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Environmental and Social Assessment

Executive Summary

For

Chongqing Small Towns Water Environment Management Project

Chongqing Holly Environment Impact Assessment Co., Ltd.

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1. Introduction

1.1 Background

The proposed Chongqing Small Twons Water Environment Management Project (hereinafter the Project) consists of embankment improvement and dyke-top roads, wastewater collection and treatment facilities as well as non-physical components regarding technical assistance and project management in the selected four small counties of Tongnan, Rongchang, Pengshui and Shizhu.

Chongqing has been selected by the central government of China as one of the pilot municipalities to promote urban-rural integration as part of the national strategies of Western Region Development intended for creating conditions for attracting investments into small towns to accommodate growing populations, so as to alleviate the pressures on the larger cities. However, the expected growth and development of the small towns of Chongqing will be greatly constrained by a series of challenges, particularly the water environmental issues including river flooding and wastewater facilities. To facilitate the development of the small towns, Chongqing has made a set of planning for social and economic development and environmental protection which place emphasis on an integrated approach to managing the water environment of the small towns. This proposed project is an integral part of the planning.

This project has been classified into Category A, which requires full assessment and preparation of EIA and EMP, collectively known as the EA documentation. An Environment Assessment (EA) has been prepared by the Chongqing Holly Environment Impact Assessment Co., Ltd. following relevant provisions specified in Chinese EA laws/regulations and technical guidelines, as well as World Bank safeguard policies. In addition, a Social Impact Assessment (SA) report has been prepared by the Chongqing PMO, with the main findings and conclusions incorporated in the EA. An Environmental and Social Management Plan (ESMP) was prepared to synthesize recommendations of the EA report and the SA Report. This document is a summary of the EA and SA documentation. In current stage, as the detailed location and scale of the proposed wastewater treatment plant and the associated pipelines under the Pengshui County component is yet to be developed, an Environmental Management Framework and Resettlement Action Framework are prepared to guide the preparation of EA and RAP, as well as the design for the wastewater treatment plant and associated pipelines.

1.2 Environmental Laws, Regulations, Policies and Applicable Standards

1.2.1 Laws and Regulations

The basis of the EIA Reports includes national and local environmental laws, regulations, policies, the World Bank's environmental and social safeguard policies and IFC's EHS Guidelines, as follows:

- Environmental Protection law of the People's Republic of China, 1989
- The Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution, 2000
- The Law of the People's Republic of China on Prevention and Control of Water Pollution, 2008
- The Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise, 1996
- The Law of the People's Republic of China on Environmental Impact Assessment, 2003
- The Solid Waste Pollution Control Law of the People's Republic of China, 2005;

- Technical Specifications for Environmental Impact Assessment;

1.2.2 Safeguard Policies and EHS

- OP 4.01 Environmental Assessment;
- OP 4.04 Natural Habitats
- OP 4.11 Physical Cultural Resources;
- OP 4.12 Involuntary Resettlement ;
- OP 4.36 Safety of Dams;
- EHS: General EHS Guideline;
- EHS: Waste Management; and
- EHS: Wastewater and Ambient Water Quality.

1.2.3 Applicable Standards

The applicable standards are included in Table 1-2.

Table 1-2 Applicable Standards

Category	Ref.	Name of standard
Environment quality standard	1	• Ambient Air Quality Standard (GB3095-1996)
	2	• Surface Water Quality Standard (GB3838-2002)
	3	• Acoustic Environment Quality Standard (GB3096-2008)
Pollutants discharge standard	4	• Noise Limits on Boundaries of Construction Sites (GB12523-2011)
	5	• Pollutants Control Limits for Sludge for Agricultural Application (GB4284-84)
	6	• Integrated Wastewater Discharge Standard (GB 18918-2002)
	7	• Integrated Emission Standard for Air Pollutants (GB16297-1996)

2. Project Description

2.1 Composition of Project

The Project Development Objective is to reduce flood risks and improve wastewater services in selected counties of the Chongqing Municipality. The constituents of the Project are described in Table 2-1 below:

Table 2-1 Description of the Project

Location	Description
Tongnan County	• Construction of 6.84 km embankment on Fujiang River against 10-year flood; • Construction of 6.84 km dyke-top road with the width of 5 m; • Construction of a rainwater discharge ditch
Rongchang	• Construction of 10.3 km embankment on Laixi River; • Construction of 13.9 km dyke-top road with the width of 4 m; • Construction of rainwater discharge ditch of 3 km; • Construction of 3 landscape bridges and 4 docks for sight-seeing boats
	• Construction of 12.3 wastewater pipeline; • Construction of one pumping station
Pengshui	• Construction of 4.687 km embankment on Wujiang River; • Construction of 4.76 dyke-top road with the width of 8 m

Location	Description
	• Construction of one municipal wastewater treatment plant and associated pipelines[1]
Shizhu	• Construction of 5.665 km embankment on Longhe River; • Dredging works of 1.180 km; • Construction of 9 box culverts and one pipe culverts; • Construction of 1.9 km dyke-top road with the width of 15 m
	• Construction of 12.5 km wastewater pipeline; • Construction of one pumping station and upgrading of one pumping station
Non-physical component	• Flood forecast and alarming system; • Project management

The location of the project is illustrated in Figure 2-1.

2.2 Projection of Wastewater Flow

County	Service Population (to 2030)	Ration of water demand (L/cap.d)	Water demand (m3/d)	Wastewater flow (m3/d)
Rongchang	173.85 thousand	220	38.24 thousand	32.52 thousand
Shizhu	86 thousand	150	12.9 thousand	3.156 thousand

3. Environmental Baseline

3.1 General Setting

Chongqing is located in the southwest of China and the upstream region of the Yangtze River. Chongqing is the largest municipality under the direct jurisdiction of the central government which represents a complex combination of the features of the big city, big countryside, big mountainous region, and big reservoir area of the Three-Gorges Reservoir. It has a total population of 29.45 million residing in its 40 districts/counties with a combined area being 82.4 thousand km2. The small towns/counties are typically located on the deep valleys and developed on the scattered patches of land. Such unfavorable topographical and geographical features lead to vulnerability of the small towns to the high risks of river flooding, landslide, and soil erosion.

3.2 Meteorology

Chongqing is situated on the transitional region between the Tibet Plateau and the middle-downstream plain of the Yangtze River, where the semi-tropical climate dominates. The precipitation is brilliant in Chongqing, while the annual precipitation in most areas of Chongqing averaging 1,000-1,350 mm. However the precipitation varies largely with different months, with 70% being distributed in the rainy season from May to September each year. The relative moisture averages 70% -80%, ranking the high moistures level in China. The annual temperature averages 16^{o}C to 18^{o}C.

3.3 Geology and Topography

Chongqing is bordered by high mountains to the north and southeast

[1] As the wastewater planning of Pengshui County is yet to be developed, the detailed location and scale of the municipal WWTP and the pipelines can not be determined in current stage. An environment management framework has been prepared to guide the preparation and approval of the EA for this component.

respectively, and then slopes to the Yangtze River valley in the middle part of the city. The terrain is rolling along the rivers and mountains, which forms the dominating landform constituted by low hills and mountains in Chongqing. The counties are typically located on alluvial plain underlain with sands and rocks where the Karst landforms are widely distributed.

3.4 Hydrology and Water Conservancy

Chongqing is located within the Yangtze River catchment, where the potential for hydropower generation is very high. The Yangtze River discharges through Chongqing from the west to the east with a total length within the city being 665 km. The main information on the hydrology and water conservancy of the project counties are summarized in Table 3-1 below.

Table 3-1 Hydrology and Water Conservancy of the Project Counties

County	Hydrology	Water Conservancy
Tongnan	Fujiang River is the secondary tributary of the Yangtze River. The total length is 670 km with the area of catchment being 36,400 km2. The annual flow rate averages 572 m3/s and the max. flow rate is 1140 m3/s.	There are totally 9 step hydropower stations on the Fujiang River. The river section within the project is between Tongnan Step Hydropower Station and the Shuangjiang Hydropower Station.
Rongchang	Laixi River is the primary tributary of the Tuojiang River which is a tributary of the Yangze River. The total length of the Laixi river is 192 km with the area of catchment being 3,257 km2. The annual flow rate averages 10.71 m2/s, and the Max. flow rate is 22.0 m3/s.	There are totally 3 step hydropower stations on Laixi river. The river section within the project is between the Shapu station and the Gaoqiao station.
Pengshui	Wujiang River is the primary tributary of the Yangtze River. Its total length is 1,053 km with the catchment area being 87,920 km2. The annual flow rate averages 1,108 m3/s, and the Max. flow rate is 2,677 m3/s.	There are totally 11 hydropower projects on the Wujiang River, with 3 within Chongqing. The river section within the project is between Pengshui station and the Yinpan Station.
Shizhu	Longhe River is the primary tributary of the Yangtze river. Its total length is 161 km with the catchment area being 2,810 km2. The annual flow rate averages 20.15 m3/s, and the Max. flow rate is 40.7 m3/s.	There are totally 4 hydropower projects on the Longhe River. The river section within the project is between Tengzigou Station and Niulankou Station.

