Initial Environmental Examination for Yulin Subproject

Project Number: 49084-001
May 2017

PRC: Small and Medium-Sized Enterprise Industrial Wastewater and Sludge Treatment Project

Yulin CT Textile and Apparel Industrial Park Water Treatment Facilities

Initial Environmental Examination

Building a better working world

ABBREVIATIONS

ADB – Asian Development Bank
AF – Affected Person
BOD_5 – Five-day Biochemical Oxygen Demand
COD – Chemical Oxygen Demand
CTEG – CT Environmental Group
DO – Dissolved Oxygen
EIA – Environmental Impact Assessment
EMP – Environmental Management Plan
E&S – Environmental and Social
GDP – Gross Domestic Product
IEE – Initial Environmental Examination
NDRC – National Development and Reform Commission
NEA – National Energy Administration
PPE – Personal Protective Equipment
PRC – People's Republic of China
RP – Resettlement Plan
SS – Suspended Solids
TDS – Total Dissolved Solids
TP – Total Phosphorus

WEIGHTS AND MEASURES

GJ – Gigajoule
kg – kilogram
km – kilometer
kW – kilowatt
t/d – tonne per day
t/h – tonne per hour
m^3/d – cublic metre per day
m/s – metre per second

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Executive Summary

A. Background

This project's Initial Environmental Examination (project IEE) report is prepared for the proposed Yulin CT Textile and Apparel Industrial Park Water Treatment Facilities in Yulin City, Guangxi Province, PRC. This facility is located in the water-consuming enterprises upgrading zone of the proposed Yulin (Fumian) Energy Conservation Environmental Protection Industrial Park. The IEE is prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of project EIA and the Industrial park EIA prepared by University of Zhongshan and New ACEF (Beijing) Environmental Protection Co., Ltd, respectively and findings of site observations.

B. Project Content

The proposed Yulin CT Textile and Apparel Industrial Park Water Treatment Facilities will consist of two major components, a wastewater treatment plant and water supply facilities, which will be located at the west of Nanliu River in Zhangmu Town, Fumian District of Yulin City of the Guangxi Province, PRC with designed land area of around 400,002m2. The total design capacity of the wastewater treatment plant and the Water Supply Facility are 100,000m3/d and 120,000m3/d respectively. The wastewater treatment plant will employ a three-stage treatment process, including pre-treatment (primary treatment), anaerobic oxidation process (secondary treatment), Fenton reagents and disinfection (tertiary treatment). The total investment for the proposed project is estimated as CNY¥1,195 million.

The effluent shall satisfy the requirements of the Discharge standards of water pollutants of dyeing and finishing of textile industry (GB4287-2012) in short term (until 2020). In long term, the quality of the treated wastewater will comply with Class IA standards of the Discharge Standards of Pollutants for Municipal Wastewater treatment plant (GB18918-2002) while the Discharge standards of water pollutants of dyeing and finishing of textile industry (GB4287-2012) would still apply to some parameters including Aniline and Chromium (VI). After the completion of the proposed subproject, wastewater will be treated properly without direct discharge of wastewater to the surrounding water bodies and help conserve water resources, therefore potential surface water and groundwater pollution can be avoided.

C. Anticipated Environmental Impacts and Environmental Management Plan

Major environmental issues during the construction phase include impacts on biodiversity, surface water quality, ground water quality, ambient air quality, socio-economic resources, physical cultural resources, community health and safety, occupational health and safety, noise pollution, solid waste, and soil erosion. There are no historical and archaeological sites within or near the subproject area, though if unknown archaeological resources and cultural relics are discovered during construction, all construction will be suspended until investigation is complete. Appropriate mitigation measures and monitoring programs have been developed to address potential hazards for workers in construction. Overall, construction-related impacts are localized, short term, and can be effectively mitigated through the strict implementation of mitigation measures specified in section IV 'Anticipated Environmental Impacts and Mitigation Measures' and section VIII 'Environmental Management Plan'.

The main potential adverse impacts during the operation phase include impacts on surface water quality, ground water quality, ambient air quality, noise pollution, solid and hazardous waste, biodiversity and water users, and occupational health and safety. It is expected that the effluent from this subproject will meet the national effluent standards under normal operation and the impact on surface water is minimal. Proper design, construction, management and maintenance of the subproject will also prevent negative impact on groundwater quality. Further, mitigation measures such as the installation of fume purification system and the plantation of landscape noise buffers, will reduce the impacts on ambient air quality and noise pollution. Careful management of solid and hazardous waste is required to minimise the impacts from waste generation.

For each impact, appropriate mitigation measures are described; strict monitoring and supervision will be undertaken to ensure that environmental impacts will be minimised to acceptable levels.

D. Alternative Analysis

Multiple alternative analyses were conducted to determine the most feasible way of achieving the subproject objectives while minimising environmental and social impacts, the three alternatives assessed were i) alternatives for sludge treatment, ii) alternatives for odour control and iii) alternatives for wastewater treatment. Results for the first alternative showed that a 'comprehensive use' strategy, i.e. Sludge will be transported to the combined heat and power plant, which powers the whole industrial park, for further treatment. It is more efficient in eliminating environmental pollution by recycling and reusing. Results from the second alternative showed that both biological methods and plant-based deodourant have simple and

convenient O&M. Results from the third alternative showed that Anaerobic anoxic oxic activated sludge process has a higher impact load resistance, simpler maintenance, lower operating cost, more effective and only requires a small area.

E. Information Disclosure and Consultation

The public consultation of this proposed subproject was conducted in accordance with both the PRC requirement and the ADB requirements. The public consultation is divided into three phases, 1) Initial public consultation, 2) Second public consultation and 3) Public Survey. During the preparation of the IEE, initial public consultation has been completed in August 2016 and the second public consultation has started on 23 September 2016. Questionnaire were distributed to village committee, villagers and units nearby the subproject area on 24 September 2016. Public notices and summaries have been posted on Yulin city environmental protection bureau website and in affected locations nearby the proposed subproject site. Information disclosure and public consultation will continue throughout the subproject implementation.

F. Grievance Redress Mechanism

CTEG will establish a grievance redress mechanism (GRM) on site for handling environmental and social complaints, including complaint recording, consultation, issue investigation, mitigation action, follow-up, general timeframe for resolution and delegation of responsibilities. The GRM will address any possible concerns and dissatisfaction of affected groups regarding the social and environmental impact of its subprojects, and seek proper solutions. It should be able to promptly respond to the affected groups, be transparent and free of gender discrimination, and adapt to the cultural traditions of the affected groups and communities. Moreover, it should enable different affected groups to express their opinions, with no fear of reprisal. The E&S General manager will be responsible for (i) resolving appeals, complaints, and disputes concerning the environmental and social impacts of subprojects which have not been resolved by the plant managers at the subproject level, and (ii) for coordinating, guiding and supervising the subproject companies in handling appeals, complaints, and disputes.

CTEG subproject companies will establish local level complaints and grievance procedures in each RP. Each subproject company will also inform the local community and the AP of the grievance and appeal procedure through public information meetings, the resettlement information brochure and other media, so they can fully understand their rights for grievance and appeal.

G. Environment Management Plan

An environmental management plan (EMP) has been prepared for this subproject. It is an essential document to ensure the implementation of mitigation measures. The EMP defines appropriate mitigation measures for the anticipated environmental impacts, addresses the potential impacts and risks identified by the environmental assessment to avoid future adverse environmental impacts, and defines the institutional responsibilities and mechanisms to monitor and ensure the compliance with PRC and ADB's requirements.

H. Conclusion

This project's IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all adverse environmental impacts associated with the project will be prevented, eliminated, or minimised to an acceptable level. The project is feasible from an environment safeguards point of view.

I. Policy, Legal, and Administrative Framework

A. Relevant laws, regulations, guidelines, and standards of the People's Republic of China

The information and data used in this Initial Environmental Examination (IEE) is in line with the subproject application report published in August 2015 and the Environmental Impact Assessment (EIA) report of the Yulin (Fumian) Energy Conservation Environmental Protection Industrial Park Development Plan (2015-2030) prepared in August 2016, which was submitted for first review. The EIA was carried out in accordance with the development plan, technical design and investment framework agreement. The baseline environmental condition and the projected impacts were assessed with reference to the relevant laws, regulations, guidelines, and standards.

The environmental impact assessment covered air, noise, water, ecology, etc. The purposes, principles, classification and scopes of assessment were in strict accordance with the Environmental Protection Law of the People's Republic of China (1989), Regulation on Environmental Protection Management for Construction Project (1998), and the Environmental Impact Assessment Law of the People's Republic of China (2002). The methodologies adopted are stipulated in the Technical Guidelines. Understanding that participation is an important part for IEE, Measures on Public Participation in Environmental Protection (2015), the latest regulation on participation, was also made reference to during impact assessment. Other legal documents relevant to the project are shown in Table I-1.

Table I-1: Applicable Policy, Legal, and Administrative Framework of the People's Republic of China

Title	Year Issued or Amended/ Code
Applicable National Laws	
The Environmental Protection Law of the People's Republic of China	1989
The Environmental Impact Assessment Law of the People's Republic of China	2002
Water Law of the People's Republic of China	2002
Law of the People's Republic of China on Prevention and Control of Water Pollution	2008
Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution	2000, 2004
Law of the People's Republic of China on the Prevention and Control of Environmental Noise	1996, 2008
Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste	2005
Law of the People's Republic of China on Water and Soil Conservation	1991
Cleaner Production Promotion Law of the People's Republic of China	2002
Urban and Rural Planning Law	2008
Land Administration Law	2004
Circular Economy Promotion Law	2009
Renewable Energy Law of the People's Republic of China	2006
Applicable National and Local Administrative Guidelines and Regulations	
Interim Procedures for Public Participation in Environmental Impact Assessment	2006
Measures on Public Participation *in Environmental Protection*	2015
Regulation on Classification of Construction Project Environmental Protection Management (MEP)	2009
Regulation on Environmental Protection Management for Construction Project	1998
Requirements for the EIA Summary of Construction Project	2010
The Administrative Measures for the Environmental Acceptance Inspection of Construction Projects	2002
The Administrative Regulations for Project Environmental Protection in Construction Projects	1998
The Notice on Enhancing Environmental Impact Assessment Management for Environmental Risk Prevention	2012
Measures of Urban Construction Waste Management in Yulin City	2010
Applicable Standards	

Title	Year Issued or Amended/ Code
Ambient Air Quality Standard	*GB 3095-2012*
Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant	*GB18918-2002*
Emission Standard for Industrial Enterprises Noise at Boundary	*GB 12348-2008*
Emission Standard for Odour Pollutants	*GB14554-1993*
Emission Standard of Environment Noise for Boundary of Site	*GB 12523-2011*
Emission Standards for Odour Pollutants	*GB 18599-2001*
Environmental Quality Standard for Noise	*GB 3096-2008*
Environmental Quality Standard for Soil	*GB15618-1995*
Environmental Quality Standard for Surface Water	*GB 3838-2002*
Identification of hazard installations for dangerous chemicals	*GB18218-2014*
Industrial Restructuring Directory	*Revised in 2013*
Integrated Emission Standard of Air Pollutants	*GB 16297-1996*
Quality Standard for Ground Water	*GB/T 14848-93*
Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Wastes	*GB 18597-2001*
Technical Guideline on EIA Regarding Acoustic Environment	*HJ 2.4-2009*
Technical Guideline on EIA Regarding Atmospheric Environment	*HJ 2.2-2008*
Technical Guideline on EIA Regarding Ecological Impact	*HJ 19-2011*
Technical Guideline on EIA Regarding Surface Water	*HJ/T 2.3-1993*
Technical Guideline on EIA: Outline	*HJ2.1-2011*
Technical Guideline on Environmental Risk Assessment for Construction Project	*HJ/T 169-2004*
Technical Specification on Water and Soil Conservation Plan	*GB50433-2008*
The Reuse of Urban Recycling Water – Water Quality Standard for Industry Use	*GB/T19923-2005*
The Reuse of Urban Recycling Water – Water Quality Standard for Green Space Irrigation	*GB/T25499-2010*
The Reuse of Recycling Water for Urban – Water Quality Standard for Urban Miscellaneous Water Consumption	*GB/T18920-2002*

Water Law of the PRC was enacted in October 2002 for the purposes of rationally developing, utilising, conserving and protecting water resources, preventing and controlling water disasters, bringing about sustainable utilisation of water resources, and meeting the need of national economic and social development. Articles 52 and 53 of the law, which state that the local governments should support centralised wastewater treatment facilities and increase the utilisation rate of recycled wastewater, and water supply enterprises shall take effective measures such as effective maintenance to reduce the leakage rate of the water supply network, are particularly applicable to this subproject.

B. Applicable ADB policies

All CTEG projects which are financed under ADB facility are required by the Environmental and Social Management System (ESMS) to comply with ADB's Safeguard Policy Statement (SPS) 2009. The SPS promotes international good practices, as reflected in internationally recognised standards such as the World Bank Group's Environmental, Health and Safety Guidelines with the aim to ensure that the implementation of all ADB-supported projects' activities will not cause significant environmental, health, social and safety hazards.

All proposed projects are assessed for their expected environmental impacts, using ADB Rapid Environmental Assessment (REA) checklists and assigned to one of the following four categories:

i. **Category A**. Proposed project is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented; impacts may affect an area larger than the sites or facilities subject to physical works. A full-scale environmental impact assessment (EIA) including an environmental management plan (EMP), is required.

ii. **Category B**. Proposed project's potential environmental impacts are less adverse and fewer in number than those of category A projects; impacts are site-specific, few if any of them are irreversible, and impacts can be readily addressed through mitigation measures. An initial environmental examination (IEE), including an EMP, is required.

iii. **Category C**. Proposed project is likely to have minimal or no adverse environmental impacts. No EIA or IEE is required although environmental implications need to be reviewed.

iv. **Category FI**. Proposed project involves the investment of ADB funds to, or through, a financial intermediary.

The subproject's potential environmental impacts have been classified as Category B for environment, requiring the preparation of this IEE report.

