfill as the heavy metal content in the sediment exceeds the standards for soil application; and it cannot be used as soil for farmland or woodland. In this way, the dried sediment cakes will be put in sealed vehicles and transported 14km from #1 dewatering site or 18km from #2 dewatering site to the landfill.

Air pollution

The alternatives for dredging that will cause less air pollution (i.e. cutter suction dredger and suction dredger) were selected during the design stage. In addition, dredging will be carried out in the dry season in autumn and winter in order to minimize the impacts of odors on residents.

Odors will be generated from the dredged materials that are stored at the two dewatering

sites. Based on experiences with similar projects, the odor can meet the limits at 30m away and it is odorless at 50m away from the site. The dewatering sites are selected to avoid sensitive receptors with the nearest one at 100m away.

Meanwhile, the dried sediment cakes will be transported in a timely manner. Disinfection and deodorization will be conducted at the two dewatering sites by using quick lime and deodorant. The workers will be protected from the odors by wearing masks.

Impacts on water environment

The proposed dredging methods will cause a little disturbance to water bodies. The impacts of dredging on water environments will be temporary and minor. When it is completed, the pollutants in the sediment can be removed and the organic pollution in the water can be reduced, so the dredging can improve the water quality in general.

The leachate of dredged materials stored at the dewatering sites would cause water pollution in the He River. Thus, sedimentation tanks will be set at the dewatering sites. The rainwater and residual water from dredged materials will flow into the tank and discharged into the He River after sedimentation.

Final disposal

All of the dredged materials will be dried with the mobile integrated dewatering equipment. The dried sediment cakes, with 50% moisture content, must be covered and transported in a timely manner so that they are not washed away by rain and cause secondary water pollution. The total amount of dried sediment cakes from this project will be 18,459 m³. They will be transported to Hezhou Waste Landfill. The capacity of this landfill can support the disposal of the sediment cakes of this project, along with the domestic wastes from Hezhou.

1.12.4 Noise

Trucks and operating machinery in the construction sites will have impacts on the acoustic environment, especially sensitive receptors like schools. The high-level noise generated by the construction machinery will affect the area within 150 m during the daytime, and 500m during nighttime if no noise control measures are applied. If barriers or fences are installed at the construction sites' boundaries, it can meet the acoustic environmental quality standard at the sensitive receptors, and the receptors at the second row from the construction site will not be affected by the construction noise. The sensitive receptors within 30m from the construction sites are identified in the EA. In particular, more stringent measures should be adopted in construction sites near the four schools and constructions should not be carried out during school time.

The generic measures for mitigating noise are developed in the environmental codes of practices (ECOP) attached to the ESMP, mainly including: using more low-noise equipment and putting the high-noise devices at the side away from residential area; prohibiting construction during noon and restricting it at nighttime; optimizing construction plan to avoid using high-noise equipment simultaneously; shock

absorption for the foundation; optimizing transportation schedule, driving slowly and forbidding car horn; maintaining trucks and machinery well; building fences or noise barriers at specific sites to protect sensitive receptors; and reducing work-time properly for workers who operate high-noise equipment and providing noise earmuffs to them.

1.12.5 Impacts on Physical Cultural Resources (PCR)

The rehabilitation of the He River and Huang'ansi channel will potentially affect the ancient dikes, pier, and walls in Xiyue Street -- which is an official approved historic cultural street. The design of this project proposes to protect these PCRs onsite so the ancient dikes and pier will be buried to keep them stable, and new landscaping and flood dike / gates will be built outside the Minguo Period dike. No construction will be conducted at or near the ancient walls.

The rehabilitation of the He River will also have potential impacts on the former site of the Babu Branch of CCP. The original design of "T" style slope has been changed to a vertical flood wall in this section of the He River in order to avoid impacts on this PCR and protect it on site.

Protection measures for the two PCRs identified during the construction phase are developed in the PCR Management Plan attached to the ESMP, including organizing training on related laws and regulations for workers and forbidding damage or stealing of cultural relics; preparing detailed PCRs protection plans with the authority; putting clear signs of PCR at the construction sites; using manual digging to avoid disturbance from machinery and to keep the PCRs stable; and forbidding construction activities in the protection areas of PCRs. In addition, chance-find procedures are also developed.

1.12.6 Air Pollution

Air pollution is mainly caused by vehicle emissions and the airborne dust generated during trench excavation, stacking, earthwork filling and material transportation. Typically, the area influenced by airborne dusts is limited to 50 m outside the boundary of the construction site or construction road. Many sensitive receptors are identified in the area within 50m from the subprojects. However, the impact of airborne dust can be easily mitigated by 70% through water spray four- five times per day, reducing truck speeds and cleaning the tires and road. As for the stockpile and transport of lime, gravel and wastes, covering and spraying are required. Other mitigation measures developed in the ESMP include installing fences not lower than 2m at the boundaries of construction sites; restoring vegetation in good time; controlling emissions from machinery and maintaining the equipment well; and forbidding emissions of toxic gases, etc. Therefore, the impact on air quality during the construction is not severe and will disappear once the construction is completed.

1.12.7 Water Pollution

Construction activities will have temporary adverse impact on water quality. Water pollutants will be caused by the domestic wastewater from 22 temporary construction camps and the small amount of wastewater generated from the construction, including

1) the washing of construction materials stockpile, residual asphalt in road construction, and residual concrete and earthwork, especially in rainy season; and 2) oily wastewater from the construction machinery. As this project is mostly constructed in urban areas, and most of the workers will be local people, the domestic wastewater can be discharged into the existing sewers in the city. In addition, construction in the water, i.e. upgrading of the three hydropower stations will affect the water quality temporarily due to the drilling slag, oily wastewater from equipment, disturbance in the water and dewatering of dredged materials.