3.5 Ecology and Soil Erosion

3.5.1 Terrestrial Ecology

The project area has been developed by human and generally is in rural setting. The agricultural crops dominate the terrestrial flora system and terrestrial animals are mainly livestocks. There are no rare terrestrial species or large wild animals observed or recorded in the project area.

3.5.2 Aquatic Ecology

The hydropower of the rivers in the four project counties has been

intensively explored by construction of a number of step hydropower stations, which has caused severe ecological fragmentation and significant modification of natural habitats of the rivers. The aquatic survey has been carried out by the EA team on these rivers during the preparation of the EA. The information collected and confirmed by local relevant departments indicates that there are no significant natural habitats, and only the river section of Fujiang River to be affected by the Tongnan Component involves one fish species under the protection at Chongqing Municipal level and two spawning sites for common fish species, i.e. carps, crucian and catfish.

The *Procypris rabaudi*, protected at Chongqing municipal level, is distributed in the trunk stream and tributaries of the Yangtze River where the slow flow and rocky riverbed provides the favorable habitat for them. However, as their migratory routes have been cut off by the step hydropower dams on the rivers, the population of the *Procypris rabaudi* has rapidly decreased. In addition, the overfishing and water pollution are considered another cause for the diminishing population of *Procypris rabaudi*in the river. The fish resource survey conducted in 2009 and 2010 shows that the *Procypris rabaudi* has disappeared in the river section within Tongnan County although fishers reported very occasional capture of the *Procypris rabaudi* in the river.

The two spawning sites are located in the upstream of the urban area of the county of Tongnan, one is near the Xibu Village and the other near the Huangjiao Village. The sand banks near the two villages are inundated in high flow season thus providing a favorable condition for the establishment of the pawning grounds for the weak sticky spawns. The information collected during the survey show that the spawning season is from March through May each year.

Although the information available show that the natural habitat in the section of Wujiang River within Pengshui County has been significantly degraded, there would be some pawning grounds for the common fish species but the specific location of the pawning grounds yet can not be identified. The experts and relevant departments suggest that although the construction of the embankment may not severely affect the pawning grounds provided proper mitigation measures are taken in construction stage, the SS in the treated effluent from the proposed WWTP under the project would potentially affect the pawning grounds. They also require that the outfall of the proposed WWTP be at least 500 m downstream of the pawning grounds. Thus the survey of the pawning grounds will be conducted under the EMF for the proposed WWTP in Pengshui County and the analysis of the potential impact by the WWTP on the pawning grounds has been highlighted for option comparison and impact analysis and mitigation measures development in the EMF.

3.5.3 Fujiang National Wetland Park

Fujiang Naitonal Wetland Park is located in Tongnan County within the catachment area of Fujiang River. This park is established for demonstration of the construction of wetland park oriented for scientific research and education, and ecological tourism. The total area of the park is 554.1 hectares and the total planning area is 1450 hectare. The Dafo Temple protection area is within the planning scope of the park. Part of the proposed embankment will occupy the land in the Class II Area zoned for rational land use of the park.

3.5.4 Soil Erosion

Chongqing has a complex distribution of various soil types, and the soil erosion is severe. The four counties are situated in either the key regions for soil erosion control and monitoring or for soil erosion prevention.

3.6 Socio-economic Status

There are totally 28.8462 million people in Chongqing, with 13.5507 million in the urban area. Among the 40 districts/counties, 14 are listed as the poverty reduction counties at national level and 4 at muniaipal level. In 2011, the employed people in Chongqing is 7.907 million, and the jobless people is 0.1296 million. In 2011, the disposable income per capita of the urban residents is RMB 20,250, RMB 1,560 less than the national average; while that of the rural residents is RMB 6,480, RMB 497 less than the national average. The economy of the four counties are centered on husbandry, agriculture or tourism.

3.7 Physical Cultural Resources

It is confirmed by the relevant authorities that this Project will involve the Darong Bridge and Wanling Ancient Town in Rongchang County, Xujiaba Site and 4 family tombs in Pengshui County, and Dafo Temple and 32 family tombs in Tongnan County.

The Wanling Ancient Town and Darong Bridge have been listed into the Cultural Heritage Inventory protected at county level and municipal level respectively for their historic, architectural and aesthetical values. The Wanling Ancient Town was built on the left bank of Laixi River where the embankment has been completed to the desired standard, and the proposed project will construct only the embankment on the right bank of Laixi River which will be partially located within the protection scope of the ancient town that covers the area 80 m-100 m from the two sides of the river. Darong Bridge, built in Ming Dynasty and recognized as the landmark of the Wanling Ancient Town, is a stone arch bridge over the Laixi River. Its protection scope is within an area 2 m from the two ends, and 15 m from the two sides of the bridge. The project will build the embankment on the right side of the river in this section.

The Xujiaba Site was the tribe site in the Shang and Zhou Dynasty. It has been classified into the Cultural Heritage Inventory protected at municipal level for its archaeological value. It is on the terrace of the left bank of Wujiang River and the project in Pengshui County will occupy the area zoned for archaeological excavation and buffer areas.

The Dafo Temple has been classified into the Cultural Heritage Inventory protected at national level. The protection scope of the temple has been classified into three areas. In the order of importance, the core area, the control area and the environmental harmonization area. The proposed works of embankment will be partially located within the environmental harmonization area.

3.8 Due Diligence Review

3.8.1 Wastewater Collection and Treatment

Currently the four project counties are lack of wastewater facilities, resulting in low wastewater collection rate and direct discharge of wastewater into the rivers without any treatment. A due diligence review of the wastewater collection and treatment service in the project area has been made and the findings are as follows:

- The wastewater collected by the project can be conveyed to the wastewater treatment plants, either in operation or in planning, through the sewers proposed under the project that will connect with the existing wastewater pipelines;
- The existing wastewater treatment plants in Rongchang County have adequate capacity to accommodate the wastewater collected by the project;
- The wastewater treatment plant in Shizhu County will be expanded by 2016, thus capable of accommodating the wastewater

collected by the project;
- As the project area in Tongnan County will not be developed in short term, construction of the wastewater pipelines is not considered and included into the project.

3.8.2 Flood Prevention Works

The due diligence review on the integrity of the flood embankment for the project area has been carried out and it is found that the embankment under the project can meet the standard of local flood prevention planning and can ensure the full integrity of the flood prevention system for the project area.

3.8.3 Sites for Municipal Sludge and Spoil

The due diligence review has been done on the facilities that will dispose of the sludge from the wastewater treatment plants receiving the wastewater collected from the project. It is found that the facilities have been designed and constructed to the sanitary standard and operating in compliance with the environmental requirements of China. The capacity of the facilities is adequate to accommodate the amount of the sludge to be generated from the wastewater treatment plants.

The spoil grounds that will receive the spoils from the projects in the four counties have been carefully sited and constructed in line with the relevant environmental requirements, and have adequate capacity of disposing of the spoils.

3.9 Current Environmental Quality

Local environmental monitoring stations of the four counties have been contracted to carry out the environmental quality monitoring program. with results of the monitoring program as follows:
- The ambient air quality of the project area in the four counties is fairly good and meet the Class II of the Ambient Air Quality Standard, except that the NO2 concentration in Pengshui exceeds the corresponding standard which is caused by the emission from the household coal-fired stoves and boilers;
- The surface water quality of the river sections within the project area is fairly good in Shizhu and Tongnan Counties and meet the Class III of Surface Ambient Water Quality Standard; while that in Rongchang and Pengshui Counties fails to meet the standard due to the direct discharge of domestic wastewater into the rivers without any treatment;

3.10 Sediment Quality

The project in Shizhu County will involve dredging of 1180 m of its river sections on Longhe River and Longshiqianxi Greek. The water pollution source survey carried out by the EA team confirms that there is no industrial wastewater discharge into the rivers. A sampling and analysis program for the sediments to be dredged has been conducted on Feb. 10, 2014 by Chongqing Mineral Resource Supervision and Testing Center according to domestic relevant specifications. The result of the program and the comparison with the Standard for Quality of Sludge for Agricultural Application (GB 4284-84) and given in Table 3-2 below.