C. Evaluation Standards for the Project

1. Surface Water Quality

The treated wastewater will be discharged to the nearby Nanliu river, which is classified as Type IV waters for segment between Hengjiang Hydrological Station and the north boundary of the second class water source conservation area in Bobai county and Type III waters for segment between the north boundary of the second class water source conservation area in Bobai county and Bobai Chengxiang water pump station in the "Environmental Quality Standards for Surface Water (GB3838-2002)". The Luotian reservoir, one of the raw water source for the proposed water supply facility, is classified as Type II water. The standards set out for Type II, III and IV waters are shown in Table I-2.

Table I-2: Standard of the Environmental Quality Standards for Surface Water (GB3838-2002) (Unit: mg/L, except pH)

Parameters	Type II Standard	Type III Standard	Type IV Standard
pH	6-9		
Dissolved Oxygen	≥6	≥5	≥3
Sulphides	≤0.1	≤0.2	≤0.5
Permanganate Index	≤4	≤6	≤10
Petroleum Hydrocarbons	≤0.05	≤0.05	≤0.5
Cyanide	≤0.05	≤0.2	≤0.2
Total Phosphorus	≤0.1	≤0.2	≤0.3
Ammoniacal Nitrogen	≤0.5	≤1.0	≤1.5
Anionic Surfactants	≤0.2	≤0.2	≤0.3
Fluoride	≤1.0	≤1.0	≤1.5
Chromium (VI)	≤0.05	≤0.05	≤0.05
COD	≤15	≤20	≤30
BOD_5	≤3	≤4	≤6
Faecal Coliforms	≤2,000	≤10,000	≤20,000
Lead	≤0.01	≤0.05	≤0.05
Zinc	≤1.0	≤1.0	≤2.0
Cadmium	≤0.005	≤0.005	≤0.005
Arsenic	≤0.05	≤0.05	≤0.1
Copper	≤1.0	≤1.0	≤1.0
Mercury	≤0.00005	≤0.0001	≤0.001
Benzene	≤0.01		
Nickel	≤0.02		

Source: Environmental Quality Standards for Surface Water (GB3838-2002)

2. Effluent Discharge Standard

All wastewater collected will be treated in the proposed wastewater treatment plant and discharged into Nanliu river, which is classified as Type IV waters, in accordance with the standard set out in the Discharge Standards of Water Pollutants for Dyeing and Finishing of Textile Industry (GB4278-2012) during the early stage of the Industrial Park development till 2020 and the Class IA standard of Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002) for the period after 2020.

Table I-3: Discharge Standard of Water Pollutants for the Treated Effluent by 2020 (Unit: mg/L, except pH)

Parameters	Applicable Standards	
pH	6-9	Discharge Standards of Water Pollutants for Dyeing and Finishing of Textile Industry (GB4278-2012)
COD	80	
BOD_5	20	
SS	50	
Chroma (dilution)	50	

Ammoniacal Nitrogen	10	
Total Nitrogen	15	
Total Phosphorous	0.5	
Total Antimony	0.1	
Sulphides	0.5	
Aniline	1.0	
Chromium (VI)	0.5	

Source: Table 2 of the Discharge Standards of Water Pollutants for Dyeing and Finishing of Textile Industry (GB4278-2012)

Table I-4: Discharge Standard of Water Pollutants for the Treated Effluent from 2025 (Unit: mg/L, except pH)

Parameters	Applicable Standards	
pH	6-9	Class IA Standard of Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18919-2002)
COD	50	
BOD_5	10	
SS	10	
Chroma (dilution)	30	
Ammoniacal Nitrogen	5 (8)*	
Total Nitrogen	15	
Total Phosphorous	0.5	
Sulphides	0.5	
Aniline	1.0	Discharge Standards of Water Pollutants for Dyeing and Finishing of Textile Industry (GB4278-2012)
Chromium (VI)	0.5	

* Note: Figure in parenthesis is applicable when the water temperature is lower than 12 °C.
Source: Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002)

3. Ambient Air Quality

Ambient Air Quality Standards (GB3095-2012) was promulgated in February 2012 and has become effective from 1 Jan 2016. The standards have two classes (Class I and II) of concentration limits for key pollutants. Class I standards apply to natural reserves, scenic areas and other environmentally sensitive areas while Class II standards apply to all other areas including residential zones, industrial zones and rural areas. Class II standards are applicable to this subproject.

Table I-5: Ambient Air Quality Standards (Class II) (GB3095-2012) (Unit: ug/m^3, except CO: mg/m^3)

	TSP	PM_{10}	$PM_{2.5}$	SO_2	NO_2	O_3	CO
Annual average	200	70	35	60	40	-	-
24-hour average	300	150	75	150	80	-	4
8-hour average	-	-	-	-	-	160	-
1-hour average	-	-	-	500	200	200	10

For the concentration level of NH_3 and H_2S at the subproject area, the applicable standard will be Hygienic Standards for the Design of Industrial Enterprises (TJ36-79). The specified standard values are listed in Table I-6.

Table I-6: Maximum Allowable Concentration of NH_3 and H_2S of Hygienic Standards for the Design of Industrial Enterprises (TJ36-79).

	Maximum Allowable Concentration (ug/m^3)
NH_3	0.2
H_2S	0.02

4. Groundwater

The Class III standard of Quality Standard for Groundwater (GB/T14848-93) is applicable to the subproject.

Table I-7: Class III standard of Quality Standard for Groundwater
(Unit: mg/L, except for Total Coliform: CFU/L and pH)

Parameters	Standard
pH	6.8-8.5
Ammoniacal Nitrogen	≤0.2
Copper	≤1.0
Lead	≤0.05
Cadmium	≤0.01
Nickel	≤0.05
Chromium (VI)	≤0.05
Volatile phenol	≤0.002

Arsenic	≤0.05
Mercury	≤0.001
Permanganate Index	≤3.0
NO_2-N	≤0.02
NO_3-N	≤20
Total Hardness	≤450
LAS	≤0.3
Fluoride	≤1.0
Cyanide	≤0.05
TDS	≤1000
Total number of bacteria	≤100
Iron	≤0.3
Total Coliform	≤3.0
Manganese	≤0.1
Chloride	≤250
Sulfate	≤250

Source: Quality Standard for Groundwater (GB/T14848-93)

5. Noise

According to the Environmental Quality Standard for Noise (GB3096-2008), Class II standards apply to mixed industrial, commercial and residential zones, Class III standards apply to industrial zones, Class IV-A standards apply to traffic arteries such as highways and main roads while Class IV-B standards apply to railways. Noise level in subproject area shall comply with the Class III standard.

Table I-8: Environmental Quality Standards for Noise (GB3096-2008) (Unit: dB(A))

Class	Day (06:00-22:00)	Night (22:00-06:00)
III	65	55

II. Description of the Subproject

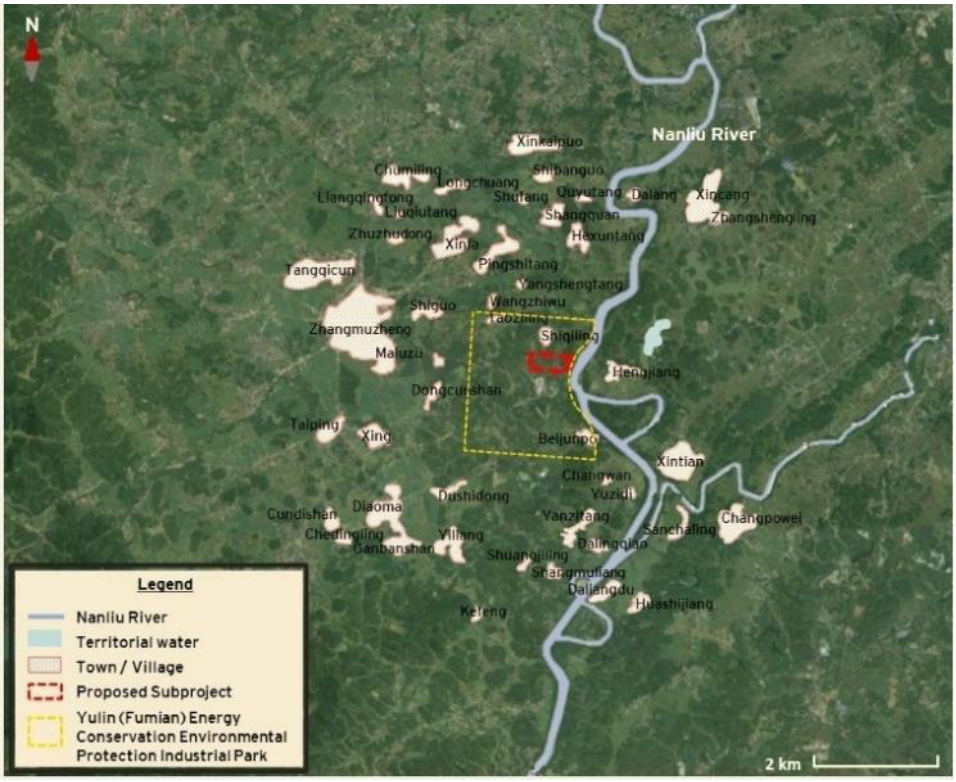
A. Subproject Rationale and Expected Benefits

There are currently over 70 industrial enterprises in Yulin city covering garment washing, paper making, leather processing, chemicals, and food and beverage processing. Among them 23 is located in Fumian district. Many companies treat their wastewater onsite before discharging it into Nanliu River, but their system is just simple and covers primary treatment only. The annual total discharges of COD and Ammoniacal nitrogen (NH_3-N) from 23 industrial companies in Fumian district of Yulin City are 1,500 tonnes and 150 tonnes respectively. The total estimated volume from the industrial companies is 34,499 tonnes per day, based on a 300 work days per year. There are 12 chemical and paper manufacturing companies anticipated to connect to the plant and discharge, with approximately 5,628 tonnes of wastewater per day. The high pollutant concentrations of the wastewater can pose severe water pollution problem on Nanliu River.

Majority of the industrial enterprises such as garment washing in Fumian district are high water consuming companies. The source of industrial raw water of these companies mainly includes water from nearby rivers. The high level of water extraction for industrial could threaten the surrounding rivers. In addition, all industrial enterprises in Fumian district have installed small scale boilers to meet their heat demand. However, most of them are low-tech with low energy efficiency, causing severe air pollution.

The provision of centralised industrial wastewater treatment services, and domestic and industrial water supply services can contribute to water resources conservation and quality improvement of Nanliu river, reduction of air pollution and the upgrade of heat and power generation efficiency. These positive impacts brought by the subproject can help the Yulin city government to achieve their environmental targets and planning directions set out in various local and regional environmental initiatives such as Guangxi province water pollution prevention and mitigation action plan, 2016 Guangxi environmental protection action plan, and Yulin city government's air pollution prevention and mitigation action plan etc.

Figure II-1: Locations of the subproject and the surrounding environment



The proposed subproject is situated west of Nanliu River in Zhangmu Town, Fumian District of Yulin City with a total area of 400,002m^2, which will consist of two components: i) wastewater treatment plant, and ii) water supply. Construction works for the subproject are expected to be completed in 10 months. The subproject will be the key infrastructure facilities located in the water-consuming enterprises upgrading zone of the proposed Yulin (Fumian) Energy Conservation Environmental Protection Industrial Park. The industrial park will be developed in 3 phases as below:

Table II-1: Proposed Development Plan of the Industrial Park

Phase	Planning Period	Development Target
I	2015-2020	Construction of infrastructure facilities including wastewater treatment plant, water supply facilities, combined heat and power facilities, water reuse system, and standard factory buildings. By the end of 2017, the existing 23 garment washing companies will be relocated to the water-consuming enterprises upgrading zone within the industrial park.
II	2020-2025	Has the reputation of being a well-developed denim garments and high-end textile fabric production base by year 2025, other qualified water-consuming industries such as leather, chemical and paper making companies in Yulin area will be relocated to the industrial park.
III	2025-2030	Develop a solid waste treatment facility and resources recovery centre, support the development of environmental products and energy saving environmental equipment manufacturing industries. The GDP of the industrial park could reach RMB1.4 billion by 2030.

Figure II-2: Location of the Subproject and the Yulin (Fumian) Energy Conservation Environmental Protection Industrial Park

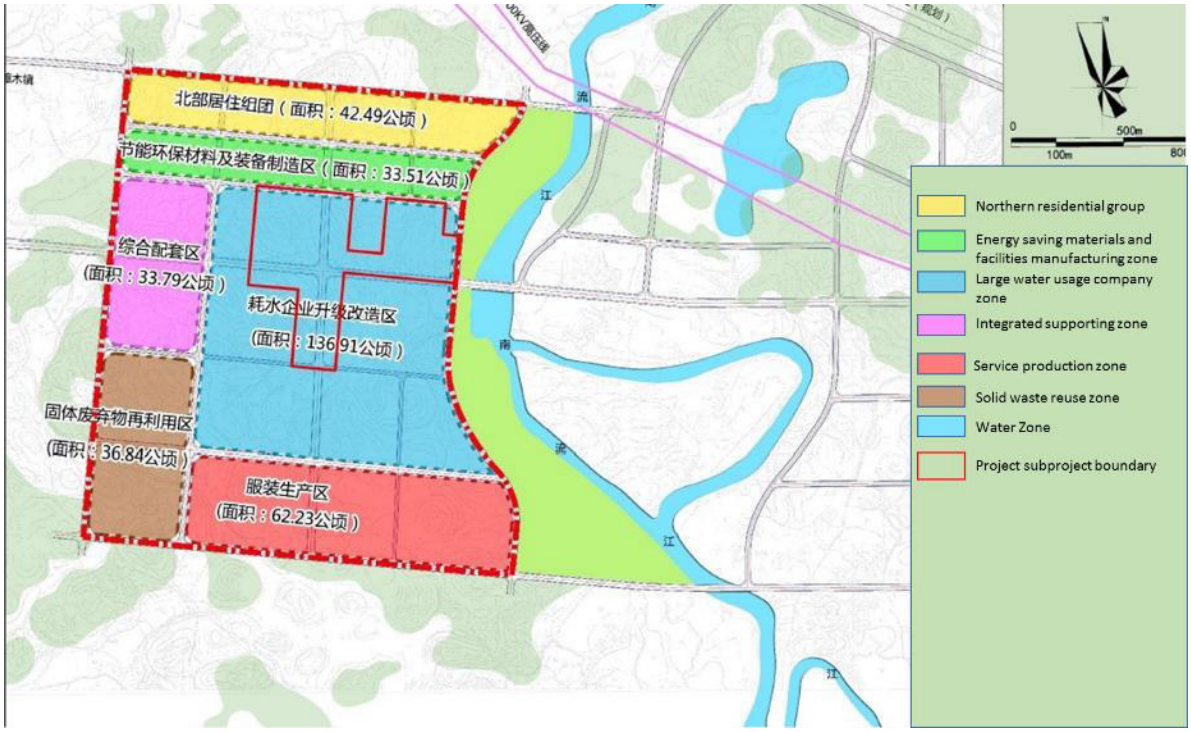


Figure II-3: Layout of the Proposed Wastewater Treatment Plant and Water Supply Facility

B. Subproject Components and Activities

Water Supply Facility

A water supply facility will be built to provide raw water for industrial enterprises and residents within the industrial park. The capacity of water supply would be 100,000t/d (Phase 1: 50,000 t/d, Phase 2: 50,000t/d) for industrial enterprises and 20,000 t/d (one-off development) for residents within the industrial park. The total capacity of water supply would be 120,000t/d.