Generic measures for controlling water pollution during the construction phase are developed in the ECOP attached to the ESMP, including reusing the wastewater from sand and gravel processing and machinery or tires washing, for concrete mixing or spraying after sedimentation; solidifying the mud at the sedimentation tank which cannot be discharged to surface water; siting the construction sites away from surface water and ensuring the site, stockpiles of diesel and asphalt 500m away from rivers; adopting measures to prevent leakage and dropping of oil; arranging foundation constructions and those in the water (e.g. hydropower stations) in dry season; and installing treatment equipment for domestic wastewater when the construction camp at suburb areas cannot rely on urban sanitation equipment and using the treated wastewater as fertilizer for farmland, etc.

1.12.8 Solid Waste

In the construction phase, solid wastes are mainly construction wastes (e.g. gravel, lime, concrete, wood, waste brick, and earthwork, etc.) and domestic wastes. 99,100 m³ of construction waste will be transported to and disposed at the existing construction waste disposal sites at Hezhou Huangtian town Gonghe Village.

The total earthwork excavated in this project will be 3.4335 million m³ while the earthwork to be filled will be 5.4515 million m³. 59,100 m³ filled earthwork will be from this project and the rest 3.2914 million m³ will be borrowed. Two borrowing sites and one disposal site will be built. The two borrowing sites are at hilly areas and the vegetation is mainly grass and gum trees.

The permanent spoil earthwork is 1.2734 million m³, 184,600 m³ of which is dredged materials with 95% moisture content. Except the dredged materials, the rest of spoil earthwork will be reused at Electronic Technology Industrial Park and filled at the disposal site. Specific measures are developed to prevent the soil erosion at the borrowing sites and disposal site (see detailed measures in Section 5.1.1).

1.12.9 Ecological Impacts

Impacts on terrestrial ecosystem

As this project is located mainly in urban or suburban areas without native vegetation, the impacts of the construction activities on vegetation is minor. The project will disturb several species of hydrophilic birds by the He River, which are all common species, but the impacts will cease once the construction is completed.

Various measures should be adopted to minimize the impacts on ecosystems, including reducing construction period and restoring vegetation as soon as the construction finishes. In addition, the subprojects of this project include greening with native vegetation which can improve the ecological environment and attract more birds.

There are 15 ancient and valuable trees discovered about 50m away from the project area. The construction activities like excavation and disposal of earthwork, stockpile of construction wastes and transportation (trucks and machinery) might affect the trees. Specific measures for protecting these ancient and valuable trees include: narrowing the areas of construction activities and reducing the construction period; forbidding actions that would damage the trees; prohibiting building, laying pipelines, installing wire, excavation, taking sand, soil or stone, emitting smokes, or pouring wastewater, solid waste or other toxic/ hazardous materials within 5m outside the vertical projection of tree canopy; and forbidding trucks and machinery entry into this area, etc..

Impacts on aquatic ecosystem

The construction in the water and dredging will affect the aquatic ecosystem and cause loss of benthonic organisms, but it can recover once the construction and dredging are finished. In addition, the dredging section is not long (3.6km) and the construction in water is arranged in dry season, so the influenced area is limited, and impacts are minor. As there is no critical natural habitat or valuable aquatic species discovered in the He River or channels, the impacts of this project on aquatic ecosystem is minor.

1.12.10 Safety of Dams

The OP/BP 4.37 “Safety of Dams” is triggered in this project. There are 21 dams related to this project, 18 at the upstream and downstream of the project area and 3 directly involved in this project. Three of the 18 dams are small dams (less than 15m in height). Most of the dams were constructed during the 1950s-1980s and one was built in the 1910s. The primary function of these dams is irrigation. They are also operated for flood control. The dam of Guishi reservoir takes multiple functions including flood control, electricity generation, irrigation, water supply and aquaculture.

The owner of this project (the Hezhou Water Resources Bureau (WRB)) had investigated the safety of the 18 dams from 2005 to 2010, and actions for consolidating and reducing risks have been gradually carried out since 2008. Among the 18 dams, the Pinggui Huimiandu Dam is currently under consolidation, and the follow-up evaluation will be conducted after construction. Other dams are under operation normally, but problems still exist in terms of weakness in the infrastructure or management (e.g. no seepage ditch in the downstream prism, lack of water level monitoring or emergency plan and no staff working at non-flood season). The WRB has developed work plans with remedial and safety-related measures for 11 dams by 2019, and that for the other six dams by 2020.

An independent expert was assigned to carry out investigations of the three dams involved in this project (i.e. dams of Huangshi, Fangling and Xiadao hydropower stations). The problems with Xiadao dam were identified and remedial measures have

been proposed, including establishing safety monitoring system and other electrical and engineering measures. The Hezhou government will buy back the Fangling hydropower station and stop operation in the near future. The upgrade of Huangshi hydropower station is included in this project as introduced in Section 2.

1.13 Impact Assessment and Mitigation Measures in the Operation Phase

Upon completion of this project, the benefits during the operation phase will be significant; as related to the reduction of flood risk in Hezhou, improvement of water quality, and increases in flood resilience, etc. However, there are also adverse impacts that will be caused by the operation of Jiangnan WWTP and pumping stations.