Table 3-2 Quality of Sediments to be Dredged (mg/kg dry sludge)

Heavy metal	Sediment	Quality of Sludge for Agricultural Application (GB 4284-84)	
		For Acid Soil (pH<6.5)	For Neutral or Alkaline Soil (pH>6.5))
Cu	47.5	<250	<500
Zn	151	<500	<1000
Pb	61.3	<300	<1000

Cd	1.23	<5	<20
Cr	62.2	<600	<1000
Ni	40.1	<100	<200
Hg	0.15	<5	<15
As	8.22	<75	<75

It is clear that the sediment quality is good and meet the standard for agricultural application, and thus can be classified into the non-toxic material.

4. Comparison of Alternatives

During project development, various alternatives have been screened and compared with technical, economic and environmental criteria. In terms of the environmental assessment of alternatives, the primary objective was to identify and adopt options with the least adverse environmental impacts at reasonable cost.

4.1 With and Without Project Scenario

The scenarios of With and Without Project have been considered and compared. The positive impact to be brought by the scenario of With Project is obviously in improving the water environment and promoting the socio-economic development. Thus the With Project is preferred.

4.2 Options for Alignment and Type of Embankment

4.2.1 Rongchang County

Three options for alignment of the embankment are considered and compared based on the above criteria. Option two which is designed generally along the original bank lines is considered the preferred option because it will cause the least soil erosion, least total cost, and less impact on Darong Bridge and create the largest cross section for flood discharge.

4.2.2 Shizhu County

Two options for alignment of the embankment are considered and compared based on the above criteria. Option one which is designed to streamline the original bank lines is considered the preferred option because it will cause the least land occupation and people resettlement, least impact on sensitive receptors and soil erosion, the least cost and larger cross section for flood discharge.

4.2.3 Pengshui County

The options for the embankment alignment on the section where the Cuoqigou river confluences with Wujiang River, and the section located in the protection scope of the Xujiaba Site have been developed and compared respectively. The consideration to avoid or minimize the occupation of the land within the protection scope of Xujiaba Site has been reflected in the development and comparison of the options.

Two options for the alignment of the embankment on the river section of Xujiaba Site have been designed and compared. Option one is designed along the existing bank line which is coincide with the boundary of the protection scope of the Xujiaba Site, thus inevitably occupying part of the protection scope; Option two is along the area 2 m out of the boundary of the protection scope of the Xujiaba Site and inside the watermark of 215 m when the reservoir is in normal storage of water, so as to avoid the land occupation of the protection scope.

Although the Option one will occupy the land within the protection scope of the Xujiaba Site, it will provide protection for the site from 20-year flooding as desired for this area and the archeological

excavation on the land area to be occupied has already been completed. And this option has been carefully designed so as to minimize the land occupation of the protection scope of the Site. In addition, the Option One will cause less soil erosion and cost, and implies the easy construction of the road and wastewater pipeline because of the streamlined alignment of the embankment; in contrast, the Option two can not meet the requirement for prevention of 20 year flood thus the Xujiaba Site is still exposed to the high risk of flooding, and it is very difficult to construct the road and the wastewater pipeline. Therefore, the Option one is considered the preferred option.

4.2.4 Tongnan County

The options for alignment of two embankment sections and one revetment section have been developed and compared. The criteria for comparison integrate the consideration of avoidance or minimization of the impact on the identified two pawning grounds and the Dafo Temple.

After comparison, the Option One for the first embankment section is considered the preferred option since it keeps the longest distance from the two pawning grounds thus the least impact on the pawning ground, and it will cause the least amount of soil erosion and the least impact on the cross section of the river for flood discharge.

Under the option comparison for the second embankment section, considerations for the end of the embankment are developed and compared, which has taken into account of the impact on the Dafo Temple protection area and the Shengli Canal. The consideration that will not pass through the Shengli Canal will not cause occupation of land within the core area of the protection scope of the Dafo Temple hence complying with the Master Planning for the Dafo Temple Protection Area and the relevant regulations, and will reduce the technical difficulty, without compromising the safety of the protection area. Therefore this consideration is preferred.

The options for the alignment of the embankment on the river section to the left of the Fujiang River mouth have been developed and compared. The Option to construct the embankment on the high land is preferred as it will cause the least impact on aesthetics, less technical difficulty and the least cost. However this option will cause the water logging problem and blocking of an existing road in the village of Shengli. This issue has been carefully considered in the design of the embankment on this section, which has reserved the corridor for the existing road and designed two ditches for rainwater discharge from this area.

The embankment on the section 2.2km upstream of the Jinfo Bridge will inevitably partially occupy the core area of the drinking water source protection area. Thus the mitigation measures have been developed and consultation with the relevant departments has been conducted for this issue. Two options for alignment of this section have been developed for comparison. The Option One is considered the preferred option because it is further from the pawning ground in Xibutang Village, and occupies less farmland and create larger cross section of the river for flood discharge.

4.2.5 Options for Type of Embankment

The options for the type of embankment for each county have been developed for comparison which place the primary consideration on the access to the water and safety of pedestrians on the dyke-top roads, and the aesthetic impact and the cost. In addition, the preferred options are also in better adaptation to local conditions.

4.3 Options for Wastewater Collection and Treatment Plan

4.3.1 Rongchang County

Three options for overall plan for the wastewater collection and treatment have been developed for comparison. Option one is to construct a new wastewater treatment plant without the need for new pumping stations; Option two is to build a new pumping station to pump the wastewater into the existing Rongchang wastewater treatment plant; Option three is to build a new pumping station to pump the wastewater into the existing Lukong WWTP which will be expanded to accommodate the wastewater collected under the project. After comparison, the Option two is considered the preferred option because it will cause the least occupation of land thus no need for resettlement of people, and the minimal impact on sensitive receptors, and thus representing the least cost option.

Two options for the alignment of the wastewater pipeline are developed. Option one is to construct the trunk sewer to collect the wastewater on the right bank of the river of Laixi, while collecting wastewater on the left side by linking sewers which then convey the wastewater to the trunk sewer on the right bank; the Option two is to construct the trunk sewer on the left bank of the river of Laixi, while collecting the wastewater from the right bank through linking sewers which then convey the wastewater to the trunk sewer. The Option Two is considered the preferred option because it implies more efficient collection of the wastewater since most people are living in the area on the right bank, and it will cause less land occupation thus less soil erosion.

4.3.2 Shizhu County

As the wastewater pipeline is an associated work to the embankment, the proposed pipeline has to be aligned generally along the embankment. In order to collect the wastewater in the residential area to the north of Longjing Road, the pipeline has to be laid under an existing road. Although there is an existing sewer collecting the wastewater from an community, the sewer is only limited to service this community and the diameter is to small to meet the requirement for this project. Thus the option to build the pipeline along the embankment and the Longjing Road is the sole option.

4.4 Options for Dredging Method

Two technical options for the dredging works are considered for the dredging works in Shizhu County under this project. Option one is to adopt the cofferdam dredging method and the Option Two is to adopt the hydraulic dredging method. The Option One is preferred for this project because it will cause less land occupation thus less damage to vegetation. In addition, it is more suitable to dredge rivers that has no or small flow in dry season as the dredging works will be scheduled in dry season to minimize the adverse impact on the aquatic eco-system.

4.5 Options for Disposal of Dredged Sediments

Three options for sediments disposal have been developed for further comparison and public consultation. They are application in farmland, application in landscaping and used as cover soil in sanitary landfill. During the public consultation, the public expressed concern on the adverse health impact of the heavy metals by application in farmland as well as the impact on the quality and yield of crops, and the health impact by application in landscaping, and therefore rejected the two options. The option to use the sediments as cover soil in landfill is preferred for its least environmental impacts and great technical reliability and representing the most safe option.

5. Environmental Impacts and Mitigation Measures

5.1 Experience and Lessons Gained in Previous Projects

Since the 1990's, totally six projects in Chongqing have been successfully appraised and partially financed by the World Bank. The main experience and lessons gained from the environmental management during the preparation and implementation of the projects have been considered in the preparation of the proposed project where intensive training sessions have been carefully developed and will be conducted for the staff from the executing and implementing units, and experienced consulting firm will be contracted for environmental management in the implementation of the project.

5.2 Environmental Impacts in Construction Phase

5.2.1 Air pollution

Concrete mixing stations and asphalt mixing stations will not be established under the project, so all concrete and asphalt will be purchased from commercial stations. The air pollution during the construction stage will be caused by the air-borne dust generated from site cleaning, excavation and refilling, and material transportation and the exhaust gas from operating equipment. The air pollutant of primary concern is considered to be the TSP, which would be mainly generated from the open stockpiling yard and exposed ground. However with the mitigation measures such as water spray applied on construction sites, the concentration of TSP will be reduced to less than 0.265 mg/m3 at 40 m from the sites. The sensitive receptors to the air-borne dust within the distance of 40 m from the construction sites have been identified and mitigation measure developed. The air-borne dust by the movement of transport vehicles would affect the area within 100 m leeward, however with frequent water spray on the roads, the impact on air quality can be mitigated.