Table II-2: Development phases of water supply facility

Total Capacity	Phase 1	Phase 2
100,000m^3/d for industrial use	50,000t/d for the industrial enterprises who have moved to the garment processing factory zone	50,000t/d for all industrial enterprises at the Yulin (Fumian) Environmental Protection Industrial Park
20,000m^3/d for domestic use	20,000t/d (one-off development)	-

Raw water comes from two major sources: Nanliu River as industrial raw water and Luotian Reservoir in Zhangmu Town as domestic raw water. Quality of the industrial raw water is shown in Table II-3 below. Both raw water collected from Nanliu river and Luotian reservoir will be treated by "Flocculation, sedimentation, Filtration, and Disinfection" process as presented in Figure II-4.

Figure II-4: Water intake point and wastewater discharge point of the subproject

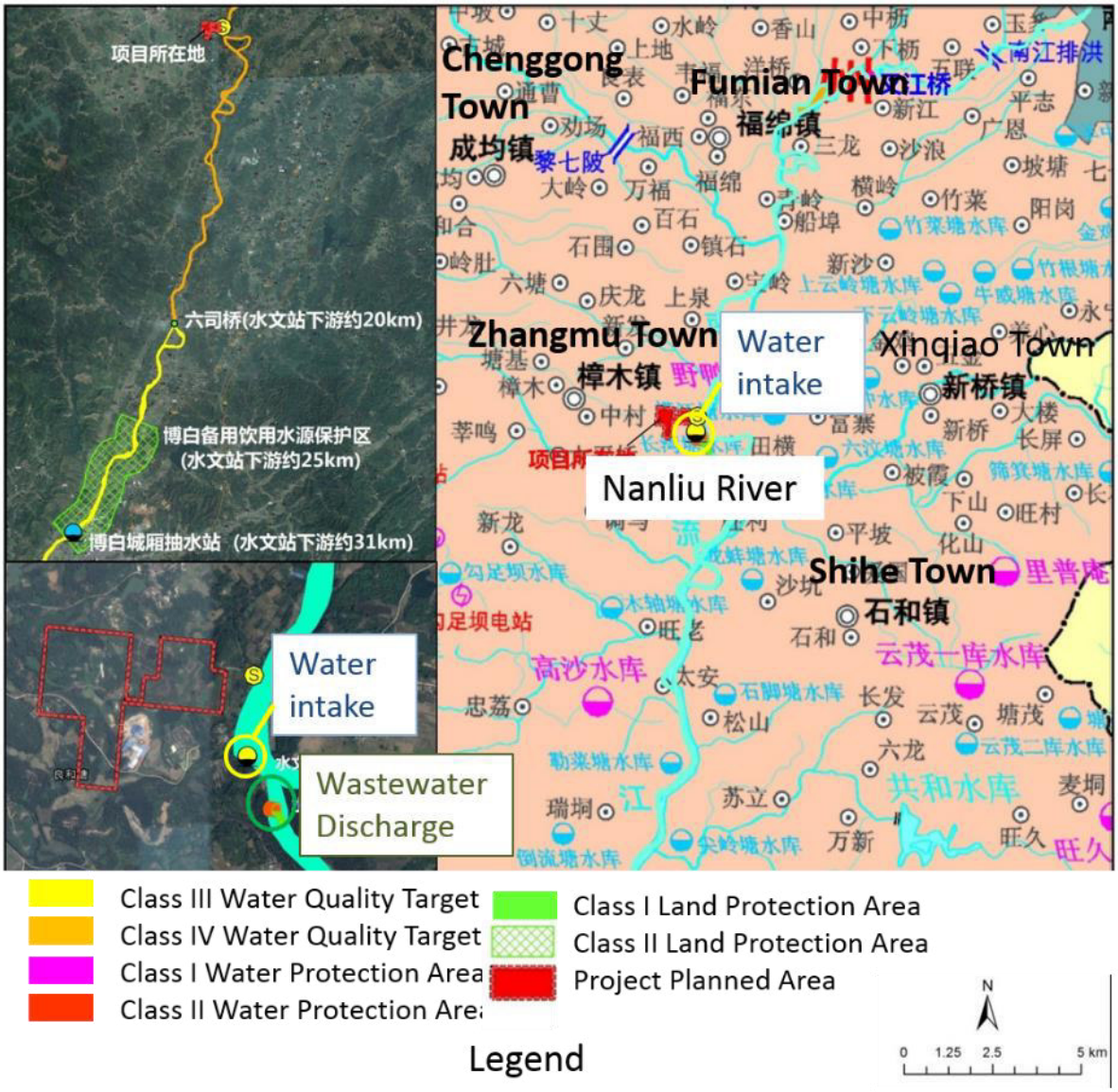


Table II-3: Influent water quality from Nanliu River (Upstream of Hengjiang Hydrological Station)

Parameter	pH value	COD_{Mn} (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	NH3-N (mg/L)	TP (mg/L)
Total	7.38	4.74	13.7	20	0.69	0.032

The treated water for domestic use will comply with the “Standards for Drinking Water Quality” (GB5749-2006), while the treated water for industrial use will meet the requirements of “The Reuse of Urban Recycling Water – Water Quality Standard for Industrial Uses” (GB/T19923-2005).

Table II-4: Standards for Drinking Water Quality (GB5749-2006) (Unit: mg/L, except for turbidity: NTU, total bacteria: CFU/L, and pH)

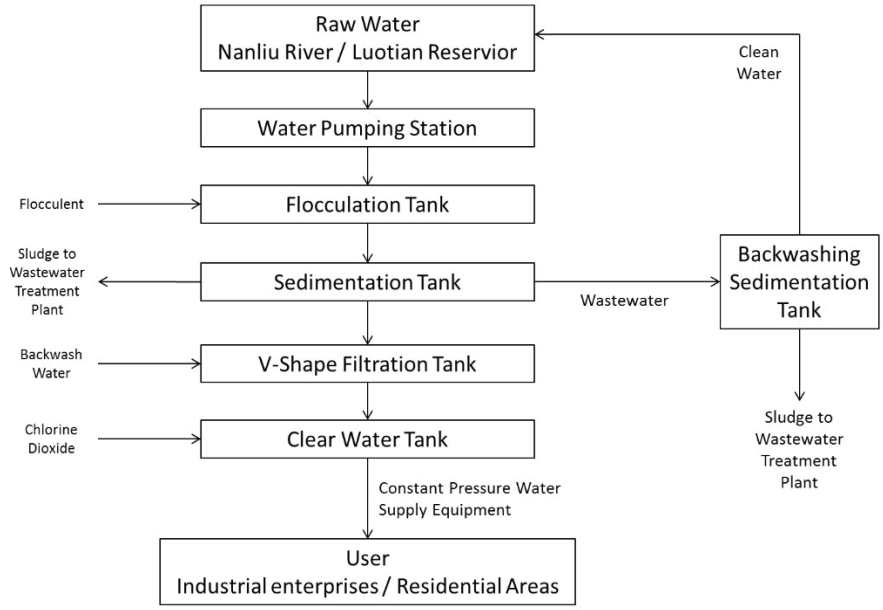
Parameter	Standard
Chroma	≤15
Turbidity	<3
Odour	Odourless
Visible matter	Nil
pH	6.5-8.5
Total hardness	450
Iron	0.3

Parameter	Standard
Manganese	0.1
Copper	1.0
Zinc	1.0
Volatile Phenols	0.002
Cationic synthetic detergent	0.3
Sulphate	250
Chloride	250
Total Dissolved Solids	1000
Chlorite	0.7
Total bacteria	100

Table II-5: Standards of "Reuse of Urban Recycled Water – Water Quality Standard for Industrial Uses" (GB/T19923-2005) (Unit: mg/L, except for turbidity: NTU, faecal coliforms: CFU/L, and pH)

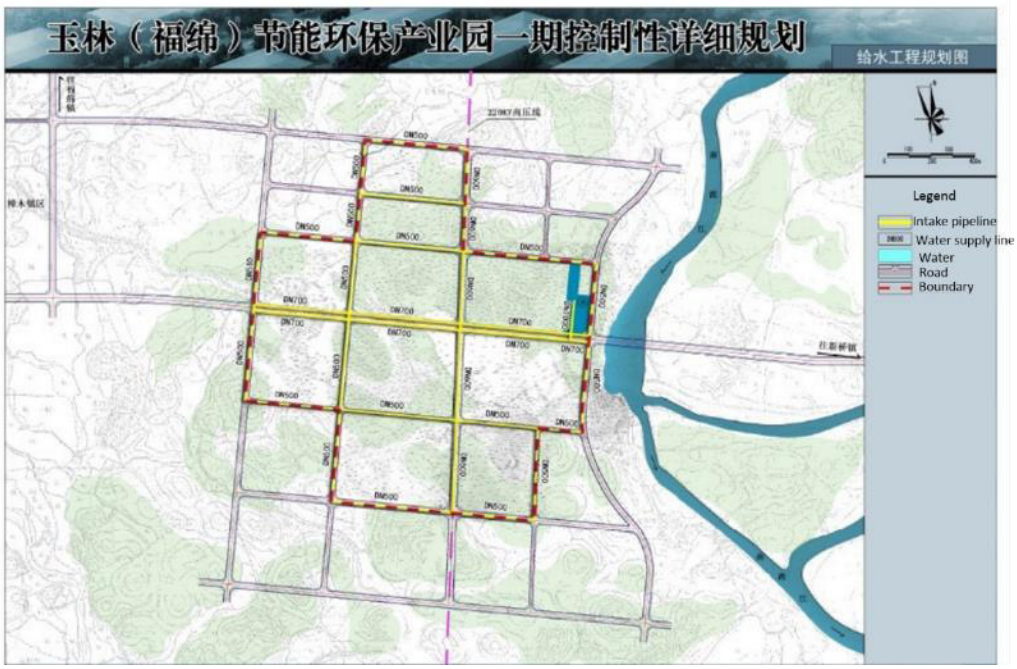
Parameter	Purpose			
	Cooling	Washing	For boiler use	For processing and product use
pH	6.5-8.5	6.5-9.0	6.5-8.5	6.5-8.5
SS	30	30	-	-
Turbidity	5	-	5	5
Chroma	30	30	30	30
BOD_5	10	30	10	10
COD	60	-	60	60
Iron	0.3	0.3	0.3	0.3
Manganese	0.1	0.1	0.1	0.1
Chloride Ion	250	250	250	250
Silicon dioxide	50	-	30	30
Total Hardness	450	450	450	450
Total Alkalinity	350	350	350	350
Sulfate	250	250	250	250
Ammoniacal nitrogen	10	-	10	10
Total Phosphorus	1	-	1	1
Total Dissolved Solids	1000	1000	1000	1000
Petroleum Hydrocarbons	1	-	1	1
Anionic Surfactants	0.5	-	0.5	0.5
Chlorine residual	0.05	0.05	0.05	0.05
Faecal Coliforms	2000	2000	2000	2000

Figure II-5: Water Supply Facility Process Flow



CTEG will be responsible for the construction, monitoring and maintenance of the water supply lines. The subproject's water supply lines will be connected to the existing Yuzhou town water supply lines for raw water from Luotian reservior, so no extra domestic raw water intake point is required. The industrial raw water intake point is Nanliu river, which is just beside the water supply facility and located near the Hengjiang Hydrological Station. The water supply pipeline for Phase 1 is approximately 3.06km. The proposed water supply network is given in Figure II-6.The pipeline would be DN400 to DN1000, which will be laid underground next to the roads with the design flow rate in Phase 1 as 0.58m/s. The construction of the water supply pipelines will be conducted in phases in line with the development of the industrial park. The proposed water supply network is given in Figure II-6.

Figure II-6 Proposed water supply network of the Industrial park



Chemicals used on-site

Chemicals used on-site are not stored in large amount and are ordered when needed. Chemicals involved in water supply process mainly include aluminium chlorohydrate (PAC), PAM, Iron sulfate, sulfuric acid, sodium hypochlorite, hydrochloric acid, liquid base, scale inhibitor, sodium bisulphite, liquid ammonia, cation-exchange resin (001x7), anion-exchange resin (201x7), Ethylene Diamine Tetra (Methylene Phosphonic Acid) Sodium (EDTMPS), sodium hypochlorite. The chemicals are ordered on need basis and will not be ordered regularly, so the storage amount will be kept low.

The consumption quantity, storage capacity available in the subproject area, and the threshold quantity (based on GB18218-2014 requirement) are listed in the following table. Chemicals are labeled and stored ventilated and cool temperature. Safety gloves and goggles must be worn when handling the chemicals. Employees have training sessions and can only handle the hazardous chemical under the supervision of those who have knowledge about the chemical being managed.