1.13.1 Positive Impacts

Hydrology and flood resilience

This project will improve the standards of the flood control infrastructure and enhance the resilience of flood system in Hezhou. In the flood season, the volume flow rate and water velocity of the He River will increase by about 10% due to flood discharges. Thus, flooded urban lands will be reduced by 9 km² (by 68.7%), and the economic loss will be decreased by RMB 1.70 billion (by 83.2%). The improvement of flood control standards for tributaries and channels will have similar benefits. If the channels were not rehabilitated, an area of 3.1km² would be flooded in a 20-year flood. Especially, the residential buildings, hospitals, schools and Xiyue Street would be flooded. The subprojects related to the tributaries and channels can avoid economic loss of RMB 0.25billion.

As the flood flow rate will be enhanced, scouring may increase as well. However, the upgraded adjustable gates of the hydropower stations, jointly with measures for preventing soil erosion can form an integrated soil conservation system and control the scour and erosion. Thus, the total sediment load in the He River will decrease. As for dry season and ordinary season, the primary hydrologic parameters, e.g. volume flow rate and velocity will not change, as this project will not affect the main riverbed.

Water Quality

The water diversion and the connection of lakes and rivers will create a continuous and flowing water system in the He River basin, so it can eliminate eutrophication and improve the water quality of the lakes, rivers and channels.

The sewage collection system to be built along the channels can significantly reduce the pollution load. The wastewater to be collected in this project is 15,000m³/d in total. The wastewater will be discharged into the existing Hezhou WWTP. As calculated, 1,888.88t of COD and 221.75t of NH₃-N will be reduced per year. The planned Jiangnan WWTP will contribute to significant reduction of water pollutants discharged into the He River. As calculated, 1,259.25t of COD and 147.83t of NH₃-N will be reduced per

year.

The dredging of the He River and tributary channels can also help improve the water quality, as a large amount of nitrogen, phosphorus, and heavy metals in the sediment will be removed by dredging. This will provide a preferable environment for aquatic species. In the long term, this project will have positive impacts on the aquatic ecosystem.

Landscape and ecosystem

In this project, an urban green ring and corridor will be built. The green ring and corridor will increase the landscape connectivity, help protect habitats and ecosystem, and establish the network for tourism and leisure and social activities. The landscape of hills and waters will be integrated into the city environment and become the ecological screen for Hezhou. The system of rivers and lakes can also enhance the livability and value of the city and facilitate social activities near the water.

Urban infrastructure

The flood control system and the drainage and sewage system are fundamental infrastructure for a city. In this project, urban infrastructure of high standard will be built to enhance flood risk resilience and water quality. This project will support the sustainable development of Hezhou and present a show case of reform and innovation.

Meanwhile, institutional capacity will be strengthened through the Technical Assistance (TA). The TA will establish mechanisms for coordination and collaboration among government agencies and enhance staff capacity in Hezhou through training, workshops and study tours, which is also critical to the sustainable development of the city.

1.13.2 Adverse Impacts

Adverse impact of Jiangnan WWTP

In the operation phase, the Jiangnan WWTP will cause negative environmental impacts including effluent discharge, odor emissions from aeration process and sludge storage, noise from pump and draught fans, as well as disposal of sludge.

The Jiangnan WWTP is capable of treating 15,000 m³ of wastewater per day. Based on the modelling result during EA process, the effluent of the WWTP will only cause a small polluted belt (11m*3m) in the He River, while the concentrations of major pollutants downstream of the polluted belt can reach the Class III standards in the “Surface Water Quality Standards”. In the total mixed section, the COD and the NH₃-N concentration will reach the baseline levels respectively at 2.8km and 11km away from the outfall.

The odor from the WWTP can meet the emission standard at 100m downwind, so the protection distance of Jiangnan WWTP is designed as 100m from the boundary. The nearest sensitive receptor is located outside of this distance. Meanwhile, bio-deodorization should be used in order to make sure the un-organized odor emissions from pumping room, aeration tank, sludge thickening tank and sludge dewatering room

can meet the standard at the boundaries.

As for noise, if muffler or sound insulation methods are applied, the noise level at the boundary of the WWTP can meet the standards. Measures for alleviating noise from the WWTP are developed in the ESMP, including using low-noise equipment and pumps, grouting the foundation evenly that can absorb all kinds of vibrations, maintaining the pumps well and regularly checking; putting sound absorbers and vibration isolation devices near pumps and at walls and grounds of the pumping room; and planting anti-pollution trees and bushes around the pumping room to absorb sounds, etc.

About 0.1t of wastes will be generated from the preliminary screening and 3t of sludge will be generated per day. The sludge with 80% moisture content will be transported to Hezhou Sludge Treatment Center for further dewatering and then be landfilled in Hezhou Waste Landfill. It is feasible to have the sludge of Jiangnan WWTP treated in the treatment center.

There will be 30 staff working in the Jiangnan WWTP. They might be exposed to microorganism in the wastewater or vapor and get infected through inhaling the vapor or drops on the skin. This is infection due to direct contact, but cannot be transmitted to people outside the WWTP. Thus, various health and safety measures for staff are developed, including providing protective suit, gloves, shoes, helmet and mask to the staff; installing guardrails around tanks; developing design and operation codes in light of international and national standards for avoiding exposure; building shower and changing rooms and educating staff on personal hygiene; developing special plans for construction in enclosed space; strengthening ventilation and isolating the workers from channels of bacteria transmitting by using for example machinery flipping over; and providing immunity program and health monitoring for staff, etc.