The exhaust gas will cause impact on the residents and properties in close proximity. However, as the equipment is in small number and will be scattered along the sites, and the construction schedule on each section of works is short, thus the impact of exhaust is minor.

Another impact of primary concern on the air is the odor from the temporary stockpiling yard for dredged sediments in Shizhu County. Comparative data gained from the similar works in Mudanjiang City indicates that the impact of the odor is largely limited to the scope within the radius of 30 m from the stockpiling yard. The result of site survey has identified that there are no sensitive receptors within 50 m from the stockpiling yard.

5.2.2 Water pollution

The construction wastewater is mainly generated from the foundation pits, grouting and washing of equipment. The surface run-off formed by rainfall through the construction site would be another source for construction wastewater. The primary pollutant is the SS and the oil from the equipment washing. Sedimentation tanks will be established on site to remove the SS and oil from the wastewater before re-use on site, thus the impact of construction wastewater is minor. Construction of the embankment in river would cause drastic disturbance of the sediments in rivers, causing high SS concentration in the water. However the cofferdam technology will be adopted and the construction of the embankment will be scheduled in low flow season, the impact on the quality of the river water is small.

Local houses will be rented to accommodate the workers thus eliminating the need for workers' camp. The domestic wastewater and solid waste will be managed and disposed of by local infrastructure service, and there would be no discharge of domestic wastewater into the river.

Construction of the embankment works would affect two drinking water

intakes:

- Part of the embankment works under Tongnan County will be located within the Class I and II protection area for the backup drinking water source which is operated only when the water supply is under shortage in the county. The government of Tongnan County has issued an official document agreeing to relocate the backup water intake to the new place 300 downstream which thus is out of the influence area of the project. The impact of SS generated by the construction will be limited to a short distance from the site, and the construction will be scheduled to avoid the operation of the new backup water intake, thus the impact on the new water intake is minor;
- Part of the revetment works under Pengshui County will be in proximity downstream of the operating drinking water intake of Shangtang Water Treatment Plant. The management of the water treatment plant has been consulted during the pubic consultation process and agreed that the operation of the water intake will be scheduled to avoid the construction of the revetment, and a monitoring plan for the SS on the location of the intake has been carefully developed in the EA and liaison with the management of the water treatment plant will be established for information exchange to ensure that the operation of the water treatment plant be not affected.

5.2.3 Noise

The primary noise source in construction phase is the operation of equipment. It is estimated that the noise level generated by the construction of the embankment works at 50 m from the construction site will meet the standard for daytime, but at least at 300 m will meet the standard for nighttime. However, with adoption of mitigation measures, such as noise barriers and prohibition of construction in nighttime, the noise impact in construction stage will be mitigated to an acceptable level.

The intensity of the noise source for the construction of wastewater pipelines is weak as the quantity of equipment is small. The period of construction on each section near the sensitive receptors is estimated to be at most two days. And with the completion of the works, the noise impact will disappear immediately.

5.2.4 Impact on Ecology

As the terrestrial eco-system in the project area has been significantly modified by agricultural development, there are no rare species of terrestrial animals or vegetation. The impact by the construction is only limited to the local small animals, such as frogs, rodents, snakes and birds, which can move to other places. Thus the impact on terrestrial ecology is minor.

The aquatic ecology has been significantly modified by the intensive step hydropower projects on the rivers where the proposed project is intended to rehabilitate or construct embankments. The information collected and the relevant departments have confirmed that there are no significant natural habitats in the river sections within the assessment area.

The turbidity of the river would be increased by the disturbance of the sediments and discharge of wastewater during the construction of the embankments, which would affect the photosynthesis of the aquatic plants and the respiration of fish. The construction of embankment will be scheduled to avoid the high flow season and the wastewater will be collected for sedimentation before re-use on site. Thus then impact on the aquatic organisms is minor. The construction noise would lead to the situation that the fish will move to other river sections. But such impact of noise is temporary and will disappear immediately after the construction is completed.

Only Shizhu Component will involve dredging works, which would reduce the bio-mass of benthic organisms. However as the river section to be dredged is relatively short and there are no important grounds for pawning, wintering and feeding, and the bio-mass of benthic organisms will recover after the dredging works is completed. Thus the dredging works in Shizhu County has small impact on ecology.

Although the information collected in Tongnan County show that there would be *Procypris rabaudi* protected at municipal level in the river of Fujiang, the survey in 2009 and 2010 reported that it has disappeared in the Fujiang River although there are very occasional capture reported by fishers. The embankment works under Tongnan County will not significantly change the hydraulic conditions of the river section within Tongnan County, hence not severely affecting the natural habitat for the *Procypris rabaudi.*

The two pawning grounds in the section of Fujiang River within the assessment area of Tongnan County are for common fish species, such as catfish and carp, and far from the proposed embankment works. The pawning ground near the Huangjiaotang Village is 200 m upstream of the proposed embankment works, and the pawning ground near Xibutang Village is 400 m east to the proposed embankment. The options for the alignment of the embankment have considered the avoidance or minimization of the impact on the two pawning grounds. The proposed embankment works will not occupy the protection scope of the two pawning grounds. The noise impact by the construction is quite small, and the wastewater will be collected for re-use on site without direct discharge into the river; in addition, the construction of the embankment will be scheduled to avoid the pawning season from March through May each year. Thus the impact on the two pawning grounds is very minor. During the public consultation, the relevant departments and experts have been consulted and they agreed with the assessment conclusions and the mitigation measures.

5.2.5 Soil Erosion

Site cleaning and grading, and temporary stockpiling of soil, may collectively cause the new loss of soil at 27,156.17 t during the construction phase. Given the context that the project is located in an area prone to soil erosion, the soil erosion would be a major impact of the project in the construction stage. A Soil Conservation Plan has been developed for each component to mitigate and monitor the soil erosion caused in construction stage where the new soil erosion will be reduced to 1098.92 t during the recovery period.

5.2.6 Solid Waste

The solid wastes include the construction waste and domestic waste requiring disposal. The domestic solid waste will be collected and disposed of by local environmental infrastructure. The project will generate collectively 1.06 million m^3 spoil, and these spoil will be disposed of in spoil grounds in each county. The due diligence review has been made for each of the spoil grounds and found that they are constructed in line with domestic environmental requirements and has adequate space to accommodate these spoil. The management of the spoil grounds have been consulted and agreement has been signed to accept the soil with the management of the spoil grounds.

The dredging works in Shizhu County will generate 49,000 m3 sediments. The sediments will be transported to the Limin Solid Waste Landfill in Shizhu County by tankers, where the sediments will be further dried to the water content of 60% before being used as cover soil. The agreement has been signed with the management of the landfill.

5.2.7 Social Impact

The extensive social impacts during the construction phase includes the impact on local land resource, traffic blocking and interruption, impact on street-side small shops. The temporary occupation of land

is of small percentage of the project area, and will be recovered to its original use once after the construction is over. Other impacts will be addressed through careful scheduling of construction and cooperation with local departments on traffic control and infrastructure service. In addition, the project would produce positive social impact including promotion of employment and increased income of local people due to purchase of local products. These positive impacts will be enhanced in the design of the bidding document that require to employ local labor whereas possible.

5.3 Environmental Impacts in Operation Phase

5.3.1 Social Impact

The proposed project will produce major social benefits as intended for improving the water environment and promoting the development of small towns in sustainable manner. The four project counties are located in mountainous region and listed into the poverty counties in Chongqing. Through the project the four counties will be benefited from:

- improved capacity against the high risk of river flooding, thus reduced loss of assets and farmland due to flooding;
- improved opportunity for employment and increase of income;
- increased value of land;
- promoted development of women; and
- improved environment and aesthetics which may stimulate the tourism sector, etc..

In addition, the project will help improve the attraction of the project area that is expected to induce the immigration of people and investment to the project area. As a result the demand for environmental service such as wastewater collection and treatment will be created. This proposed project fits well into with the development plan for small towns and will help satisfy the growing demand for environmental service.

The proposed project will also induce the change of the land use in the project area, the land use plan has already been updated and approved by the relevant departments. The impact on land use in operation stage thus has been addressed.

5.3.2 Cumulative Impact

In the preparation of the EA, the potential cumulative impact on the water quality due to the pollution loads discharged from the proposed project and other works have been considered. However, as the wastewater flow collected by the proposed project has been already considered in the designed capacity of the existing WWTPs and the industrial wastewater is also discharged into the existing WWTPS for further treatment after pretreatment on site. Thus there would be no additional pollution loads discharged into the river sections within the project. In addition, the impact on surface water quality by the existing WWTPs have already been assessed in their EAs.