Table II-6 Information about chemicals to be used on-site

Parameter	Consumption quantity for water supply (t/a)	Consumption quantity for wastewater and sludge treatment (t/a)	Storage capacity available	Threshold quantity according to Identification of hazard installations for dangerous chemicals (GB18218-2014)
PAM	-	281.44	-	-
PAC	18	2640	60	-
Iron sulfate	-	8250	60	-
Concentrated sulfuric acid	-	990	20	100
Sodium hypochlorite (10%)	-	45	80	-
Calcium carbonate	-	2324.9	-	-
Iron(III) chloride	-	1743.7	-	-
Chlorine dioxide	25	-	10	-
Calcium hydroxide	0.822	-	-	-

Wastewater treatment plant

The wastewater treatment plant with design capacity as 100,000t/d (Phase 1: 50,000t/d) is designed to collect and treat all industrial wastewater generated from the garment processing enterprises. The wastewater treatment will mainly include pre-treatment (coarse removal, coagulation, sedimentation, pH adjustment), anaerobic acidification, aeration, coagulation and sedimentation, filtration, and decolouring. When the final sedimentation, filtration and decolouring processes are completed, the treated wastewater will be discharged to the nearby Nanliu river.

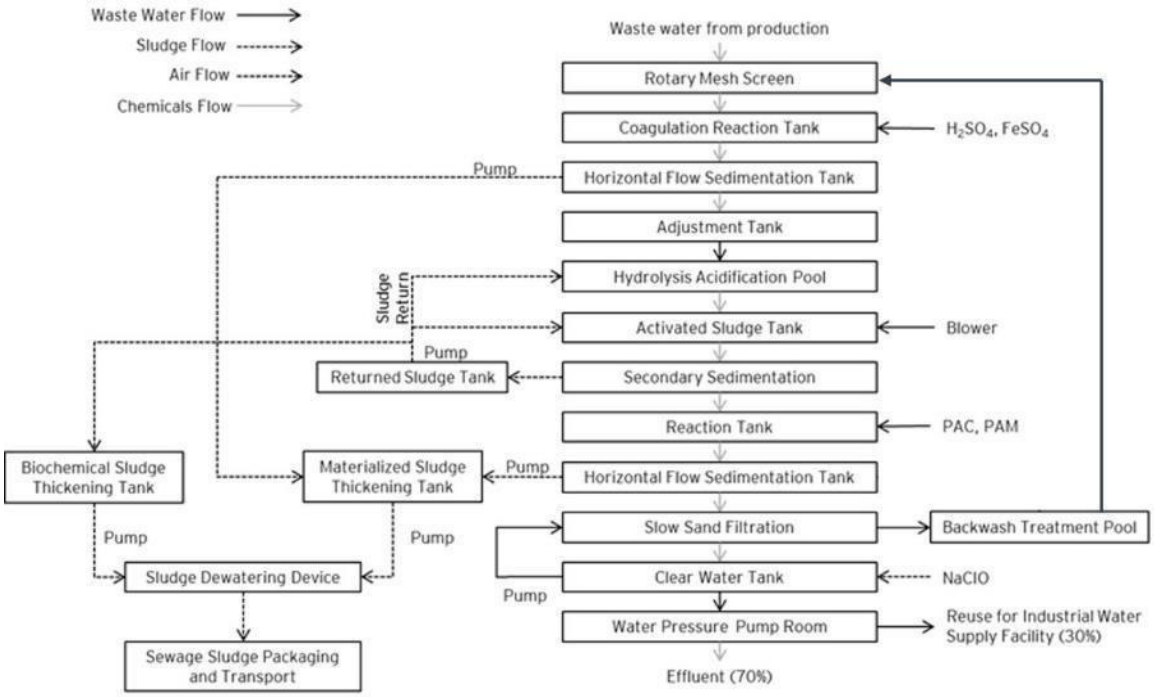
The wastewater treatment process flow is presented in Figure II-6. The treated wastewater will be in compliance with Table II-7 requirements of Discharge standards of water pollutants of dyeing and finishing of textile industry (GB4287-2012) in short term (until 2020). In long term, the quality of the treated wastewater will comply with Class IA standards of the Discharge Standards of Pollutants for Municipal Wastewater treatment plant (GB18918-2002) while the Discharge standards of water pollutants of dyeing and finishing of textile industry (GB4287-2012) would still apply to some parameters including Aniline and Chromium (VI).

Table II-7 Designed Influent and Effluent Quality (Unit: mg/L, except pH)

Parameter	Designed Influent (mg/L)	Short term Effluent Concentration（mg/L）	Long term Effluent Concentration（mg/L）
pH	9-11	6 - 9	6 – 9
COD_{Cr}	800	60	50
BOD_5	250	20	10
SS	350	50	10
Chroma (dilution)	400	50	30
NH3-N	25	8	5
Total Nitrogen	35	15	15
Total Phosphorous	2.0	0.5	0.5
Sulphides	3.0	0.5	0.5
Aniline	2.0	1.0	1.0
Chromium (VI)	1.0	0.5	0.05
Cadmium	-	-	0.01
Arsenic	-	-	0.1
Lead	-	-	0.1
Nickel	-	-	0.05
Benzopyrene	-	-	0.00003

AOX	-	12	1
Oil and Grease	-	-	1
Pesticides	-	-	0.5
Chromium (Total)	-	-	0.1
Copper	-	-	0.5
Zinc	-	-	1
Phenol	-	-	0.3
Temperature increase (°C)	-	-	-
Coliform bacteria (MPN/100ml)	-	-	-
Fecal Coliform (Number/L)	-	-	10^3

Figure II-7 Wastewater treatment plant process flow



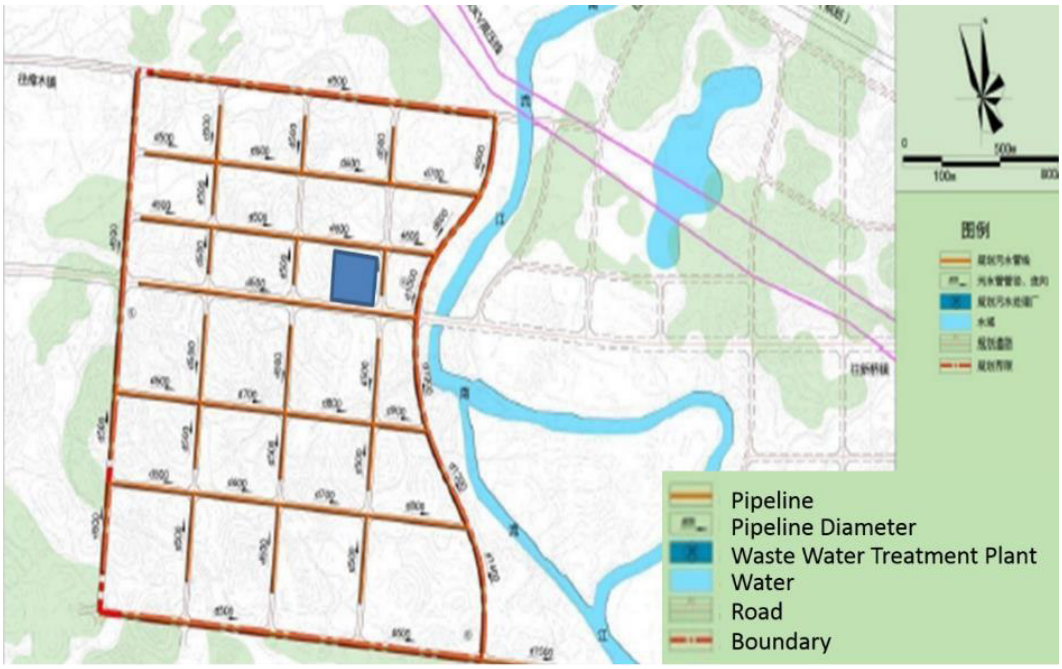
<u>Built processes and instrumental design to prevent substandard effluent:</u>
Preventive design and process to ensure that all wastewater is properly treated before discharge include registration of new corporate in the industrial park, constant update with existing corporates on their production capacity and development, constant monitoring and checking of the influent and effluent quality. Any deviation from design parameter will lead to process adjustment of staggering or even suspension of discharge.

There are also emergency measures in place to prevent substandard discharge. This includes the provision of emergency collection tank with pipes connecting to discharge point and a valve to prevent outflow. This is supported by the monitoring system at the discharge point and for analysis of all operational process parameters. As soon as process failure is found, the monitoring team is notified, any substandard treated wastewater will be immediately redirected to back to the process that is identified to be at fault.

<u>Pipelines</u>
CTEG will be responsible for the construction, monitoring and maintenance of the sewer network. Based on the overall planning of Fumian district, the main and secondary sewer lines of the industrial park will run along the main and subsidiary roads. The wastewater generated by industrial enterprises will be diverted to the main sewer line via the nearby subsidiary sewer line before discharging to the wastewater treatment plant. The sewer lines would be DN400 to DN1000 using HDPE pipelines. The construction of pipelines will be conducted in phases in line with the development of the industrial park. The main and subsidiary sewer lines will be buried at a depth of 2.5m and less than 2.0m respectively. The first phase consists of constructing a 2540m long pipeline, with a capacity of 50000m^3/day

The network of sewage, water supply, road drainage, steam pipes should be well aligned with each other during design and construction stages. Apart from the above mentioned pipers, there are no fixed pipelines at the location, no impacts are expected on other existing pipelines during construction.
The proposed sewer network is given in Figure II-8.

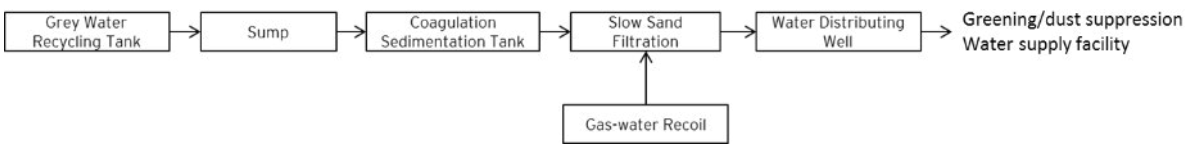
Figure II-8 Proposed Sewer Network of the Industrial Park



All sludge generated from the wastewater treatment process will be sent to the combined heat and power system, which is adjacent to the wastewater treatment plant, by conveyor belt for further treatment by incineration. The sludge conveyor belt connects sludge pressing zone with the sludge drying area. It is predicted that 2.92t/a of sludge will be generated from water supply process and around 159 tonnes of sludge will be generated from the wastewater treatment process in the long term. The combined heat and power system can treat 250 tonnes of sludge per day (80% water content). This arrangement can ensure that all sludge will be only generated and properly treated within the subproject area, preventing potential environmental impacts caused by the transportation of sludge.

In order to further reduce the amount of pollutants discharged to the Nanliu River, after Year 2025, it is suggested that part of the treated wastewater from the wastewater treatment plant would be diverted to the water reuse system for further treatment. The reclaimed water will be used for two major purposes: 1) greening and dust suppression and 2) discharged to the water supply facility for further treatment and eventually be used as raw water by the surrounding industrial enterprise. The quality of the reclaimed water can meet standard set out in "The Reuse of Urban Recycling Water – Water Quality Standard for Green Space Irrigation" (GB/T25499-2010) and "The Reuse of Recycling Water for Urban – Water Quality Standard for Urban Miscellaneous Water Consumption" (GB/T18920-2002). The water reuse system will run for 24 hours a day with design capacity as 30,000t/d, the process flow is outlined below.

Figure II-9: Water Reuse Process Flow



<u>The combined heat and power system</u>
A combined heat and power system, which will supply power to the industrial park, will also support the power requirement of the wastewater treatment plant. The combined heat and power system will not be financed by ADB. This will also be constructed in 3 stages as shown in Table II-3 below. The total capacity will include operations of four boilers and turbines

and will generate a total of 136t/h steam and 34,000kW/h electricity. The annual coal consumption for boiler's use would be approximately 446,400 tonnes.

The coal storage area will be developed in 2 phases. During the first phase it can store around 2,725 tonnes of coal so as to meet the demand of the two 75t/h boilers. The storage capacity of the area will be increased to 7,440 tonnes after the expansion of the area.

Influent water of the combined heat and power system come from municipal water supply facilities, approximately 50% of cooling water will be reused in the system.

Selective Non-catalytic Reduction (SNCR) technology will be applied for flue gas desulphurisation, dust collector filter bags will be also used to ensure that the concentration level of air pollutants could meet the requirements of the "Emission Standard of air pollutants for thermal power plants" (GB 13223-2011).

Figure II-10 Location of the Combined Heat and Power System area

Figure II-11 Layout of the Combined Heat and Power System area

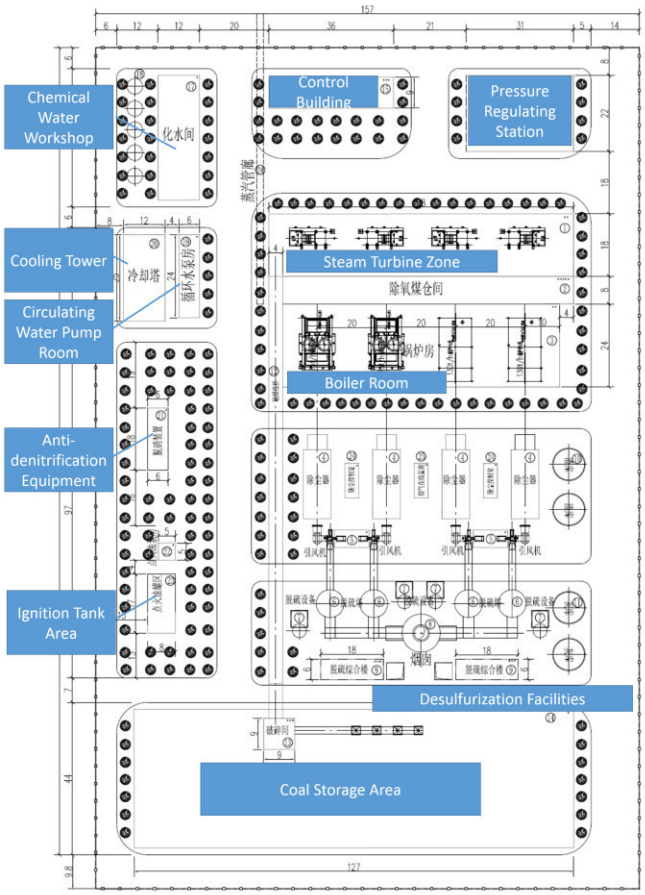


Table II-8: Proposed Capacity for Combined Heat and Power System

Stage	Equipment installed	Fuel
I	One 75t/h Circulating Fluidised Bed Boiler and one 7MW Non-condensing steam turbine	90% coal + 10% diesel
II	One 75t/h Circulating Fluidised Bed Boiler and one 7MW Non-condensing steam turbine	90% coal + 10% diesel
III	Two 130t/h Circulating Fluidised Bed Boilers and two 12MW Non-condensing steam turbines	90% natural gas + 10% diesel

It is expected that installation of two 75t/h circulating fluidized bed boilers and two 7MW non-condensing steam turbine as well as the supporting pipe system will be completed and put into production in 2018. Coal, supplemented with diesel, will be the major fuel during stage 1 and 2, mainly due to cost considerations. Biofuel will be also considered to replace the use of coal.