Adverse impact of pumping stations

The major adverse impacts of Huang'ansi and Shizigang pumping stations will be noise. They will be working only when discharge of flood waters is necessary, so the operation period is short and intermittent. If the equipment is well maintained and foundation vibration isolation measures are adopted, then the impacts of noise on the residents will be minor. Still, mitigation measures are developed in the ESMP, including using low-noise equipment, grouting the foundation evenly that can absorb all kinds of vibrations, maintaining the pumps well and regularly checking; and putting sound absorbers and vibration isolation devices near pumps and at walls and grounds of the pumping rooms, etc.

Adverse impact of capacity building component

Civil work is not included in the subproject E-2: Water environmental monitoring system, as the capacity building component includes only procurement of monitoring and sample testing equipment. During the operation of the laboratory, the adverse impacts would be caused by improper treatment or disposal of wastewater, wastes or emissions from the experiments. The EA proposes requirements for the lab, including:

treating or disposing the wastewater, wastes and emissions in compliance with national regulations; putting acid, alkali and other toxic liquid in separate buckets, storing in a special room and sending it to certificated organization for final treatment; conducting experiments that may cause emissions in chemical hood and emitting the gas through high stack; putting the wastes from the experiments in designated trash bin and sending them to certificated organization for final disposal; strengthening fire, theft and poisoning prevention measures; and establishing system of storing, using and registering for flammable, explosive or toxic substances; and other lab management rules.

1.14 Cumulative impacts

The methodology for the cumulative impact assessment defined in the International Finance Corporation (IFC)'s "Good Practice Handbook-Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets" has been applied in this EA.

The important valued environmental and social components (VECs) selected for cumulative assessment are the flood control benefits, drainage benefits, and reduction of water pollutants. The scope of the cumulative impact assessment covers a 30km-long section of the He River, ranging from Huangshi hydropower station upstream to Duling hydrologic station and the Hezhou city center at the north side of the He River. Specific existing projects and planned projects in this scope for flood management and water pollution control were identified on the basis of four related plans of Hezhou. The baseline year is 2016. The 2023 scenario and 2030 scenario were developed; and extensive consultations with related government agencies and people affected by the related projects were conducted in the process and their feedback has been integrated in the cumulative impact assessment.

The cumulative impacts of this project and related existing and planned projects are significantly positive. The results show that this project is an integral part of the overall flood management system in the He River basin. By 2030, the whole flood management system will be completed in Hezhou, and the flood risk resilience will be largely improved. Hezhou city center can reach 100% of planned drainage capacity with the construction of 19 more pumping stations that reach the same standard. The cumulative reductions of COD and NH₃-N discharged into He Rive will be significant, 45,365kg and 5,325kg per day respectively in 2030.

In addition, the social impacts of this project will be combined with related existing and planned project. On the one hand, the cumulative socio-economic benefits are significant. Upon the completion of all of these projects, the multi-year average economic benefit will be RMB 202.3733million. The improvement of water environment in Hezhou city center is also beneficial for economic development. On the other hand, some of the cumulative social impacts are adverse (e.g. permanent land acquisition). The people affected by the related project should be resettled properly, or the cumulative social impacts may induce conflicts and influence the implementation

of this project. When some of the subprojects of this project and related projects are constructed simultaneously, there might be cumulative impacts on the local traffic if not managed properly.

This cumulative impact assessment also provides recommendations for collaboration among government agencies to ensure the achievement of the synergic benefits and minimize the adverse social impacts, including: establishing flood management system in Hezhou, strengthening monitoring of water quality in the He River main stream and properly arranging resettlement of related projects.

1.15 Environmental risks

The environmental risks include accidental discharge from Jiangnan WWTP, breaking of sewage pipelines, and occupational health and safety risk for workers during maintenance of the facilities. The mitigation measures and the emergency preparedness plan have been developed and included in the EA.

1.16 Due Diligence Review

A due diligence review of associated projects was carried out. The associated project will connect to the river rehabilitation in this project, or will receive and treat/dispose the wastewater and solid waste collected or generated in this project.

Several sections of dikes along the He River main stream connect to the sections to be rehabilitated in this project. Yongfeng Lake and Jintai Lake will be connected with the channels to be rehabilitated in this project. This project will be coordinated with the associated dikes and lakes especially with those simultaneous constructions.

The sewage collection system will be built along the channels in this project and the wastewater will be discharged to Hezhou WWTP. This WWTP has received environmental approval, and 60,000 t wastewater can be treated per day with current capacity of 30,000 t/d for Phase I (under operation since December 2010) and the same capacity for Phase II (completed in Oct. 2017). The discharged sewage can meet the standards stably with A²/O technology according to the monitoring data.

The sludge generated from the Jiangnan WWTP proposed in this project will be transported to the Sludge Treatment Center, which has got environmental approval and been under trial operation since January 2016. Its treatment capacity is 100t/d sludge with 80% moisture content. The treated sludge (60% moisture content) can meet the applied standards and is disposed at Hezhou waste landfill. The wastewater from the pressure filter is treated in the center and can meet the applied standard as well.