Chongqing is facing challenges in the management of the water environment, among which the overriding issues are the water pollution and river flooding. In order to tackle the water pollution problem, Chongqing Government has developed an ambitious plan-The 12th Five Year Plan for Environment Protection (the Plan hereinafter), which establishes the water quality target that by year 2015 the water quality in the primary rivers should meet Class II while for the secondary rivers that 85% of the regular monitoring points meet the desired quality. The rivers of Laixi and Longhe are classified into the secondary rivers while the Wujiang River into the primary river. To meet the expected water quality target, the Plan calls for the reduction of COD and NH3-N loads at 395,000 t/a and 51,000 t/a respectively by the end of 2015 through proposing construction of priority works. This project is an integral part of the priority works. This project will

not only collect the wastewater but also treat the wastewater by construction of WWTP in Pengshui County, thus helping achieve the pollution load reduction target. The cumulative impact has been assessed based on the identified VECs as reduction of COD and NH3-N loads in the context of the Plan, the priority works and the previous projects financed by the WB in Chongqing. The proposed project will help reduce the load of COD 3225.35 t/a and NH3-N 236.75 t/a respectively, representing 0.82% and 0.46% of the target respectively.

5.3.3 Noise Impact

The primary source for noise impact is the operation of the pumping stations and traffic noise on the dyke-top roads. As there are no sensitive receptors around the pumping station in Rongchang Component, the assessment of noise impact is limited to the pumping stations in Shizhu Component. The model recommended by the Technical Guideline for Acoustic Impact Assessment is used to predict the noise levels at the sensitive receptors. The modeling results show that the noise level at the sensitive receptors will slightly exceed the standard. The mitigation measures have be developed to reduce the noise level to the standard.

The dyke-top roads are mainly designed for landscaping and movement of maintenance materials for the embankment. The traffic flow on the roads is so small that the traffic noise is minor.

5.3.4 Other Impacts in Operation Phase

Other potential impacts of the project in the operation phase are summarized in Table 5-2.

Table 5-2 Other Potential Impacts in Operation Phase

No.	Issue	Impacts
1	Wastewater	• The proposed project will not produce and discharge wastewater, but collect and treat the wastewater to the standard;
2	Aesthetics	• The embankments are designed to be adapted to the surrounding environment and will improve the aesthetics of the rivers; • Part of the proposed embankment will be located within the Class II and Class III area of the protection scope of the Dingmingshan-Yunhe Scenic Area. This project will not occupy the land in the core area and only occupy only 1.02% of the total area of the Scenic Area. The area to be occupied by the project does not involve any scenic spots.
3	Ecology	• The hydraulic conditions in the rivers will be slightly changed by the embankment, but such change will not significantly modify local aquatic ecology; • Part of the embankment will be located in the rational use area of the Fujiang National Wetland Park, without occupying the land in the core area. The land to be occupied by the project is only 0.247% of the total of the park. The proposed project is in compliance with the master plan of the park and will not change the hydraulic conditions and integrity of the park. • Analysis of the potential impact of the treated effluent from the proposed Pengshui WWTP on the aquatic ecology has been highlighted in the EMF and the aquatic ecology survey will be done under the EMF;
4	Flood Discharge	• The proposed embankments will only slightly affect the flooding level and velocity, the flood discharge capacity of the river sections

		downstream will not be severely affected;

5.4 Mitigation Measures

For details of the generic environmental codes of practice please see the Annex 1 and mitigation measures for operation stage please see Annex 2 attached.

6. Impacts on Physical Cultural Resources

The proposed project in the counties of Tongnan, Rongchang and Pengshui is expected to involve the physical cultural resources. During the project development stage, options have been carefully considered to avoid or minimize the impact on the physical cultural resources and relevant department s and experts have been consulted during the process of public consultation. In addition, a Physical Cultural Resources Management Plan has been prepared in line with the OP 4.11 which includes the mitigation measures, institutional strengthening, and monitoring plan, the procedure of Chance Find which will be applied throughout the construction stage.

The project will involve 36 family tombs. The compensation for the relocation of the tombs has been considered in the RAP.

6.1 Rongchang County

The project in Rongchang County involves the Wanling Ancient Town protected at county level and the Darong Bridge protected at the municipal level.

- The Wanling Ancient Town is on the left bank of the Laixi River where the embankment has already been constructed to the desired standard. The proposed project will construct the embankment along the right bank of the river. Thus it is expected that the proposed project will not affect the Wanling Ancient Town.
- The Darong Birdge is over the Laixi River, the construction of the embankment along the right side of the Laixi River would affect the stability and the aesthetics of the bridge. During the public consultation, the relevant department and experts require that the construction of embankment be kept out of the protection scope of the bridge and manual works be suggested to replace mechanical equipment so as to minimize the impact on the bridge. Such requirements have been considered and included in the mitigation measures for construction near the Darong Bridge.

6.2 Tongnan County

The proposed project in Tongnan County will be located on the edge of the Dafo Temple protected area. The construction works of the embankment will produce noise, air-borne dust, vibration and aesthetic impact, but as the project is far from the core area, such impacts are considered minor; Although the distance from the core area of the Dafo Temple protection scope, protected at national level, to the project is 270 m, a pre-cautionary approach has been adopted that a monitoring plan has been developed and incorporated into the EMP to monitor the impact of vibration on the stability of the temple;

6.4 Pengshui County

The proposed project in Pengshui County will occupy the land in the archeological excavation area and the buffer area of the Xujiaba Site where the archaeological excavation has already been completed. During the consultation, the relevant department agreed to the project provided that all requirements in the relic protection regulations be followed. Such relevant requirements have been considered and incorporated in the EMP. In addition, as the Xujiaba Site is on the edge of river bank suffering from severe soil erosion that has exposed the site to high risk of landslide and flooding, although the proposed project will occupy the land within the archeological excavation area

and the buffer area of the site, safety of the core area can be secured by the project.

7. Risk Analysis and Safety of Dams

The Risk analysis has been carried out in line with the Technical Guideline for Environmental Risk Analysis Assessment. The potential risks have been identified to be the accidents of pollution of surface water and groundwater due to break of wastewater pipelines. The aftermath of such accidents have been assessed which include the pollution of water bodies, air and ecology. According to the guideline, there will be no source of significant risk under the project, with the preventive and mitigation measures developed in the EA, the risk of environmental accidents will be mitigated effectively.

Totally four existing dams have been identified that would affect the successful operation of the proposed project. Thus a Dam Safety Assessment Report has been prepared in line with the OP4.36. The findings of the assessment report is that except for the Sankuaishi Dam, the dams were designed, constructed and being operated in good quality; the Sankuaishi Dam was constructed in 1979 and has been enhanced for several times since then but still some risks exist. However the Sankuaishi Dam will be demolished in 2018 according to the hydropower development plan, and it is concluded that the Sankuaishi Dam will operate safely by 2018.

8. Land Acquisition and Resettlement

Resettlement Action Plans have been prepared for this project in line with the domestic and the World Bank's requirements and policies. This project will permanently occupy land of 2049.78 mu, among which permanent acquit ion of collectively owned land is 1331.44 mu including 751 mu farmland, affecting 6348 people in 1540 households; temporary occupation of land is 577.76 mu including 351.52 mu farmland.

The demolition of structures will involve 69 households, 4 industries/utilities, 2 small shops, 11 private farmers, and 12 invalid structures. The total area to be demolished is 23767 m2 affecting 480 people. The residential houses to be demolished is 17172 m2, accounting for 72.25% of the total; the industries/utilities to be demolished is 942 m2, 3.96% of the total; the small shops to be demolished is 100 m2, 0.42% of the total; the private farmers to be demolished is 1583 m2, 6.6%; the invalid structure is 3970 m2, 16.7%.

The farmland to be occupied is along the river which is prone to the river flooding, thus the cash crops are seldom planted on such land. The occupation of the farmland will only lead to small percentage of income loss, averaging less than 16.71% per capita. In addition, there are 46 vulnerable people to be affected by the project. The livelihood and vulnerable people recovery plan has been developed to ensure that the income of the people at least the same with that before the project. Under the recovery plan pension funds have been reserved for the vulnerable people who will be given priority for the employment of labors in the maintenance of the assets financed by the project.

9. Public Consultation and Information Disclosure

9.1 Public Consultation

In accordance with the requirements of the China's EA Law and the World Bank, two rounds of public consultation were conducted by the EIA team. The first round focused on environmental screening to define public concerns, to assist identification of key environmental issues and to draw public response and comments on the initially developed mitigation measures for the potential adverse impacts identified before EA TOR finalization. The second round was designed to ensure public awareness of the EA effort and final project definition and

mitigation by presenting a draft EA report to the public through information disclosure procedures. Details of the two rounds of public consultation undertaken are presented in Table 9-1.