In long term (until 2030), following the promotion of clean energy in Guangxi, the natural gas pipe system will be constructed and natural gas, supplemented with diesel, will be used as the major fuel for the combined heat and power system.

The dewatered sludge from water supply and the wastewater treatment process will be conveyed to the combined heat and power system by conveyor belt. It is predicted that 2.92t/a of sludge will be generated from water supply process and around 159 tonnes of sludge will be generated from the wastewater treatment process in the long term.

C. Project Alternative

The following are different alternatives for sludge treatment, odour control and wastewater treatment taken into consideration in this subproject. Our decision on particular technology is dependent on cost, feasibility, and effectiveness.

i) Sludge

Table II-9 Alternatives for Sludge Treatment

Alternatives	Description	Advantages	Setbacks
Incineration	Sludge must be dried prior incineration to ensure spontaneous combustion. Emissions from the plant must be treated to ensure compliance to laws, avoiding air pollution and recovering waste heat.	Significant reduction in sludge volume after incineration. Most of the sludge can be recycled and reused. Small area is required.	Incinerators are capital intensive and the process is complicated. Incineration is energy intensive and requires a high operating cost. Potential risk of air pollution and emissions of dioxin.
Passive aerobic composting	The dried sludge is mixed with filler (e.g. wood dust), and the mixture is placed on the packed bed. Oxygen is then supplied by rotary air blowers instead of vessel. Odour from the mixture is isolated and absorbed by covering it.	Fillers can be reused. After the process is completed, the mixture can be smashed and filtered to isolate the fillers. Water is removed from the composting process, increasing the solid content from 40 to 55%.	A longer time is needed to digest the sludge. Heavy metal in the compost must be carefully monitored. Demand for compost is unstable.

Alternatives	Description	Advantages	Setbacks
Active aerobic composting	Mixture is stacked into a long strip, creating a larger surface area. This facilitates convection and diffusion of air. Air can also be supplied mechanically using rotary air pumps. DANO Technology: Air is mechanically supplied in the drum that automatically mixes the refuse.	DANO drum is a highly mechanized and time-saving technology. No significant environmental impacts will be resulted. Water is removed from the composting process, increasing the solid content from 40 to 55%.	It is energy intensive and detailed monitoring is required. A longer time is needed to digest the sludge. Heavy metal in the compost must be carefully monitored. Demand for compost is unstable.
Enclosed Aerated Windrow	Mixture enters the windrow and air is being supplied mechanically in the composting process. The mixture will be moved along the windrow towards the exit.	Water is removed from the composting process, increasing the solid content from 40 to 55%.	A longer time is needed to digest the sludge. Heavy metal in the compost must be carefully monitored. Demand for compost is unstable.
Landfilling	It refers to sending the dried sludge to landfill. It will be mixed with municipal waste. Two types of landfilling: -Aerobic -Anaerobic	Landfill sites provide a huge capacity for handling sludge. The cost of investment is relatively low comparing to other technologies. Operation is simple and it is easy to manage.	A large area is required. Odour problems are commonly found in landfill sites.
Drying	The drying process can produce pellets with diameter of 1-4mm and with water content less than 10%.	These pellets could be used in agriculture, forestry and landfilling.	
Blended combustion of dried sludge pellets	Sludge (with water content: 80%) is mixed with various filler materials and burn with coal in power plants.		High cost of combustion

Based on the above comparison, we have adopted a 'comprehensive use' strategy. Sludge will be transported to the nearby combined heat and power plants for further treatment. It can prevent leakage during from transportation, hence eliminating environmental pollution. Moreover, it demonstrates our commitment in environmental protection by recycling and reusing the sludge.

ii) Odour Control

Table II-10 Alternatives for Odour Control

Alternatives	Application	Cost	Advantages	Disadvantages	Effectiveness
Packed tower	Can be applied to medium to high levels of pollution. It is used in large-scale facilities.	Medium level of investment and operating cost is required.	It is Effective and reliable. It can be used for a long duration.	Chemical wastewater is produced and appropriate treatment must be done.	99%

Alternatives	Application	Cost	Advantages	Disadvantages	Effectiveness
				Chemical use is required.	
Wet scrubber	Can be applied to medium to high levels of pollution It is used in large-scale facilities.	It is more costly than the other methods.	Only a small amount of chemicals is required.	Water softening is required. Size of the absorber is relatively large.	N/A
Activated carbon	Can be applied to low to medium levels of pollution. It is used in both small and large-scale facilities.	Dependent on the frequency of replacement and regeneration of activated carbon.	Simple structure and method of use.	Only applicable for odour at a low concentration. Difficulty in predicting the life of Activated carbon.	N/A
Biological Aerated Filter	Can be applied to low to medium levels of pollution. It is used in both small and large-scale facilities	Only low investment and cost of operation is needed.	Only simple operation and maintenance is needed.	There is ifficulty in establishing design standards. Not applicable in treating high concentration odour.	>95%
Thermal Oxidation	Can be applied to high level of pollution. It is used in large-scale facilities	High investment and operating cost are required.	Effective in removing volatile organic compounds.	Only economical when it is used to treat high velocity odours that are difficult to be treated by other technologies.	N/A
Activated Sludge treatment tank	Can be applied to high level of pollution. It is used in small to large-scale facilities	It is economical for facilities equipped with rotary air pumps and diffusion devices.	A simple operation and maintenance is needed. Effective in removing pollutants.	The rotary air pumps are highly vulnerable to corrosion. Not applicable in treating high concentration odours.	90-95%
Plant-based deodourant*	Can be applied low level of pollution. It is used in small-scale facilities	Higher operating cost is needed.	Only a low cost of investment is needed.	Efficiency of removing odour is higher. (>90%)	N/A

Our sources of odour (fenced wells, reaction pools and sludge tanks) are covered by a lid to ensure minimal leakage. More than 95% of odour can be prevented by this simple step. The lids are made by profiled steel sheets.

We also remove odour by using biological methods. The principle of this technology is to utilize the chemical characteristic where some parts of the odourant compound can be dissolved in water and absorbed by microbes. The odourant compound can then be decomposed and reduced to remove organic compounds that contains carbon, Sulphur and nitrogen. Microbes on the film can further reduce them to carbon dioxide and water. The advantages of using biological methods include a simple management, low cost of investment and maintenance, high ability to remove various kinds of odourants (including H2S, CS2, NH3 and other odourants), high effectiveness (~95%) and its ability to prevent secondary pollution.

Emissions from other parts of our operation are treated by using plant-based deodourant. The principle is to spray the deodourant mist at a specified area. Chemical reactivity and biological activity of the deodourant compounds facilitate reaction with odourants. This reaction changes the structure of the deodourant compound and increases its instability, hence facilitating other chemical reactions to remove odours and enhance air quality. The effectiveness of this technology is very high (~90%).

From the above analysis, both methods have a simple and convenient O&M. Therefore, we have decided to use both of them in ensuring better odour control.

iii) Wastewater

Table II-11 Proposed Technology for Wastewater Treatment

Items for comparison	Conventional Aeration technology	Our proposed technology
Facilities employed	Structures required for aeration of wastewater and secondary sedimentation tank are needed.	A/O tank (Anaerobic anoxic oxic activated sludge process) and a secondary sedimentation tank
Impact load resistance	Strong adaptability to changes in volume, quality and temperature of water. Operation is impacted easily. (e.g. Reflux ratio)	Ratio of soluble organic compounds increase after passing through the hydrolyzation & acidification pool. Strong adaptability to changes in volume, quality and temperature of water.
Maintenance	Relatively low automation control, maintenance is dependent on technician's skills. Complex operation is needed. Sludge bulking may be resulted from the grow of filamentous bacteria	It is equipped with relatively high automation control Only Simple and convenient system management is needed.
Area	Large	Small
Sludge production	Volume is small due to aerobic digestion.	Volume is small and can be removed by sedimentation easily.
Effectiveness	Outflow BOD complies with the limit set by law and regulations. Due to the long duration for aerobic digestion, bacterial oxidation occurred and the sludge activity is relatively low. A low sedimentation rate is resulted and hence the level of suspended solid (SS) may exceed the limit.	High level of sludge activity and sedimentation rate is resulted from adopting the A/O process. Therefore, outflow SS and BOD comply with limits set by laws and regulations.
Operating cost	Extended aeration; high power and hence electricity consumption lead to a high operating cost.	Anoxic reaction reduced the electricity consumption and hence a lower operating cost.

The above parameters serve as our decision matrix. We can conclude our proposed technology, i.e. Anaerobic anoxic oxic activated sludge process, has a higher impact load resistance, simpler maintenance and lower operating cost. Moreover, this process is more effective and only requires a small area.

D. Manpower Requirement

During construction stage, there will be around 100 staff working onsite, mainly construction workers. The size of the staff required for wastewater treatment plant and water supply facility during operation are 56 and 30 respectively. The wastewater

treatment plant and water supply facility will run in a 24/7 operation with 8-hour shifts. The number of staff by category is shown in Table II-12.

Table II-12 Number of staff required by category during operation stage

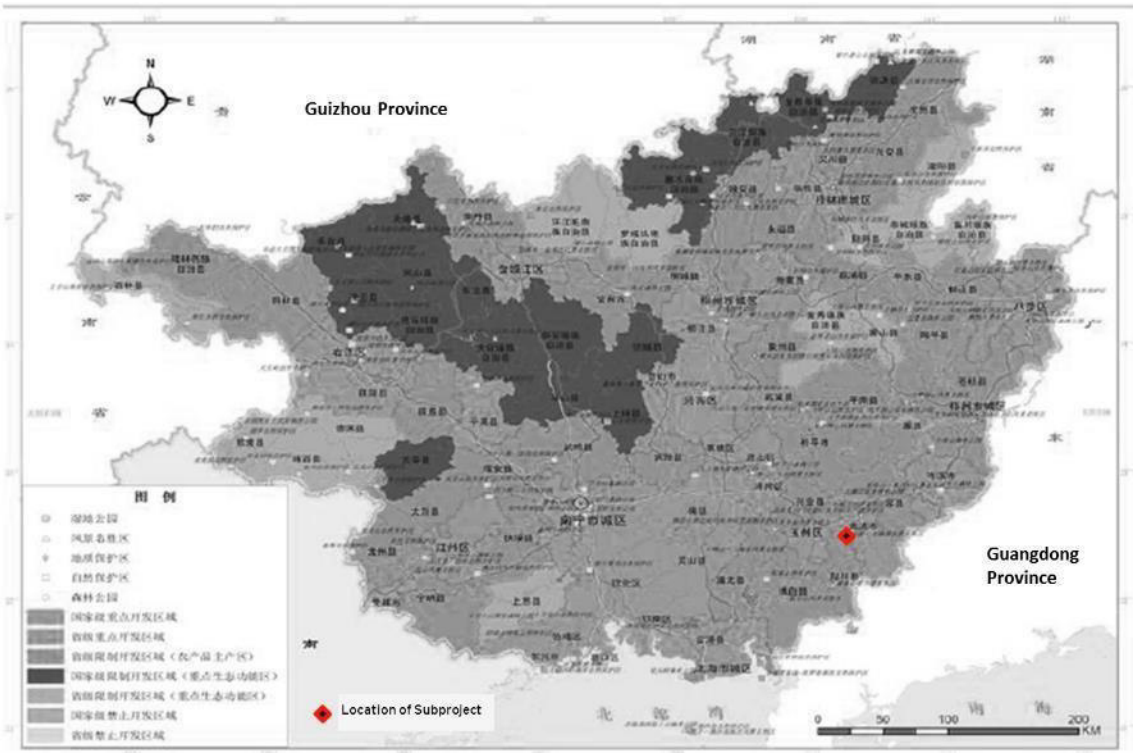
	Wastewater treatment plant	Water supply facility
Manager and Engineer	6	6
Production staff	35	10
Maintenance staff	3	4
General staff	12	10
Total	**56**	**30**

III. Description of the Environment

A. Location

The subproject area is located in Zhangmu Town, Fumian District, Yulin City (geographic coordinates: 21°38'~23°08'(N), 109°33'~110°53'(E)), in the southeastern part of Guangxi Zhuang Autonomous Region, along the border with Guangdong in the PRC. Fumian District is approximately 8km southwest from the center of Yulin City. The land surrounding the subproject is mainly used for industrial and residential. There are also some villages (around 1000m away), hospital (around 2000m away), and schools (around 1900m away) near the subproject area.

Figure III-1: Location of the proposed subproject on the map of Guangxi Zhuang Autonomous Region, the PRC



B. Topography

Yulin city is situated in the hilly basin. In the far northeast there is a Darongshan Mountain while in the southwest there is a Liuwanshan Mountain. Nanliu River valley and Beiliu River valley occupy the central area. Fumian district is situated in the central area of Yulin Basin, which is located south to Daronghshan Mountain and East to Liuwanshan Mountain with a total land area of 393km^2. It is mainly a flat and fertile terrain with some low hills in the northeast.

C. Climate

Yulin City's districts are in the lower latitudes, south of the Tropic of Cancer which has a typical subtropical monsoon climate. The area has a sunshine rate of 41%, annual sunshine of 1,807.6 hours with an annual average relative humidity of 79%, and an average annual temperature of 21.9˚C, with an extremely low temperature of -2.1˚C. During the wet season from April to September, the Nanliu River basin is hot and humid with frequent monsoons, typhoons and southerly winds. During the dry season from October to March, the Nanliu River basin has dry and cold winter winds and cold air from the north. The average annual wind speed is around 2.4m/s, the maximum wind speed is 17.2m/s, wind level around 1-2. There are long frost-free periods, usually up to more than 344 days frost free, the average air pressure is 1,003.2.