The sludge cakes from the Sludge Treatment Center and those dried from dredged materials in this project will be transported to Hezhou Waste Landfill. The landfill has received environmental approval, and started operation in 2008. A promotion project of the leachate treatment station is under construction and expected to complete in December 2017 in order to meet the national new standard for leachate. According to analysis in Section 5.1, the capacity of this landfill can support the disposal of the sludge

cakes generated from this project.

To conclude, the associated projects can well connect with this project and are capable of accommodating the wastewater/ wastes in an environmentally sustainable manner.

Land Acquisition and Resettlement

In order to minimize land acquisition and resettlement, the design of this project has been optimized to reduce the impacts on residents and organizations. To address land acquisition and resettlement impact, extensive consultation and investigations were conducted during the preparation stage. Based on that, a RAP has been developed in accordance with national laws/regulations and the requirements of the Bank's OP4.12.

The total permanent land acquisition caused by this project will be 250.69ha. This will affect 759 households with a population of 4,536. The total temporary land acquisition will be 69.71ha which will affect 307 households, with a population of 1,849. The plot area of buildings to be demolished in this project is 164,194.71m², including rural and urban residential houses, affiliated buildings, six office buildings, and state-owned small shops. The financial sources will be domestic banks and government financial allocation.

As for permanent and temporary land acquisition, a compensation plan has been included in the RAP. The standard for compensation was determined in light of laws and regulations of China, Guangxi and Hezhou as well as the Bank's safeguards OP4.12. In particular, the affected farmers will be provided with opportunities for start-up business, free job training and internships, small loans from banks, and subsidies for urban pensions. The vulnerable communities will also be included in social insurance, provided with pensions, rural medical insurance, small loans, and free job training and opportunities. For small shops, the compensation for business loss and resettlement will be negotiated with the renters. The affected office buildings will be resettled and rebuilt, or monetary compensation will be provided upon negotiation.

The institutional framework of resettlement is established in the RAP. The Project Management Office (PMO) is leading the land acquisition and resettlement work and responsible for supervising the implementation and reporting to the Bank in accordance with the RAP. The Hezhou Land Acquisition and Resettlement Office (LARO) is responsible for the implementation of the RAP and has headquarters in Babu District and Pinggui District. Several working groups have been established in affected villages in order to support the implementation of the RAP and to facilitate the communication with communities. An external institute will be assigned to monitor and evaluate the implementation of the RAP and to prepare the report for the Bank every six months.

The grievance redress mechanism is also established. The affected people can report complaints through various channels (e.g. calling hotline, sending letter to or visiting higher authorities appeal for help) via village committee, PMO, LARO, external monitoring institute, Office of Letters and Calls, or courts.

PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

1.17 Public Consultation

In accordance with the requirements of China's EIA Law and regulations, as well as the Bank's safeguard policies, key stakeholders were identified through field investigation and stakeholder analysis in order to ensure meaningful consultation for this project. The stakeholders include government agencies, like WRB, Hezhou Forest Bureau, Land Use Bureau, Urban Construction Bureau, Planning Bureau, Transport Bureau, Bureau of Aquatic Products, PCR authority, and Nanning Railway Bureau, etc., and residents and other sensitive receptors in the area of influence.

Two rounds of public consultation were conducted by the EA team. The first round, carried out in April 2016 and February- September 2017. The project information was disclosed at project-affected communities/villages and government website before the consultation. The first-round consultation informed the public general project information and drew their opinions, comments and recommendations on the project through questionnaires and several interviews and meetings with affected people and experts. The second round consultation was carried out after the draft EA report was completed in September 2017. The draft EA report was accessible to the public in the PMO and government website. The affected people and stakeholders were well informed with the project design, potential impacts and corresponding mitigation measures through interviews and meetings.

In general, the public are very supportive for the project and eagerly expecting the improvement of the environment and flood control as a result of the project. However, the public and agencies expressed some concerns about the project, ranging from farmers' land acquisition and future employment, construction schedule, sewer system, impacts of noise on schools, to impacts on PCR. The EA team forwarded these concerns to the FS team and SA team and collaborated with them to incorporate the comments in the design. Some counter measures to address the concerns were also incorporated into the EA report and ESMP.

Public consultations were conducted in forms of questionnaire, interview and meeting by the SA team jointly with the LARO and land use authorities in the engaged districts and townships throughout the preparation of RAP. The project information was disseminated to the displaced families for refining the project design, selections of the alternatives and the locations of the subprojects. In the construction phase, the public consultation will be continued through the implementation of this project by the same authorities and an independent monitoring institute.

1.18 Information Disclosure

Information of this project and the EA has been disclosed to the public via accessible channels. During the first round of consultations, the project information and major

documents were disclosed at project-affected communities/villages, and on the websites of Hezhou Environmental Protection Bureau and Hezhou Development and Reform Committee.

The draft EA documents were released on the websites of the Hezhou Environmental Protection Bureau and the Hezhou Development and Reform Committee on Oct. 9 2017; and the hard copies were placed in the PMO. The electronic versions of the EA documents are also available at the Bank's external website , as of October 25 2017.

The draft RAP was disclosed at Hezhou municipal website on October 9, 2017, and available at the external website of the Bank since October 25, 2017.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

One stand-alone ESMP was developed. The ESMP includes generic measures to mitigate environmental impacts during the construction and operation phases and site-specific measures, institutional arrangement and responsibilities for implementation and supervision, and budget and source of financing for each activity. The ESMP also includes environmental monitoring and capacity building programs, as well as reporting and public grievance mechanisms.