Table 9-1 Implementation of the Public Consultation

Round	Timing	Participants	Method	Organizer
1	May to Aug, 2013	Representatives of communities and villages in the project affected area; experts and relevant departments regarding the physical cultural resources and natural habitats	Questionnaires and public meeting	EA Consultant
2	Oct. to Nov 2013	Representatives of communities and villages in the project affected area; experts and relevant departments regarding the physical cultural resources and natural habitats	Questionnaires and public meeting	

During the consultation, the public expressed several concerns on the land occupation and the livelihood recovery, and environmental impacts including air-borne dust, noise, water pollution, and hope to get employment opportunity during the construction. These concerns have been responded in the public meetings or incorporated in the EA. Through the consultation, it is understood that the public strongly support the project as they think it would be a good approach to improving their living conditions. During the consultation, all of the people think that the impacts of primary concern are effectively mitigated to an acceptable level.

The experts and relevant departments made suggestions on the domestic procedure for approval of EA regarding the natural habitat and physical cultural resources, and the key points to be considered in the first round consultation; and they have agreed with the conclusion of the impact analysis and mitigation measures.

9.2 Information Disclosure

Information on the project EA has been disclosed to the public throughout the public consultation. An advertisement has been placed on the Chongqing Daily on March 9, 2014, the most popular local newspaper during the second round consultation to invite the public to express their concerns about the project, and to inform the public the place to assess to the draft EIA report which has been placed in the affected villages and communities that are easily accessible to the affected people since Oct. 2013. The full text of the EA documents have been disclosed on local website since March 8, 2014 at an address: http://www.eiafans.com/forum.php

10. Environmental and Social Management Plan

10.1 Institutional Arrangement

The duties and responsibilities for institutions for environmental and social management have been identified for stages of design, construction and operation respectively. These institutions will be involved in the environmental management, supervision and monitoring.

- The Chongqing PMO will take the ultimate responsibility for environmental protection and management. The Chongqing PMO is the implementing agency being responsible for day to day environmental management during the construction phase and operation phase. Its responsibilities will include engagement of professional supervision and monitoring services, allocation of budget for environmental management, response to environmental monitoring reports and the taking of appropriate

mitigation actions. They will also handle any environmental events which may occur during construction and operation;
- PMO of each project county will jointly responsible for the environmental management of the project within the county.
- Chongqing Municipal EPB will be responsible for enforcement of environmental regulations and standards and review of environmental monitoring reports;
- Environmental Supervisor will be responsible for review of environmental protection schemes submitted by construction bidders and corresponding expenses involved in environmental protection; review of construction contract, and supervision over the owner to write environmental protection contents, related costs and corresponding penalties in the construction contract; reporting current situation of construction environment management to relevant departments in a timely manner, and put forward rational suggestions specific to problems found; preventing the behaviors causing environmental pollution or future trouble including the behavior of violating environmental laws & regulations, and giving penalties for the behavior generating great impact on environment;
- Contractors will be responsible for implementing the mitigation measures for construction phase.

10.2 Training Plan

A training program has been developed for the PMO staff, environmental supervisors, contractors and environmental monitoring units with the contents focusing on the responsibilities of the relevant organizations, environmental regulations, mitigation measures, supervision, reporting system and public grievance.

10.3 Environmental Monitoring Plan

An environmental monitoring plan has been developed for both the construction and operation phases and incorporated into the EMP as shown in Annex 3, so as to further ensure the proper implementation of mitigation measures.

10.4 Environmental Supervision

ESMP implementation will be managed by Chongqing PMO. An environmental and social management unit will be established in the PMO with dedicated safeguards staff. Civil work contractors and supervision companies will be required to assign qualified environmental staff to their team to ensure effective implementation of the ESMP. PMO, under assistance of on-site environmental supervisors, local EPB and external monitoring institution, will supervise the implementation of ESMP. To improve local capacity, the ESMP proposes capacity training activities for civil work contractors, PMO, environmental supervisors, and monitoring institutions etc.. The ESMP also specifies monitoring plan, and budget for the ESMP implementation. A set of environmental compliance checklists for the contractors and supervisors have been developed for construction period including checking the implementation of all of the mitigation measures, and correction of environmental practice and environmental acceptance for checking the implementation of the monitoring plan, mitigation measures and reporting system.

10.5 Reporting and Public Grievance Mechanism

The requirements for environmental supervision and monitoring, as well as the reporting system has been clearly specified. The public grievance mechanism will be established and maintained throughout the project to deal with any public concerns in environmental management.

10.6 Cost Estimate for Implementation of EMP

The total cost estimate for implementing the EMP is 10.496 million

RMB including 8.5 million RMB for soil erosion control and recovery. The budget for the environmental monitoring plan is 91 thousand RMB.

Annex 1 Generic Environmental Code of Practice for Design and Construction Stages

Links and key elements	Mitigation Measures
A. Design Stage	
General	• Comprehensively analyze and compare scale and route selection scheme for flood control works from multiple aspects, such as environmental protection, social needs, technology & economy and project, geological exploration and local planning. • Select the optimum scale and route selection scheme and submit to the governmental administrative authority of the county and the Owner of the Project for approval.
Air	• Optimize construction technology; reasonably select construction site.
Surface water	• Reasonably select water-related construction technology; reasonably determine construction period (low-water period, storage period of upstream dam); confirm rationally dredging technology & method and time period (low-water period). • Select optimum construction time period; reasonably select waste disposal area and material yard; etc.
Ecology	• Avoid ecologically sensitive area for route selection whenever possible.
Acoustic environment	• Select optimum construction machinery, control construction time period, etc.
Social	• Investigate the presence of cultural relics and historic sites in the project area during design; avoid and protect physical cultural resources for the route selection whenever possible. • Minimize relocation during route selection; select the route with little land requisitioned and with slight impact. • Select reasonable route; avoid dense community.
B. Construction Stage	
Air pollution	• During the storage and loading, the materials should be covered; • water spray should be provided at each construction site per day; • Trucks transporting earth and solid waste should be covered; • Construction sites should be enclosed; • Transportation of materials in the urban area should be arranged in nighttime; • Equipment and vehicles certified with national codes for sanitation should be used so as to ensure the vehicular emission meet the relevant standards.
Water pollution	• Wastewater generated from mixing of concrete should be recycled after coagulation sedimentation. • Management of construction machinery should be strengthened. Such situations as escaping, running-out, dripping and leaking should be avoided as much as possible; treatment facilities including permanent car washing station, oil trap and grit chamber and so on should be provided, so that oily wastewater can be reused after treatment in the oil trap and grit chamber; • Domestic wastewater may be used for pit toilet on the construction site, or may be treated with sanitary facilities of local farmers nearby. Feces are used for local agricultural production. Temporary pit toilet should be removed after construction, covered with quicklime and treated like sanitary landfill. Based on site conditions, vegetations can be planted after landfill. • Materials at the construction site must be protected against rain and seepage with sufficient canvases and asphalt felts, preventing such materials from mixing with rainwater and flowing into water body. • If construction activity is carried out near a water body, earth and rock shall not be piled up at the side closer to the water body. If such case is unavoidable, temporary retaining wall shall be constructed to prevent earth and rock from falling into Laixi river and causing impact on the water