Fumian District is located south of the Tropic of Cancer as well and has a subtropical monsoon climate with abundant heat and an average rainfall of 1,592mm. The area has an annual sunshine of around 1813.9 hours and its temperature hovering around 21.8˚C. The dominant wind direction in the summer is south-east and in the winter is north-west.

D. River System and Water Resources

Yulin city has an extensive river system that consists of 104 rivers with drainage basin over 50km^2, and 52 rivers with drainage basin over 100km^2. While the major rivers in the system include Nanliu River, Beiliu River, and Jiuzhou River, Beiliu River is the principle river within the subproject area.

Nanliu River is originated from the south of Darongshan Mountain, flowing from the eastern region to the central region and then to the south. The mainstream is 285km long with a catchment area of 9704km^2. As most of the winding rivers in the area have a shallow river bed, during heavy rainstorms, flooding can happen easily and rapidly.

Nanliu River flood gate to Zhangmu Town Hengjiang hydrological station segment of Nanliu River is classified as Type IV waters, which is applicable to the waters areas for industrial use and entertainment that is not directly touched by human bodies. This water segment is mainly used by Fujin agricultural sites. The segment from Hengjiang hydrological station to Bobai City water extraction station is classified as Type III waters, which is applicable to the abstraction for human consumption in second class protection area, protected areas for the common fishes and swimming areas.

The treated wastewater will be discharged from the subproject through the pipe to Nanliu River at 380m downstream from Hengjiang hydrological station.

E. Ecological resources

Fumian District has an abundant forest resources, the region's forest land takes up 74,500 acres, covering about 30% of Fumian's town area. 90% of the forest are covered with green hills, including Eucalyptus Trees (按树), Pine Trees (松树), Fir Trees (杉木), star anise (八角) from Illicium verum, trees of Longan, Lychee and many more.

The Yulin territory has a diverse range of wildlife including amphibians, reptiles, birds and mammals, over 23 species are listed as National Key Protected Species such as Python molurus (蟒蛇) (Grade I), Manis pentadactyla (穿山甲) and Rana tigrina (虎纹蛙) (Grade II) as well as more than 59 species including turtle, Bungarus fasciatus (金环蛇) and Francolinus pintadeanusare (鹧鸪) are listed as Key protected terrestrial animal in Guangxi.

Overtime, the natural environment and habitat has been disrupted by intensive human activities. The subproject site will be built in an existing industrial park which mainly has secondary natural and planted vegetation.

F. Soil and mineral resources

Fumian District is situated in the southeast hilly basin, it consists of various soil types like paddy soil and red loam, which are extremely suitable for subtropical crops, for example rice, sugar cane, lychee, longan, banana, pineapple, sisal, herbs, flowers and plantation growth.

The whole Yulin City area is filled with high grade non-metallic mineral resources that are easy to exploit. More than 10 kinds of minerals have already been found and around 20 minerals deposits, 4 of which are large-scale, while 5 of which are medium sized. The main minerals found include Fluorite, Aluminum, Phosphorus, Monazite, Limestone, Granite, Mineral water etc. The most abundant minerals currently found are Iron, Limestone, Fluorite, and Titanium.

G. Socioeconomic condition

The location of the subproject site, Fumian District, located in southern Guangxi was established in 1997 by Yulin City. By the end of 2013, Fumian District had a population of 424,000 people, with a population growth of 7.29% per year.

In 2013, Fumian District had a GDP of 548,000,000 yuan, 198,000,000 yuan came from the primary industry, 215,000,000 yuan came from the secondary industry, and 135,000,000 yuan from the tertiary industry. The district had a total fixed asset investment of around RMB 7 billion and a total value of export as USD 5.8 million.

Fumian District is an important agricultural development project area for the PRC, especially for Yulin City, the district is rich in agricultural products such as black melons, star anise, cinnamon, lychee, longan and other agricultural products. It has also been able to produce high quality grains, eggs, pork and other hazard free vegetables. In 2013, a new area of cultivated land was used to increase and improve and agricultural activities, which provided 338,000,000 yuan annual output of agriculture, forestry, animal husbandry and fishery activities, a growth of 3.5%. Other than agricultural development, Fumian District has participated in garment, feather, leather production, veterinary medicine and other enterprises.

The subproject site has a key advantage when it comes to transportation, it is within reasonable distance from downtown Yulin City, which makes transportation to nearby cities like Naning, Beihai, Qinzhou, FangChengGang, Guigang, Wuzhou, Liuzhou, Zhanjiang, Maoming and other city centers very efficient. Yulin City also has railway for larger cities like Beijing, Shanghai, Gangzhou, Hangzhou, and Kunming.

There is no physical or cultural heritage, structures or sites that are of historical, archaeological, paleontological or architectural significance exists within the subproject area.

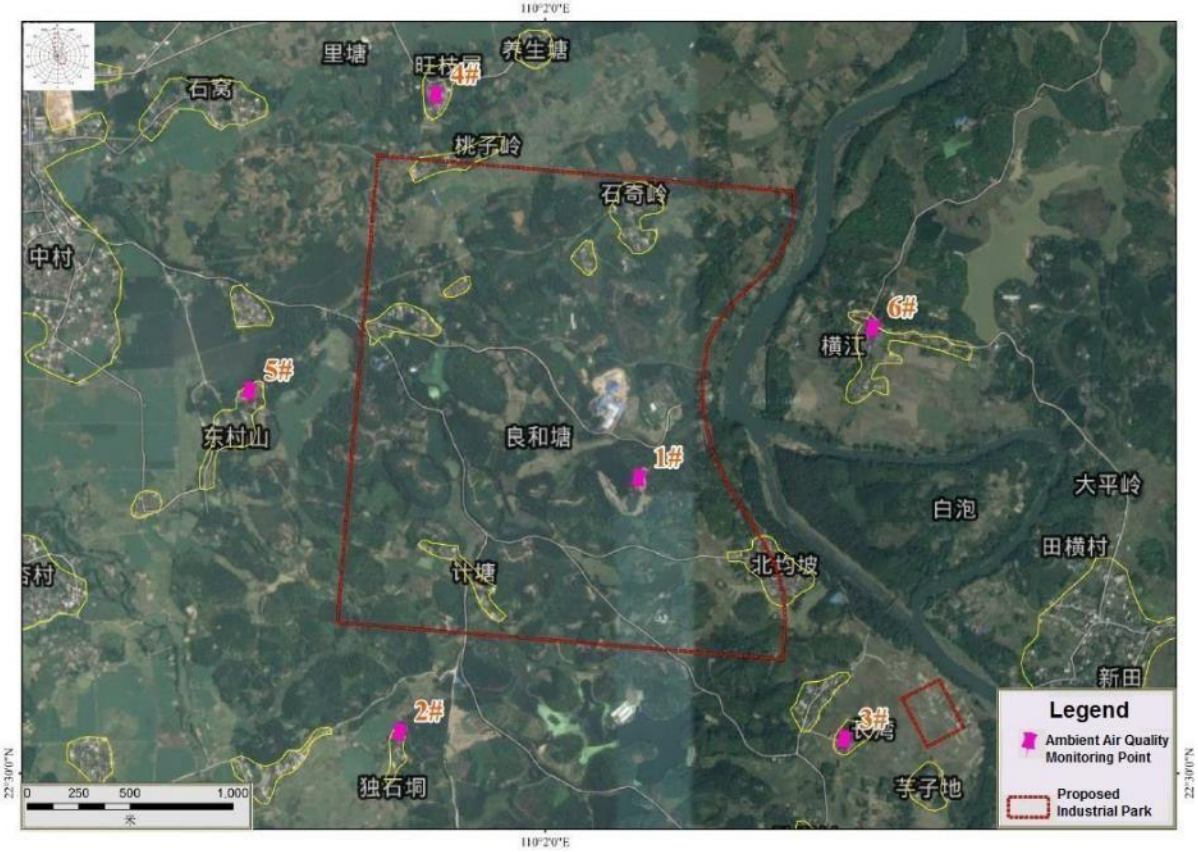
H. Environmental Quality Baseline

The section describes the baseline ambient air quality, surface water quality, groundwater quality and noise assessment for the subproject area. The samplings were conducted by Guangxi Hai Qin Tian Cheng Technical Testing Services Co., Ltd.

1. Ambient Air Quality

Ambient air quality sampling was conducted at six locations. Six parameters, including PM10, TSP, SO2, and NO2 were sampled in Lianghe Pond (1#, 良和塘), Dushi Dong (2#, 独石垌), Chang Bay (3#, 长湾), Wangzhiwu (4#, 旺枝屋), Dongshancun (5#, 东山村), and Hengjiang (6#, 横江) at the subproject site for 7 consecutive days from 10th to 16th October 2015.

Figure III-2: Ambient air quality sampling sites



Source: Industrial Park EIA report

Table III-1: Ambient air quality sampling at 6 sampling sites (Unit: μg/m³)

Parameter	Sampling site	24 hour average concentration							Standard
		10/10	11/10	12/10	13/10	14/10	15/10	16/10	
NO_2	1#	8	9	7	9	7	8	10	80
	2#	10	10	9	8	9	6	8	
	3#	10	12	8	9	7	9	7	
	4#	10	11	6	10	9	10	11	
	5#	12	10	11	9	9	10	11	
	6#	10	8	10	9	10	11	10	
SO_2	1#	9	8	8	9	8	9	7	150
	2#	10	9	9	11	10	11	10	
	3#	12	11	11	11	9	13	10	
	4#	9	7	9	8	8	10	8	
	5#	12	9	12	10	9	10	10	
	6#	11	10	9	8	9	10	11	
TSP	1#	48	58	50	57	43	47	62	300
	2#	65	58	63	49	63	54	52	
	3#	49	51	45	56	60	49	53	
	4#	63	56	51	67	54	48	59	
	5#	78	59	67	73	63	79	49	
	6#	83	59	78	66	81	67	75	
PM_{10}	1#	43	52	45	48	38	41	56	150
	2#	58	51	57	45	55	49	47	
	3#	43	45	39	48	53	41	47	
	4#	59	49	47	55	49	44	50	
	5#	70	53	59	65	57	71	44	
	6#	74	51	71	58	71	60	67	

Parameter	Sampling site	One-time concentration			Standard
		10-11/10	11-12/10	12-13/10	

H_2S	1#	2	2	3	10
	2#	2	2	2	
	3#	2	2	2	
	4#	2	2	2	
	5#	3	3	3	
	6#	3	3	2	
NH_3	1#	30	30	30	200
	2#	30	30	20	
	3#	20	20	20	
	4#	17	20	20	
	5#	38	30	40	
	6#	43	40	40	

Source: EIA report

Table III-1 shows that SO_2, NO_2, PM_{10} and TSP satisfy Class II standards of Ambient Air Quality Standards (GB3095-2012). NH_3 and H_2S are able to meet one-time maximum allowable concentration of the Hygienic Standards for the Design of Industrial Enterprises (TJ36-79).

All baseline sampled parameters are within their respective standards.

2. Surface Water Quality

Monitoring was conducted at six locations near the subproject areas as shown in Table III-2 below.

Table III-2: Locations of Surface Water Quality Monitoring Stations

Ref.	Locations	Applicable Surface Water Quality Standard
1#	Hengjiang Hydrological Station	Class IV of the Environmental quality standards for surface water (GB3838-2002)
2#	Discharge point	
3#	300m downstream of the discharge point	
4#	1500m downstream of the discharge point	
5#	3300m downstream of the discharge point	
6#	Chengxiang Pumping Station, Bobai County	Class III of the Environmental quality standards for surface water (GB3838-2002)

Source: Industrial Park EIA report

The sampling was conducted once per day for three consecutive days from 10th to 12th Oct 2015. Three monitoring points were sampled for each sampling site. 22 water quality parameters were sampled and the results are shown in Table III-3.

Table III-3: Surface water quality sampling at 6 sampling sites (Unit: mg/L except for pH and temperature, ug/L for heavy metals)

10 Oct 2015

Parameter	1#			2#			3#			4#			5#			6#			Class III Standard	Class IV Standard
	Left bank	main stream	right bank	Left bank	main stream	right bank	Left bank	main stream	right bank	Left bank	main stream	right bank	Left bank	main stream	right bank	Left bank	main stream	right bank		
pH	7.38	7.50	7.24	7.38	7.56	7.42	7.23	7.12	7.36	7.23	7.32	7.25	7.26	7.24	7.23	7.24	7.23	7.25	6-9	6-9
Temperature	24.6	24.8	24.2	25.2	25.3	24.6	25.3	25.1	24.9	24.7	24.5	24.6	24.5	24.7	24.6	24.5	24.5	24.6	-	-
DO	6.12	6.31	6.52	6.36	6.24	5.95	6.32	6.53	6.41	6.53	6.62	6.62	6.81	6.72	6.63	7.01	7.20	7.12	≥5	≥3
SS	20	22	18	19	22	21	23	22	24	17	19	19	20	21	18	17	16	15	≤30	≤60
COD_{Mn}	4.7	4.8	4.7	5.1	5.0	5.1	5.1	5.0	4.9	4.8	4.8	4.8	4.8	4.8	4.8	4.1	4.5	5.2	≤6	≤10
COD_{Cr}	13.7	13.9	12.8	12.5	12.6	12.8	14.2	13.9	12.6	15.1	15.1	15.1	18.8	19.1	17.9	14.3	15.2	15.6	≤20	≤30
BOD_5	3.3	3.4	3.6	3.2	2.9	3.3	3.6	3.5	3.6	3.2	3.1	2.9	4.1	3.8	3.6	2.8	2.5	2.3	≤4	≤6
Petroleum Hydrocarbons	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	≤0.05	≤0.5
NH_3-N	0.687	0.654	0.685	0.589	0.596	0.523	0.652	0.598	0.632	0.667	0.671	0.680	0.785	0.801	0.795	0.254	0.259	0.254	≤1.0	≤1.5
Fluoride	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.06	≤1.0	≤1.5
TP	0.06	0.04	0.04	0.05	0.05	0.06	0.04	0.05	0.05	0.05	0.04	0.04	0.03	0.05	0.03	0.03	0.04	0.03	≤0.2	≤0.3
LAS	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	≤0.2	≤0.3
Volatile phenol	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	≤0.005	≤0.01
Sulfide	0.026	0.024	0.028	0.028	0.026	0.023	0.032	0.036	0.035	0.022	0.020	0.021	0.023	0.024	0.022	0.020	0.020	0.020	≤0.2	≤0.5
Cyanide	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	≤0.2	≤0.2
Chromium-6	0.008	0.006	0.007	0.005	0.004	0.005	0.004	0.003	0.003	0.004	0.005	0.005	0.003	0.004	0.005	0.003	0.003	0.003	≤0.05	≤0.05
Aniline Compunds	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	-	-
Arsenic	2.0	1.9	1.6	2.0	1.9	1.6	2.0	1.9	1.6	1.8	2.0	1.9	1.8	1.5	1.8	1.2	1.1	1.0	≤5.0	≤10
Mercury	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	≤0.1	≤1.0
Lead	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	≤50	≤50
Cadmium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	≤5.0	≤5.0
Copper	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	≤1000	≤1000

Source: EIA report

Based on the results shown in Table III-3, water quality of 1# - 5# meets Class III standard of Environmental Quality Standards for Surface Water (GB3838-2002). 6# is also able to meet Class IV standard of Environmental Quality Standards for Surface Water (GB3838-2002).