In particular, the generic measures are summarized in three ECOPs and one management plan for PCRs as the annexes to the ESMP, including: ECOP for Dike Construction; ECOP for Small Waterworks Construction; ECOP for Road and Pipeline Construction; and Physical Cultural Resources Management Plan.

1.19 Institutional Arrangement

The organizations engaged in the environmental management of this project include the Bank, the PMO, WRB, Hezhou Environmental Protection Bureau (EPB), Hezhou Municipal Engineering Administration Bureau (MEAB), design unit (FS team), EA team, contractors, construction supervisors, external monitoring teams, and the operators. The responsibilities of the organizations are:

- Environmental specialists of the Bank: supervising the whole project cycle from preparation to implementation and completion, and providing requirements on environmental issues in light of the Bank's safeguard policies.
- The PMO: assisting the Bank to supervise the overall environmental management of this project.
- Local supervising organizations including the WRB (the owner of this project), the MEAB and EPB: ensuring the enforcement of the measures required by the Bank and included in the ESMP and guiding environmental management staff to conduct daily environmental supervision. Specific department and staff should be assigned for this project.
- FS team and EA team: developing ESMP, proposing environmental protection measures, integrating measures into the design and assisting the implementation of

the ESMP.

- Contractors: implementing environmental protection measures included in the ESMP and bidding documents.
- Construction supervisors: supervising the implementation of mitigation measures at the construction sites, identifying problems and proposing remedial measures, reporting to the owner every month and recommending solutions for potential environmental problems.
- External monitoring team: assisting the PMO on inspection of construction sites and the implementation of mitigation measures carried out by the contractors, reporting to the PMO, developing the execution report of the ESMP and other related reports and submitting them to the PMO every half year.

1.20 Mitigation Measures

The measures for avoiding and mitigating impacts of this project are developed in the ESMP in coordination with the implementation and supervision agencies. In particular, the measures cover the feasibility study, construction, and operation phases of this project. Mitigation measures will be incorporated into the detailed designs, tender documents, and contracts; and will be implemented by the design institutes, contractors, and construction supervisors under the supervision of PMO, EPB, and related agencies. The major prevention and mitigation measures are summarized in Table 0-1.

Table 0-1 Major prevention and mitigation measures

Activities	Impacts	Prevention and mitigation measures	IMPL ORG*	SUPV ORG**
Feasibility Study Phase				
Design of this project	<p>The original design would induce:</p> <ul style="list-style-type: none"> ▪ More land acquisition and resettlement; ▪ Demolishing or occupying PCRs; ▪ Significant impacts of odors, leachate, residual water from the dredging activities; ▪ Impact of noise during operation phase, and wastewater accidental discharge from Jiangnan WWTP. ▪ Impacts on local traffic due to the opening of covered channels ▪ Impacts on railway 	<ol style="list-style-type: none"> 1. Narrow the boundaries by changing the design of dikes and avoid PCRs and sensitive receptors that would be affected by noise from the pumping stations and the WWTP. 2. Optimize the dredging methods and select the most applicable method for each river/channel through alternative analysis. Select the dewatering sites that are 100m far from the sensitive receptors. Shorten the sludge transportation route and avoid residential areas. 3. Propose a series of noise prevention measure for pumping stations, ranging from procuring low-noise equipment, to concrete foundation and other vibration isolation measures. 4. Design bridges over the channels after the cover is opened. 5. Take into account an extra capacity of the Jiangnan WWTP as a “buffer” when accidental discharge happens in order to avoid impacts on He River. 6. The FS team is coordinating with Nanning Railway Bureau to develop detailed construction plan in light of the “Regulations on Railway Transportation Safety”. 	FS team	N/A
Construction Phase				
Widening dikes, civil works, stockpile and transportation of construction materials and earthwork, construction camps and roads	<ul style="list-style-type: none"> ▪ Noise ▪ Airborne dust ▪ Wastes 	<ol style="list-style-type: none"> 1. The Annex 1 “ECOP for Dike Constructions” will be applied. 2. Noise barriers higher than 2m should be installed at the construction sites near the three schools and the construction would avoid school time. 	Construction unit	EPB
	Soil erosion	<ol style="list-style-type: none"> 1. The Soil and Water Conservation Plan for this project will be applied. 2. Pile the top soil at the temporary yard; cover the bare land. 3. Greening afterward through planting trees, bush and grass, and turf slope. 	Construction unit	EPB
	Water pollution	<ol style="list-style-type: none"> 1. Conduct construction in dry season and reduce construction period. 2. Plant vegetation as soon as construction is completed. 3. The Annex 1 “ECOP for Dike Constructions” of ESMP will be applied. 	Construction unit	EPB
	<ul style="list-style-type: none"> ▪ PCR near construction sites ▪ 53 new tombs to be 	The Annex 4 “PCR Management Plan” will be applied.	Construction unit	Culture and Media Bureau; External