Links and key elements	Mitigation Measures
	body and aquatic flora and fauna. • Small amount of suspended sediment generated from the construction activity in cofferdam can be treated by sedimentation, so as to prevent suspended materials from entering other water bodies beyond the cofferdam to the largest extent. • Construction camp should not be set near the environmental sensitive site, ensuring good cleanness & hygiene conditions on the construction camp and the sanitary safety of drinking water.
Noise	• Fence and enclosure would be provided around the work area during construction to reduce diffusivity of dust nuisance. Firm and beautiful fences with height no less than 1.8m should be provided around the construction site in series. • Perform hardening of ground. Road in the construction camp, access road and construction material stockpile area must be hardened, with road surface kept clean. • Facilities for car washing and drainage must be provided at access of the construction camp. Any car pulled out of the construction camp must be washed out, without flying, scattering, leaking particles and carrying soil. • Construction should be carried out in a civilized manner, with necessary measures for dust nuisance prevention taken. For dust production point where cement is mixed, unloaded and poured, simple dustproof facilities should be provided, such as shelter workshop, dust board and water sprayer. Number of times of onsite mixing should be minimized and such work should be kept far away from the object under environmental protection. The construction site should be arranged reasonably, and all aggregates should be stacked and stored in a unified manner and covered with protective cloth. Powdery materials such as cement should be transported in bag or tanker. Transportation in bulk is prohibited. Besides, special warehouse should be set, with reliable measures for dust nuisance prevention provided. • Water should be sprayed in the construction area to prevent dust. The Contractor should develop regulations on dust prevention by spraying water, and involved areas include working surface, road section, temporary dumping site and main road for transportation under construction as well as bare land not under construction. Frequency of water spraying should be determined by the Engineer based on site conditions and may be increased properly in case of high wind or dry weather. • Management of transport vehicle: Cement, aggregate and other similar materials would easily generate dust nuisance. For transportation of materials that would easily scatter and leak, they must be loaded based on normative procedures. Closed transporter should be intact, neat and clean. Overloading is strictly prohibited. • The Contractor must select the construction machinery and transportation facility conforming to relevant national sanitary standards and use high-grade fuel, so that the exhaust gas emitted meets relevant national standards. The construction machinery and transportation facility should be maintained and serviced frequently to prevent accidental leakage of gasoline and diesel. • Mess hall is built in the living area of constructors. Fuel coal is prohibited. All the constructors would use clean energy sources such as natural gas, liquefied gas and electricity. • The Owner should incorporate the special fund for dust nuisance control during construction into the cost estimate of the Project, and the Contractor should ensure that such special fund is used as designated.
Solid Waste	• A small amount of disposed construction wastes generated during the demolishing of original buildings within the scope of embankment foundation should be transported to the disposal area for construction wastes designated by municipal departments. Mixture of materials stripped from the embankment and foundation earth and stones would be generated during the excavation of embankment foundation. The materials stripped from embankment foundation should be used for

Links and key elements	Mitigation Measures
	placement of levee slope after humus soils are removed. The foundation earthwork should be used as fill for the embankment and its land area. • The dredging sludge from Shizhu component should be transported to Yaodianzi Waste Treatment Plant operated by Limin Waste Disposal Co., Ltd. of Shizhu County for sanitary landfill.
Ecology	• The farmland and trees should be protected. The workers should be provided with training sessions on protection of wild animals and vegetations; • The construction of vegetation, side slope and drainage ditches should be carried out together with the main structures; • The land temporarily occupied should be restored for cropping or vegetation establishment immediately after the construction is completed; • The area for site cleaning should be strictly controlled. Any vegetation beyond the area to be cleaned should be restored for establishment of vegetation; • The occupation of farmlands should be minimized. • Local species of trees and vegetations should be selected and used for compensation for the loss of vegetation due to the construction.
Soil Erosion	• Construction of borrow pits should be scheduled in low flow season; • Topsoil should be removed and stockpiled in a flat area with temporary retaining wall surrounded with ditches and sedimentation tank. The stockpile should be covered. The topsoil will be used for ecological restoration of the works; • The borrow pits should be filled with soils immediately after the it is closed for vegetative establishment; • The existing roads should be selected for access roads; • The construction site surface should be hardened. After the construction, the hardened surface should be loosened for vegetative establishment; • Construction should be reasonably scheduled to minimize the period of temporary land occupation. The site to be temporarily occupied should be restored with vegetation after the construction is completed.
Cultural Resources	• If physical cultural relics are found during construction, (including ancient sites and ancient tombs), construction should be suspended immediately. • The construction site should be closed and protected under the supervision of the engineering supervisor and report to local cultural departments. Without the permit from the cultural department the construction should not be resumed.
Construction Safety	• Warning signs should be set up at the place or equipment that would cause occupational health impact; • Protective equipment, such as helmet, safety belt, shoes and gear, should be provided to the workers; • During the high temperature, cooling equipment or materials should be provided in site and the rest schedule should be carefully arranged.
	•

Annex 2 Mitigation Measures for Operation Stages

Works	Mitigation Measures
Pumping Stations	• The pump station should be arranged far from residential settlement and equipment maintenance should be strengthened.
Risk	• Design of embankment works and the strength of wastewater pipe network should be strengthened. • Inspection and maintenance should be strengthened.

Annex 3 Environmental Monitoring Plan

Period	Works	Monitoring Object	Monitoring Point	Monitoring Item	Monitoring Frequency	Total Expense (RMB 10,000)	Monitoring Unit	Responsible Organization	Supervision Organization	Standards and Norms Executed
Monitoring after completion for acceptance	Sewage collection and treatment works	Noise	Boundary of Rongchang sewage lift pump station	Equivalent continuous sound level A	Monitoring once; monitoring continuously for 2d; once in the daytime and once at night every day.	0.2	Qualified organization entrusted by the Owner in the form of a contract	The Owner	Environmental Protection Bureau of Rongchang County	Class 2 standard in the Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008)
			Boundary of Shizhu sewage lift pump station		Monitoring once; monitoring continuously for 2d; once in the daytime and once at night every day.	0.2	Qualified organization entrusted by the Owner in the form of a contract	The Owner	Environmental Protection Bureau of Shizhu County	
Construction period	Flood control and sewage collection and treatment works	Noise	Rongchang upstream 1#, 3# and 5# temporary construction sites; downstream 2#, 3# and 5# temporary construction sites	Equivalent continuous sound level A	Monitoring once during peak construction hours; monitoring continuously for 2d; once in the daytime and once at night every day.	0.6	Qualified organization entrusted by the Owner in the form of a contract	The Owner of each component	Environmental Protection Bureau of Rongchang County	Class 2 standard in Environmental Quality Standard for Noise (GB3096-2008)
			Shizhu 2# and 4# temporary construction sites; Southwest Liren Hospital			0.3			Environmental Protection Bureau of Shizhu County	
			Pengshui 1# and 2# temporary construction sites; Xiatang Neighborhood Committee			0.3			Environmental Protection Bureau of Pengshui County	
			Tongnan 1# temporary construction site; Tongnan			0.2			Environmental Protection Bureau of Tongnan County	

Period	Works	Monitoring Object	Monitoring Point	Monitoring Item	Monitoring Frequency	Total Expense (RMB 10,000)	Monitoring Unit	Responsible Organization	Supervision Organization	Standards and Norms Executed
			Culture and Martial Art School;							
		Ambient air	Rongchang upstream 1#, 3# and 5# temporary construction sites; downstream 2#, 3# and 5# temporary construction sites	TSP	Monitoring once during peak construction hours and monitoring continuously for 3d	1.2	Qualified organization entrusted by the Owner in the form of a contract	The Owner of each component	Environmental Protection Bureau of Rongchang County	Class II standard in Integrated Emission Standard of Air Pollutants (GB16297-1996) (new pollution)
			Shizhu 2# and 4# temporary construction sites; Southwest Liren Hospital			0.6			Environmental Protection Bureau of Shizhu County	
			Pengshui 1# and 2# temporary construction sites; Xiatang Neighborhood Committee			0.6			Environmental Protection Bureau of Pengshui County	
			Tongnan 1# temporary construction site; Tongnan Culture and Martial Art School;			0.4			Environmental Protection Bureau of Tongnan County	
		Surface water	500m downstream of the dredging section of Shizhu County	SS	Monitoring 1d during the peak hours of dredging; monitoring once respectively in the morning and afternoon; analyzing mixed samples	0.2	Qualified organization entrusted by the Owner in the form of a contract	The Owner	Environmental Protection Bureau of Shizhu County	Class III standard in Surface Water Environmental Quality Standards(GB3838-2002)
			Water intake of Shangtang water plant of	SS	Monitoring once (about 30d) every day during	3.0		The Owner	Environmental Protection Bureau of	

Period	Works	Monitoring Object	Monitoring Point	Monitoring Item	Monitoring Frequency	Total Expense (RMB 10,000)	Monitoring Unit	Responsible Organization	Supervision Organization	Standards and Norms Executed
			Pengshui County		the river-involved construction; monitoring once respectively in the morning and afternoon; analyzing mixed samples				Pengshui County	
			Xibutang spawning ground	SS	Monitoring once for 2d during peak hours of river-involved construction; monitoring once every day respectively in the morning and afternoon; analyzing mixed samples	0.2		The Owner	Environmental Protection Bureau of Tongnan County	
		Cultural relics	Giant Buddha Temple	Observation of cultural relics	Tracking and observing when approaching the construction at the cultural relics section	/	Tongnan Cultural Relics Department Entrusted	The Owner of each component	Environmental Protection Bureau of Tongnan County	Timely prevent the actions which may damage the cultural relics and suspend the construction timely if cultural relics are found damaged.
			Darong Bridge and Lukong Ancient Town			/	Rongchang Cultural Relics Department Entrusted		Environmental Protection Bureau of Rongchang County	
			Xujiaba Site	Supervision of cultural relics	Supervising and managing on site during the construction at the cultural relics section	/	Pengshui Cultural Relics Department Entrusted		Environmental Protection Bureau of Pengshui County	Carry out construction within delimited scope and declare timely in case cultural relics are discovered.
Operation period	Sewage collection and treatment works	Noise	Boundary of Rongchang sewage lift pump station	Equivalent continuous sound level A	Monitoring once every year; monitoring continuously for 2d; once in the daytime and once at night every day.	0.2	Qualified organization entrusted by the Owner in the form of a contract	The Owner	Environmental Protection Bureau of Rongchang County	Class 2 standard in the Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008)
			Boundary of Shizhu sewage lift pump station		Monitoring once every year; monitoring continuously for	0.4	Qualified organization entrusted by the Owner in	Organization	Environmental Protection Bureau of Shizhu County	