Figure III-3: Surface water quality sampling sites

3. Groundwater Quality

Five sites near or in the subproject area were selected for groundwater quality. 13 water quality parameters were monitored. Parameters were sampled once on 10 October and 2 December 2015.

Table III-4: Groundwater Quality in 5 sampling sites near the subproject area on 10 October 2015.
(Unit: mg/L, except for Coliform: CFU/L and pH)

Parameter	Sampling site					Standard
	1# Shiqi Range	2# Beijunpo	3# Building Materials Factory	4# Ji Pond	5# Dongcunshan	
pH	7.34	7.4	7.31	7.34	7.39	6.5-8.5
Ammonia nitrogen	0.056	0.025	0.112	0.025	0.082	≤0.2
COD_{Mn}	0.5	0.6	0.6	0.5	0.6	≤3.0
Total Hardness	84.3	93.2	59.6	52.1	100.0	≤450
Fluoride	0.06	0.05	0.07	0.09	0.08	≤1.0
Sulfate	15	5	20	10	18	≤250
Volatile phenol	0.0003	0.0003	0.0003	0.0003	0.0003	≤0.002
Coliform	20	20	50	30	40	≤3.0
Chromium-6	0.004	0.004	0.004	0.004	0.004	≤0.05
Lead	0.001	0.001	0.001	0.001	0.001	≤0.05
Copper	0.001	0.001	0.001	0.001	0.001	≤1.0
Arsenic	0.0002	0.0004	0.0002	0.0003	0.0003	≤0.05

Source: EIA report

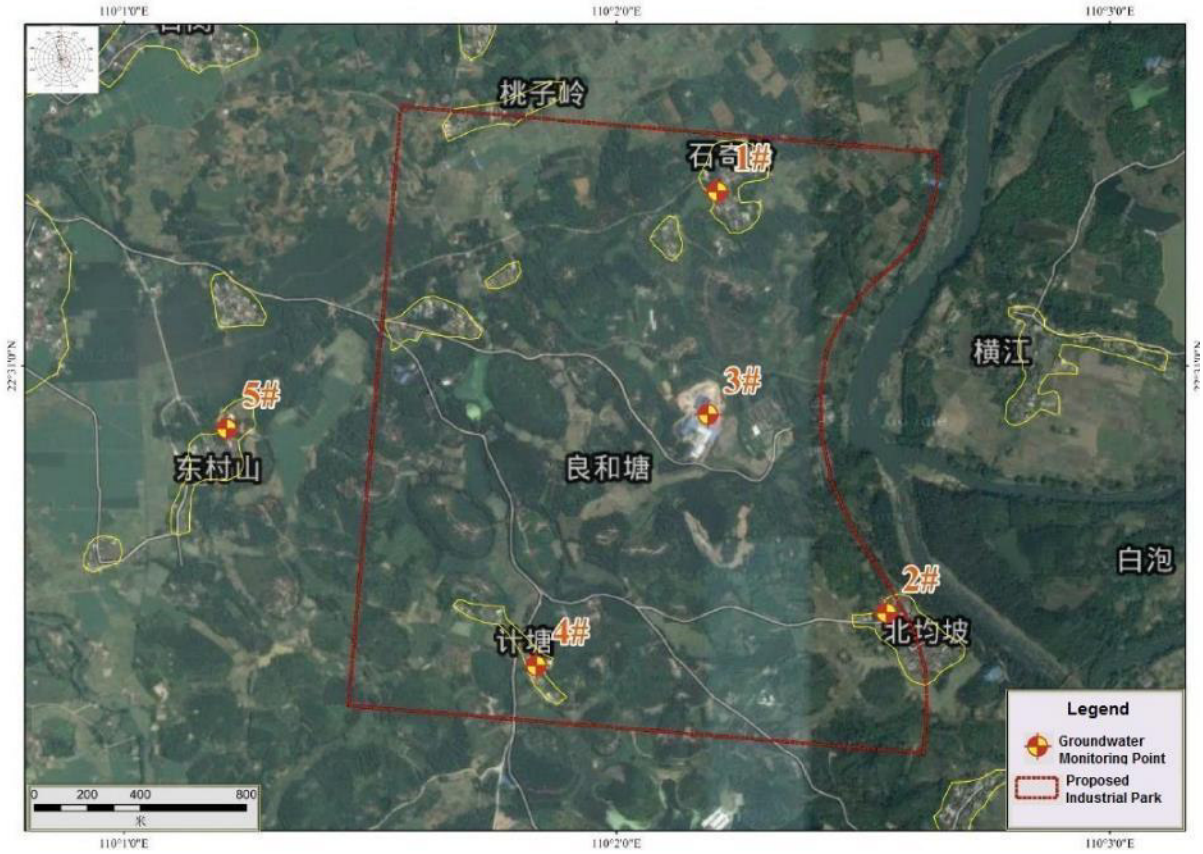
Table III-5: Groundwater Quality in 5 sampling sites near the subproject area on 2 December 2015.
(Unit: mg/L, except for Coliform: CFU/L and pH)

Parameter	Sampling site					Standard
	1# Shiqi Range	2# Beijunpo	3# Building Materials Factory	4# Ji Pond	5# Dongcunshan	
pH	7.30	7.36	7.33	7.28	7.37	6.5-8.5
Ammonia nitrogen	0.065	0.030	0.162	0.025	0.135	≤0.2
COD_{Mn}	0.6	0.7	0.9	0.5	0.7	≤3.0
Total Hardness	95.4	148.0	68.4	58.7	103.0	≤450
Fluoride	0.09	0.11	0.15	0.12	0.10	≤1.0
Sulfate	30	20	40	25	28	≤250
Volatile phenol	0.0003	0.0003	0.0003	0.0003	0.0003	≤0.002
Coliform	50	40	80	40	60	≤3.0
Chromium-6	0.004	0.004	0.004	0.004	0.004	≤0.05
Lead	0.001	0.001	0.001	0.001	0.001	≤0.05
Copper	0.001	0.001	0.001	0.001	0.001	≤1.0
Arsenic	0.0002	0.0005	0.0002	0.0004	0.0003	≤0.05
Mercury	0.00001	0.00001	0.00001	0.00001	0.00001	≤0.001

Source: EIA report

The results indicate that all parameters apart from coliform meet Class III standard of Quality standard for groundwater (GB/T14848-93).

Figure III-4: Groundwater quality sampling sites



Source: Industrial Park EIA report

4. Noise

Noise monitoring was conducted on 11-12 October 2015. A total of 5 monitoring points were set up at the boundaries of the subproject area. Monitoring was conducted twice a day, once in the 09:00-18:00 at daytime and once in 23:00-06:00 at night. There was no rain or thunder during measurement. The wind speed was less than 5 m/s during measurement.

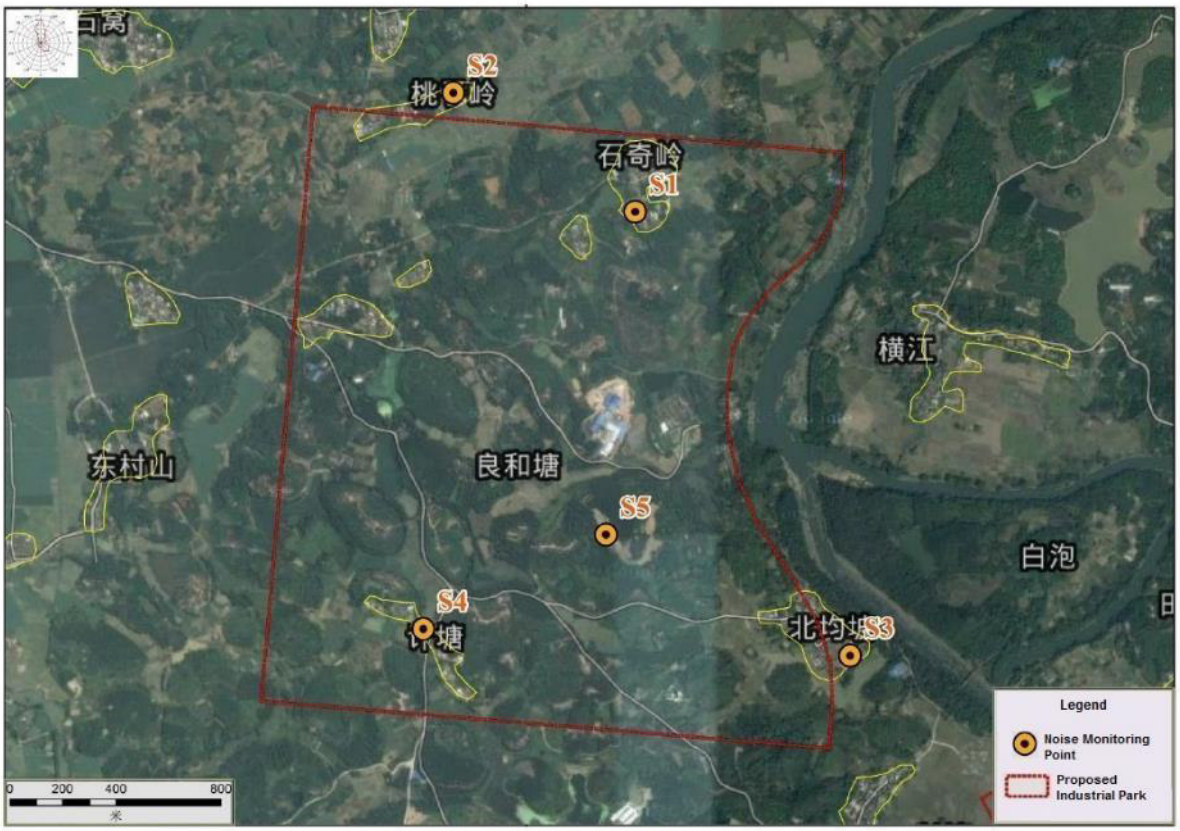
According to the Environmental Quality Standard for Noise (GB3096-2008), the subproject area is classified as Class I. The monitoring results in Table III-6 below show that noise level at all monitoring locations meet the Class I.

Table III-6: Noise level at boundaries of the Subproject (Unit: dB(A))

No.	Monitoring Location	Monitoring date (2015)	Day		Night	
			Result	Standard	Result	Standard
S1	Shiqi Range	11 October	45.2	55	36.9	45
		12 October	43.9		36.5	
S2	Taozi Range	11 October	48.5		36.5	
		12 October	46.2		37.1	
S3	Beijunpo	11 October	50.2		40.3	
		12 October	49.8		39.2	
S4	Ji Pond	11 October	47.4		37.5	
		12 October	48.3		37.8	
S5	Lianghe Pond	11 October	48.9		37.2	
		12 October	48.2		36.8	

Source: Industrial Park EIA report

Figure III-5: Noise level monitoring locations



Source: Industrial Park EIA report

IV. Anticipated Environmental Impacts and Mitigation Measures

A. Assessment of Potential Impacts

Currently the garment washing companies are scattered throughout the Fumian district. Many garment washing companies have installed a simple wastewater treatment plant onsite to treat their own wastewater before discharging to the surrounding water bodies, but it is also found that some companies even discharge their effluent directly into natural water bodies, causing degradation of surface water and ground water quality. Once the wastewater treatment plant is built in the area, all garment washing companies will discharge their effluent directly to the wastewater treatment plant for further treatment, which can reduce their environmental pressure due to the more stringent effluent limitations as required by Discharge Standards of Water Pollutants for Dyeing and Finishing of Textile Industry (GB4287-2012) and will be treated to Class 1A standards of the Discharge Standards of Pollutants for Municipal Wastewater treatment Plant (GB18918-2002). The wastewater treatment plant not only serves to protect the environment, but also helps the government authorities to monitor the quality of wastewater discharge more effectively. The proposed water reuse system will also help conserve water resources as 30,000m^3/d of the treated wastewater can be reused for industrial use.

As this subproject will provide centralised water supply facilities, wastewater treatment plant, and water reuse system, it will significantly improve the infrastructure and the operating environment for the whole proposed industrial park. It is expected that the subproject can help attract more industrial enterprises to station in the industrial park and thus serve an important role to boost the local economy.

In conclusion, it is anticipated that the subproject: wastewater treatment plant, domestic and industrial water supply system, and water reuse system will contribute to the environmental protection, water conservation and support the sustainable development of the Fumian District and Yulin City.

B. Environmental Impacts and Mitigation Measures during Construction

The environmental impacts are assessed and predicted based on information from a qualified professional third party. Mitigation measures are identified accordingly. These mitigation measures will be included in the Contractual requirements. Only contractors that have these technical capacity, proven track record, and on-going stable performance will be engaged throughout the construction phase.

1. Impacts on ambient air quality

Anticipated sources of air pollution during construction phase include: i) dust generated from construction activities such as excavation and backfilling works; ii) dust generated from loading, unloading, transport, piling of construction materials such as cement and gravel, iii) dust generated by the vehicles movement and operation of construction machineries; iv) emissions of pollutants such as sulfur dioxide, nitrogen oxides and particular matter from diesel-powered construction vehicles and construction machineries; and v) cooking fumes from canteen.