Activities	Impacts	Prevention and mitigation measures	IMPL ORG*	SUPV ORG**
	resettled			monitoring institution for resettlement
	Impacts on ancient or valuable trees 50m away from the construction sites	<ol style="list-style-type: none"> 1. Narrow the areas of construction activities and reduce construction period. 2. Actions that would damage the trees are forbidden. 3. The following actions are forbidden within 5-m outside the vertical projection of tree canopy: buildings, laying pipelines, installing wire, excavation, taking sand, soil or stone, emitting smokes, or pouring wastewater, solid waste or other toxic or hazardous materials. Trucks and machinery are also forbidden from entry into this area. 4. The following actions with trees are forbidden: carving, nailing, binding, or hanging on the trees, or leaning things on the tree. 	Construction unit	MEAB
	Impacts on local traffic, particularly on travels of students and school staff	<ol style="list-style-type: none"> 1. Coordinate with transport authority and develop plans for public transportation. Start construction after approved by the authority. 2. Clear signs should be installed at the construction sites before the launch of the construction. Use the media and social media to inform in advance if possible. 3. Carry out the construction section by section. The excavation and backfilling of earthwork should be done as soon as possible. 4. Temporary sideways should be built if construction is carried out near public devices. The transportation of materials should avoid rush hours in the city. 5. The traffic police would direct the traffic during the rush hours of schooling. 	Construction unit	Transport Bureau, Transport Police
	Impacts on existing pipelines and cables underground	<ol style="list-style-type: none"> 1. The construction unit should communicate with the authorities to collect more information of underground pipelines and cables. A coordination team should be established. No construction could be conducted until approved by the authorities. 2. Develop emergency plan according to the location and depth of the pipelines and cables and try to avoid them during construction. 3. The authorities should be informed with construction plans, location and schedule and related pipelines or cables. 	Construction unit	Construction Bureau
Earthwork	Soil erosion	<ol style="list-style-type: none"> 1. The Soil and Water Conservation Plan for this project will be applied. 2. Pile the top soil at the temporary yard. Measures for drainage and sedimentation tank should be carried out. 3. Greening afterward through planting trees and grass, and turf slope, etc. Cover the bare land during construction phase 4. In particular, the soil erosion at temporary yard should be prevented by putting straw 	Construction unit	WRB

Activities	Impacts	Prevention and mitigation measures	IMPL ORG*	SUPV ORG**
		bags filled with soil at the boundaries.		
Upgrade Fanglin hydropower station	Impacts on irrigation	A new electric irrigation station and three pumps will transfer the water from the He River to the existing irrigation channels.	Construction unit	WRB
Dredging	Water pollution and impacts of dredged materials	<ol style="list-style-type: none"> 1. Inform the public about the dredging plan, its environmental impacts, the routes of cutter suction dredgers and transportation of dredged materials and sediment cakes. 2. Conduct the dredging at dry season and reduce construction period in order to minimize the disturbance of water. 3. Drainage ditches should be excavated around the dewatering sites and the leachate, residual water and rain should be directed into the sedimentation tank, and then can be discharged into He River. 4. The dredged materials and dried sediment cakes should be transported timely. 5. At the two dewatering sites, use quick lime and deodorant for disinfection and deodorization. The workers will be provided with masks. 	Construction unit	EPB
Open the covered channels	Impacts on the small shops and the parking lot	<ol style="list-style-type: none"> 1. Compensation to small businesses and affected organizations is included in the RAP. 2. Use parking lots nearby to release the pressure of parking. 	Construction unit	Public Works Administration
Implementation of this project	Land acquisition and resettlement	<ol style="list-style-type: none"> 1. The design of this project has reduced occupying lands. 2. The affected people/ family and organizations will be compensated. The standard was determined in light of national and local laws and regulations as well as the Bank's safeguards OP4.12. 3. The affected farmers will be provided with opportunities for start-up business, free job training and internship, small loans from banks, and urban pension. 4. The vulnerable communities will also get guaranteed with social insurance, provided with pension, rural medical insurance, small loans, and free job training and opportunities.. 5. For affected organizations, office buildings will be resettled and rebuilt or monetary compensation will be provided upon negotiation. 	LARO	PMO Project owner
Operation of related dams	Safety risks of 21 related dams may affect this projects.	Implement the work plans for handling safety risks with the related dams, e.g. resolving problems with seepage ditch in downstream prism, strengthening water level monitoring and personnel capacity and developing emergency plans.	WRB	PMO Project owner
E-1 Building hydrologic stations (TA component)	Noise, dust, wastes and impacts on water environment	Annex 2 "ECOP for Small Waterworks Construction" will be applied.	WRB	PMO Project owner
Operation Phase				
Operation of	Noise	1. Maintain the pumps well. Regularly check the motor and the concentricity of pump	Operator	EPB

Activities	Impacts	Prevention and mitigation measures	IMPL ORG*	SUPV ORG**
pumping stations		shaft and ensure that the bearings are well lubricated. 2. Reduce the wear parts of the pump.		
Operation of Jiangnan WWTP	Odor, noise and sludge	1. Collect the odors from pumping room, aeration tank, sludge thickening room and dewatering room and treated with bio-technique. 2. Set protected area that is 100m away from the boundaries of the above rooms/ tanks. 3. Maintain the pumps well; regularly check the motor and the concentricity of pump shaft and ensure that the bearings are well lubricated. 4. Planting anti- pollution trees and bushes around the pumping room. 5. The sludge from the WWTP will be transported to Hezhou Sludge Treatment Center for further dewatering and then sent to Hezhou waste landfill.	Operator	EPB
	Workers' health and safety	1. Protective suit, gloves, shoes, helmet and mask must be provided to the staff. Guardrails around tanks should be installed. 2. The design and operation codes should be developed in light of international and national standards for avoiding exposure. 3. Shower and changing rooms should be built and education on personal hygiene is needed. 4. Special plans for construction in enclosed space should be developed in light of international and national standards. Ventilation is required before the workers entry the space and they should carry gas detection device. 5. Isolate the workers from channels of bacteria transmitting by using for example machinery flipping over.	Operator	Center for Prevention and Control of Occupational Diseases
Accidental discharge from the WWTP	Water pollution due to accidental discharge from the WWTP	1. Establish institutional arrangement and mechanisms. 2. Provide training and study tour to managements and staff. Establish evaluation mechanism and only qualified staff can be employed. 3. Strengthen the check of pipelines in order to identify problems in time. 4. Prepare several sets of equipment that is easy to get damaged and ensure plenty of back-up parts. The motors must have back-up sets. 5. The operation of electric equipment should follow safety codes. The main devices should have monitoring data in computer and can alarm timely and record location and time and accidents so that repair can be arranged soon.	Operator	EPB
Breaking of sewer	Water, soil and groundwater pollution due to leakage of sewer	1. Check the quality of pipeline and the layout before laying pipelines. Check the wells whether it meets the applied standards. 2. Fix the protruding seam of pipelines due to extrusion and prevent the pipeline from being blocked.	Operator	EPB