Period	Works	Monitoring Object	Monitoring Point	Monitoring Item	Monitoring Frequency	Total Expense (RMB 10,000)	Monitoring Unit	Responsible Organization	Supervision Organization	Standards and Norms Executed
					2d; once in the daytime and once at night every day.		the form of a contract			

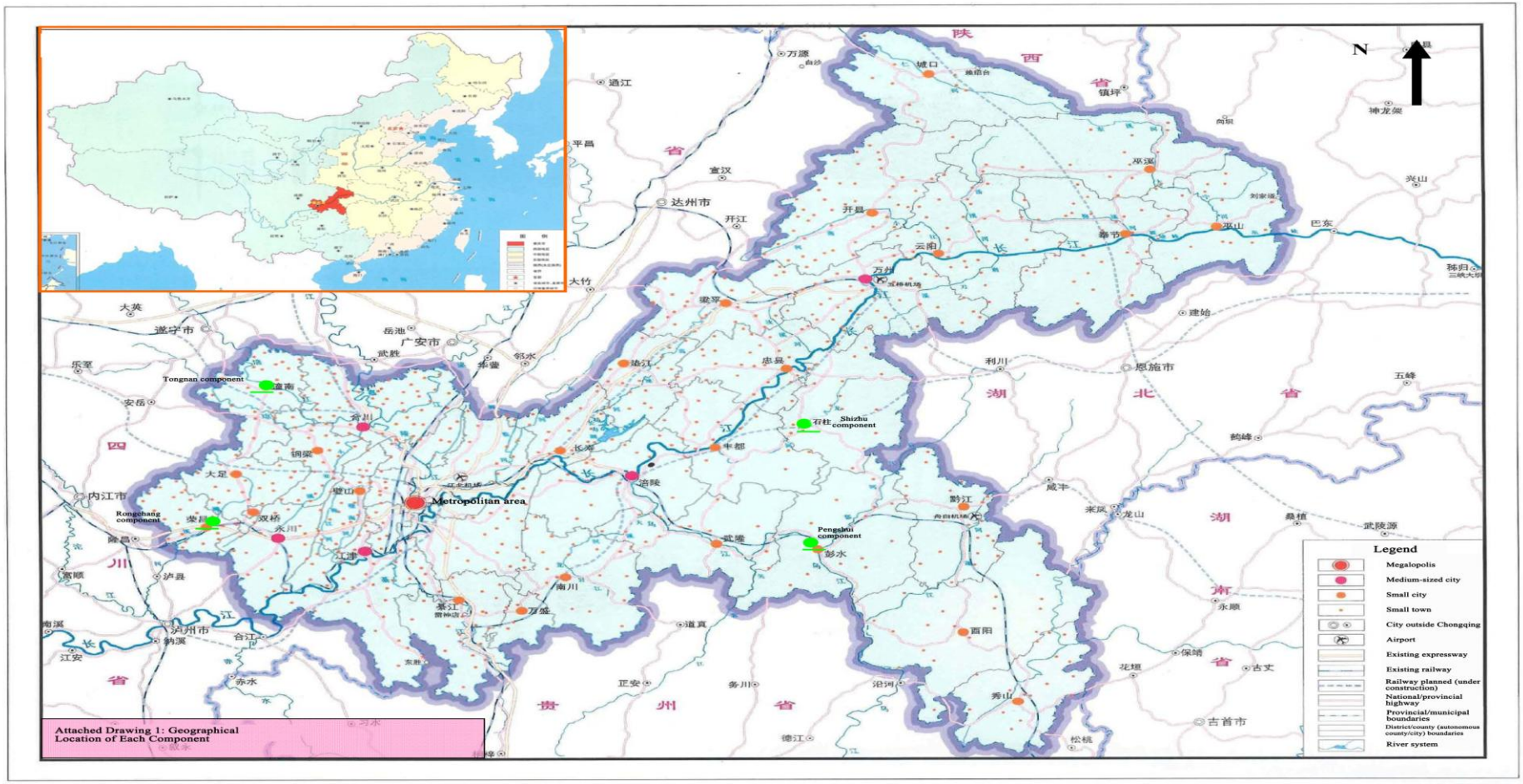

Figure 2-1 Location of the Project

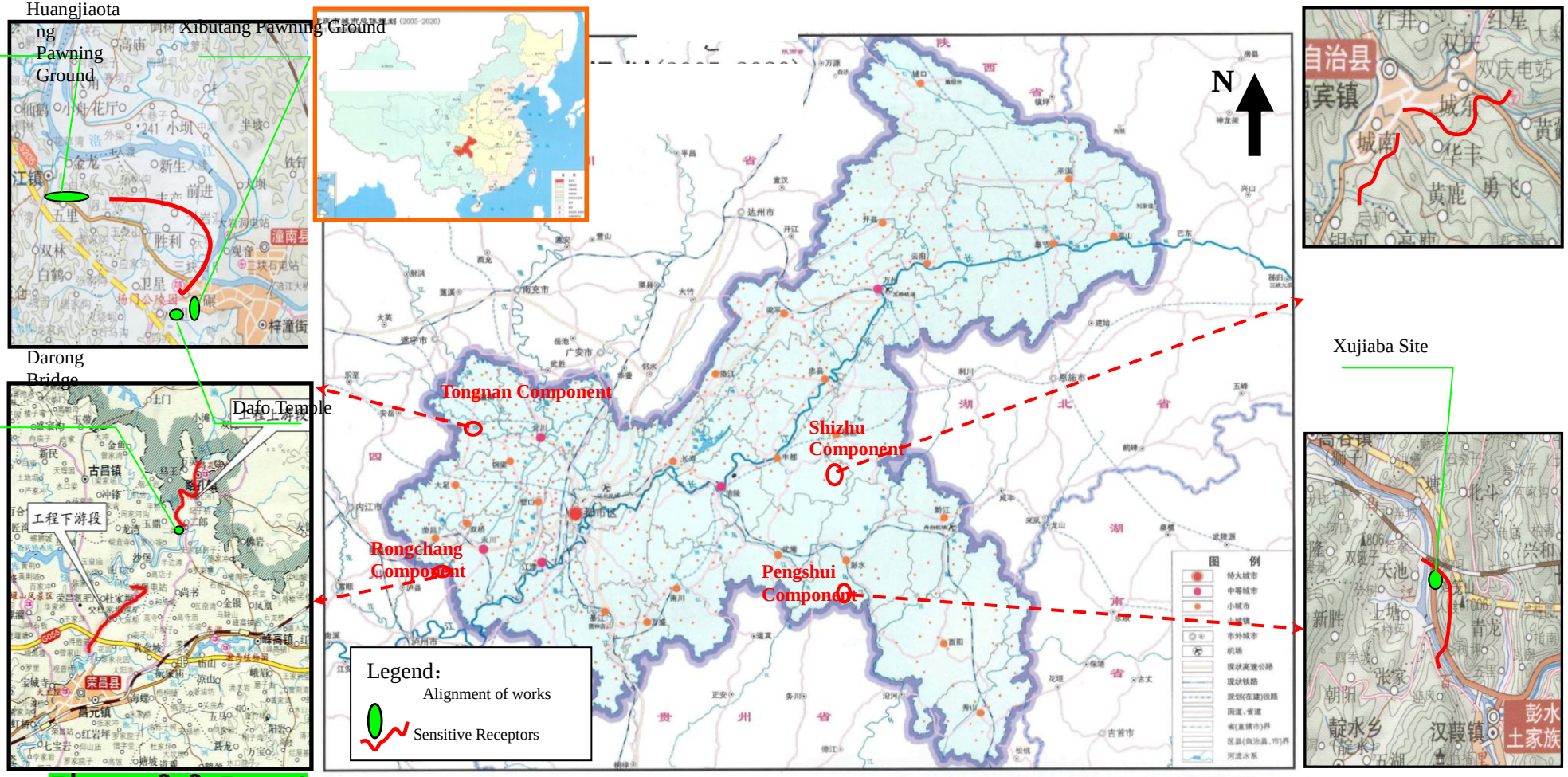

Figure 2-2 Important Sensitive Receptors