Activities	Impacts	Prevention and mitigation measures	IMPL ORG*	SUPV ORG**
		3. Backfilling the trench should wait until the concrete of pipeline base is hard. Stones or gravels should not be backfilled. The backfill should be conducted layer by layer and balance the weight to protect the pipeline. 4. Establish mechanisms for pipeline monitoring and supervision. Change the damaged pipeline timely.		
E-2 Operation of lab for water environmental monitoring (TA component)	Wastewater, wastes and emissions from experiments in the lab	1. The treatment and disposal of the wastewater, wastes and emissions should be in compliance with national regulations; 2. The acid, alkali and toxic liquid should be put in separate buckets, stored in a special room and sent to certificated organization for final treatment; 3. The experiments that may cause emissions should be carried out in chemical hood and the gas should be emitted through high stack; 4. The wastes from the experiments should be put in designated trash bin and sent to certificated organization for final disposal; 5. Fire, theft and poisoning prevention measures should be adopted; 6. The system of storing, using and registering for flammable, explosive or toxic substances should be established.	EPB	PMO

*Implementation organization; **Supervision organization

1.21 Environmental Monitoring and Supervision

An environmental monitoring plan was developed for the construction and operation phases and incorporated into the ESMP, which includes the monitoring location, frequency, monitoring parameters, standards applied, cost estimate, as well as responsibilities of different organizations. At the construction phase, monitoring of ambient air quality will be conducted periodically at sensitive receptors. The water quality of the channels, tributaries and the He River will be monitored every six months. Monitoring of acoustic environmental quality will be carried out at 25 sensitive receptors twice a year. The moisture content of five samples of dewatered sediment cakes will be monitored once a week during the dredging period at the dewatering sites. In addition, monitoring of soil erosion will be carried out during the construction phase. During the operation phase, quarterly monitoring of air emissions, wastewater discharge and noise will be conducted for Jiangnan WWTP. The water quality of Huang'ansi, Shizigang channels and He River will be monitored every quarter as well.

An environmental monitoring plan for associated projects was also proposed, including Hezhou WWTP, Hezhou Sludge Treatment Center and Hezhou Waste Landfill.

The cost for environmental monitoring in this project is RMB 784,300 and that for soil erosion monitoring is RMB 560,000.

1.22 Capacity Building and Training

A training program was developed for the PMO staff, project owner, construction supervisors, and contractors. The training will focus on the responsibilities of the relevant organizations, environmental regulations, mitigation measures, environmental monitoring, requirements on supervision and reporting, and public grievance mechanism. The total estimated cost for the training program is RMB 120,000.

1.23 Reporting and Public Grievance Mechanism

The requirements for reporting system has been clearly specified, including reporting on project progress, execution of the ESMP, monitoring, and public concerns etc. The public grievance mechanism will be established and maintained throughout the project to deal with any public concerns on the project implementation and related environmental and social issues.

1.24 Investment for Environmental Protection

The total estimated investment for the environmental protection of this project is about RMB 49.6067million, including RMB 2million for EA at the feasibility study phase; RMB 3.23 million for implementing mitigation measures, carrying out external monitoring, construction supervision and training during the construction phase; RMB 16.5767million for soil conservation; RMB 26.55million for implementing the work plans for “the safety of dams”; and RMB 1.25million for environmental acceptance, monitoring and training at the operation phase. Among them, the measures for dam

safety and those at the operation phase will be invested by the project owner itself and not covered by the Bank's loan- RMB 27.8 million in total.

Conclusions

Upon completion of this project, the flood control and drainage infrastructure and flood risk management will be significantly improved in Hezhou. This project will also reduce water pollution in the He River, and contribute to improvement of water quality. In addition, this project will help strengthen the water resources planning in Hezhou.

During the construction phase, the civil works, transportation, and dredging in this project will induce air pollution (dust and odor), noise, wastewater and wastes, and cause some adverse impacts on PCRs, railways, and irrigation. This project will also lead to land acquisition and resettlement. During the operation phase, some adverse impacts of discharge of treated sewage, odor, and noise from Jiangnan WWTP and pumping stations will be generated. However, these adverse impacts can be avoided or mitigated by various measures proposed in the ESMP and through better design, public consultation, and implementing the RAP and recommendations on "the safety of dams". To conclude, the benefits of this project outweigh the adverse impacts; and this project is feasible in environmental and social aspects.

Annex 1: Location of Hezhou Municipality



Annex 2: Scope of the Project