The information about the closest sensitive receivers are listed in the table below.

Table IV-1: Key air sensitive receivers near the subproject area

Name	Direction	Nearest Distance from the Project (m)	Type	Scale
Dongshancun	West	430	Village	572 residents from 138 households
Dushi Dong	Southwest	160	Village	157 residents from 25 households
Wangzhiwu	North	205	Village	100 residents from 30 households
Hengjiang	East	460	Village	200 residents from 30 households
Lianghe Pond	Industrial park	/	Village	245 residents from 60 households
Chang Bay	Southeast	160	Village	250 residents from 40 households

Emission from Canteen cooking fume is anticipated at NO_2: 0.282kg/d, SO_2: 0.046kg/d, and Dust: 0.022kg/d. With installation of a fume purification system of 6000m3/h that will operate for 5 hours per day, middle-scale emission standard as stated in Emission Standard of Cooking Fume (GB18483-2001) can be met. .

Table IV-2 Emission Standard of Cooking Fume

Scale	Small	Middle	Large
Maximum Allowable Emission Concentration (mg/m^3)	2.0		
Minimum removal efficiency of purification facilities	60	75	85

The impacts mentioned above are expected to be only short-term, intermittent and localized. To minimise the impact on air quality, the following mitigation measures should be implemented:

- Spray water on construction site to reduce dust;
- Dust fence should be installed around the construction site;
- Cover construction materials if they are temporarily stacked outdoor;
- No construction activities during strong windy days;
- Excess construction materials and construction waste should be removed from sites regularly;
- Vehicle transporting construction materials and soil should be installed with anti-spill devices. Loading should be carried out carefully to ensure that there will be no spilling during transportation;
- Routing and schedule of construction vehicles should be carefully planned without passing through sensitive zones such as residential areas;
- The speed of the vehicles within the construction site should be controlled;
- All construction vehicles should be covered with tarpaulin. Vehicle cleaning facilities will be provided. All vehicles will be cleaned properly before they enter or leave the construction sites to prevent soil, mud and other dirt being deposited on access roads;
- Spills of soil, mud or other materials on the road should be cleared;
- Use of environmentally-friendly decoration materials. Maintain good ventilation in places where painting and other activities that could release volatile organic compounds (VOC) or toxic gas are undertaken;
- Burning of construction and demolition waste as fuel is not allowed; and
- Plant trees or bushes once the construction work is finished

With the above mitigation measures, no significant impacts on ambient air quality are anticipated to occur during construction stage.

2. Impacts on surface water quality

Wastewater generated during the construction phase includes muddy water from excavation work, cooling water from construction machinery, water effluent from construction process and cleansing. All these wastewaters contain certain grease and sediments with high concentration of SS (5000 mg/L) and petroleum as well as high alkalinity (pH: 11-12). In addition, domestic wastewater, which has a certain content of organic matter, bacteria and pathogenic microorganisms, will also be generated from workers' activities. The average number of active workers onsite during construction phase is estimated to be around 100. According to the Industrial Park EIA report, the average daily water consumption per worker is 0.06m^3 and the average daily wastewater volume would be about 85% of the water consumption. As the proposed construction phase is expected to be completed in 10 months, assuming 25 working days per month, the predicted total quantity of wastewater generated would be around 1,275m^3. Projections of total wastewater discharge and concentrations of effluent quality parameters are presented in Table IV-1.

Table IV-3: Pollutants in Domestic Wastewater Generated during the Construction Phase

Parameter	Discharge Concentration (mg/L)	Quantity Generated	
		Daily	Within the 10-month construction stage
Domestic wastewater (100 workers)	-	5.1 m^3	1,275 m^3
CODcr	300	2.70 kg	0.68 t
BOD_5	150	1.35 kg	0.34 t
SS	200	1.80 kg	0.45 t
Ammonia Nitrogen	30	0.27 kg	0.07 t

Source: EIA report

Septic/Sedimentation tank will also be installed onsite to collect and treat the domestic wastewater. The treated wastewater will be reused for dust suppression and watering. It is expected that the impacts on surface water quality would be minimal provided that the recommended mitigation measures are properly implemented.

3. Impacts on ground water quality

During the construction stage, groundwater would be pumped out for the lowering of groundwater level in foundation construction. According to the EIA report, the Groundwater table was found at a depth of approximately 0.2-0.7m below the surface at the subproject area. Since most of the building structures of the subproject are above the ground with only a few are semi-buried structures, it is anticipated that the impact on groundwater during foundation construction would not be significant. The following preventive and mitigation measures will also be implemented to protect groundwater quality.

- Install temporary diversion ditches and drains. Surface runoff will be diverted to sedimentation tank for removal of SS and then reused for dust suppression; and
- During the construction stage, wastewater and solid waste will be treated on-time, temporary storage site should also be covered accordingly to reduce the impacts on ground water quality due to surface runoff.

4. Noise pollution

Construction activities that contribute to noise impact include 1) operation of construction machineries and equipment such as pile driver, excavators, cranes, vibrators, concrete mixers, and generators etc, and 2) transportation. The noise impacts will be sudden and localized.

Predicted noise impacts from construction machinery at different distance are calculated based on the Technical Guidelines for Noise Impact Assessment (HJ2.4-2009). Considering various assessment parameters including frequency, historical weather and climate data of Yulin city such as annual average temperature (22℃) and relative humidity (78%), the predicted noise levels of different construction machineries at distances are shown in Table IV-4 below.

Table IV-4: Predicted Noise Levels of Construction Machinery at different distances (Unit: dB(A))

Noise Source	Predicted noise levels at distance (m) from source										
	5m	10m	20m	30m	40m	50m	100m	150m	200m	300n	400n
Excavator	84	78	72	68	66	64	57	54	51	47	44
Pipelayer	88	82	76	72	70	68	61	58	55	51	48
Vibrator	95	89	83	79	77	75	68	65	62	58	55
Loader	90	84	78	74	72	70	63	60	57	53	50
Bulldozer	90	84	78	74	72	70	63	60	57	53	50
Pile driver	100	94	88	84	82	78	73	70	67	63	59
Truck	89	83	77	73	71	69	62	59	56	52	49
Mobile crane	86	80	74	70	68	66	59	56	53	49	46
Air compressor	93	87	81	77	75	73	66	63	60	56	53
Cutting machine	95	89	83	79	77	75	68	65	62	58	55
Welding machine	95	86	80	76	74	72	65	62	59	55	52

Source: EIA report

Assuming there will be five different types of machine operating simultaneously, the overall sound pressure level from combined sources at different distances is also estimated (Table IV-5).

Table IV-5: Overall Sound Pressure Level at different distances

Distance	5m	10m	20m	40m	50m	100m	150m	200m	300m	400m
Overall Sound Pressure Level dB(A)	97.9	91.9	85.8	79.7	77.7	71.3	67.5	64.7	60.6	57.5

Source: EIA report

According to the cumulative construction noise prediction results presented in Table IV-3, construction activities within approximately 100m of the site boundaries during the daytime, and 400m during the nighttime, could fail to comply with the Emission Standard of Environmental Noise for Boundary of Construction Site (GB12523-2011) which specifies the noise level limit at construction site boundaries as 70dB(A) during the daytime and 55db(A) during the nighttime.

According to the Industrial Park EIA report, there are few villages located within 200m from the proposed industrial park construction site. The nearest noise sensitive receivers are Diaoma village in Dushidong and Shengli village in Changwan, which is 160m away from the subproject area with a total of approximately 400 residents. Therefore, noise impact on nearby noise sensitive receivers to a certain extent is anticipated during the construction stage.

To ensure that the construction activities would be in compliance with the requirements of the Emission Standard of Environmental Noise for Boundary of Construction Site (GB12523-2011), and to protect on-site workers who will be exposed to noisy work environment, the following measures should be implemented accordingly:

- Install noise barriers along the construction site boundary and movable noise barriers to block construction noise from heavy machinery;
- Adopt advanced construction method, for example using hydraulic pile driver instead of diesel hammer pile driver, to minimise noise impacts;
- Develop proper construction schedule, minimise each construction equipment's time of operation as practical as possible;
- Low noise equipment will be chosen as practical as possible;
- Noisy construction activities will be avoided during lunch break and the night time as practical as possible. No pile driving will be allowed during the nighttime;
- Minimise the number of construction machines running in the same place and at the same time as practical as possible; and
- PPE for hearing protection such as earplugs/earmuffs, noise-cancelling headphones will be provided to workers who will work around heavy machinery.

5. Solid Waste

Major solid waste generated during the construction stage includes construction waste such as excess excavated earth/soil, debris, gravel, sand, scrap metal, glass, scrap plastic, broken brick, cement bags, and municipal solid waste from workers activities. Based on a waste generation rate of 0.5 kg per worker per day, 10-month construction period, 25 working days per month, and 100 workers during the construction stage, it is estimated that a total of 12.5 tonnes of municipals solid waste will be generated. Improper waste management and disposal could cause odour, health and sanitation problems, visual impact, and threaten the surrounding environment including soil, surface water and groundwater resources.

The following mitigation measures to minimise impacts from waste generation during the construction stage should be implemented:

- Excavated earth/soil will be backfilled and debris, gravel, broken brick will also be reused to the extent possible;
- Municipal solid waste will be properly segregated. Construction solid waste such as reinforced steel should be reused to the extent possible;
- Construction waste, including hazardous construction waste, will be disposed of at the designated areas only. According to Clause 8 of the Measures of Urban Construction Waste Management in Yulin City, the subproject is required to apply for "construction waste disposal permit" before disposal of construction waste.
- Sufficient garbage collection bins and dumpsters will be installed at the construction site. Domestic waste will be collected on a regular basis by the local sanitation departments and delivered to a licensed landfill for disposal;
- Granular materials and waste will be properly sealed, wrapped, secured and covered on transport vehicles, which will follow a specified route only; and
- Contractor will be required to remove all temporary facilities, construction waste and muck accordingly once the construction phase is complete.

6. Soil Erosion

Construction works such as excavation and backfilling will have the potential to remove or disturb existing vegetation and soil characteristics, which could result in severe soil erosion. To prevent this from happening, the following mitigation measures will be implemented:

- Avoid carrying out construction activities such as excavation during rainy season and windy period;
- Excavation and backfilling will be balanced to the extent possible so as to minimise the need for fill transportation;
- When excavation is conducted, remove and store topsoil at a designated area for future use in landscaping; and
- Once excavation, backfilling, or the construction stage is complete, exposed soil and disturbed surfaces will be properly re-vegetated as quickly as possible.

7. Impacts on physical cultural resources

According to the EIA report and observations during site visit, there are no historical and archaeological sites within or near the subproject area. However, if unknown archaeological resources and cultural relics are discovered during construction, all construction activities will be suspended to keep the scene intact and the relevant personnel will report to the local

administrative department in charge of cultural relics in accordance with the requirements of Law of the PRC on Protection of Cultural Relics. The construction activities will be only resumed if the investigation is complete and formal permission is obtained from the local administrative department in charge of cultural relics.

8. Occupational Health and Safety

Construction activities could cause harm and danger to the workers. Potential hazards for workers in construction include falls from heights, machinery accidents, vehicle accidents, falling materials or objects, slips, trips and falls, electrocute, failures to use PPE, repetitive motion injuries, heat strokes, and fires and explosions, Contractors will be required to implement adequate precautions to protect the health and safety of their construction workers. The following measures will be implemented by CTEG and the contractors:

- Garbage collection bins will be cleared by local government's sanitation department daily to prevent outbreak of diseases;
- Provide adequate sanitation facilities such as latrines;
- Sufficient safety signage and warnings will be provided around the site;
- Ensure material stockpiles or stacks are stable to avoid collapse and possible injuries to construction workers;
- All workers are required to wear PPE like helmet, safety gloves, safety shoes, and ear mufflers at all times when they are in the construction area. The condition of the PPE will be checked on a regularly basis;
- Provide medical insurance coverage and pre-employment physical examination for all workers;
- Ensure first aid kits are always accessible to the construction workers;
- Clean and adequate supplies of drinking water will be guaranteed;
- A record management system will be implemented to maintain records of health and safety performance during construction phase. It will include documentation and reports of occupational diseases and incidents. The records will be reviewed during compliance monitoring and auditing;
- Avoid scheduling labour intensive and outdoor works for a time when the temperature is extremely high and the weather is in bad condition; and
- Provide adequate training to workers on occupational health and safety, HIV/AIDS and other communicable disease awareness and prevention, proper use of PPE, and emergency response.

9. Impacts on Biodiversity

The subproject area were mainly farmland, fish ponds, and woodlands. The impacts on biodiversity from the project include inevitably soil erosion, vegetation loss, change of the condition of the habitat (including land and aquatics). However, with existing human activities, the biomass in the area is low. Common species are found in the area.

The sources of impacts on biodiversity are namely change in land use (both temporarily and permanently), on-site produced construction wastewater, air pollutants from construction machineries, dust, as well as the construction activities itself which include noise and lights. All of these will lead to reduction in vegetation cover, flora, fauna, and biodiversity as a result.

However, the impact is expected to be localized and temporary, and will not create long term significant impact on the structure of ecological system, or on the agro-, especially with mitigation measures.

During construction, trees and vegetation are preserved where possible. Greenery will be planted to beautify the subproject area and provide habitat to flora and fauna.

The following mitigation measures can be implemented to minimize the impacts on biodiversity. The measures mainly focus on planning of greening of the area.

- Conservation of top soil by storing the topsoil separately before excavation and utilize it for greening purpose;
- Timely implementation of greening and paving of roads after cut and fill to prevent further soil erosion due to explosion.
- Enhancement of greening effort using multi-layer greening of trees, shrubs, and grass for compensating the loss of habitat, increase biodiversity, biomass, and attract fauna especially birds;

Refer to section 6 of this chapter for measures to avoid soil erosion in order to reduce impacts on vegetation cover.

10. Impacts on socio-economic resources

The subproject will create job opportunities to nearby communities, causing lower unemployment rate of the areas and higher average income of the local residents. During the construction phase, around 100 workers will be employed.

11. Impacts on Community Health and Safety and Risks to Public Utilities

The subproject's construction works could cause undesirable disturbance and temporary inconvenience to traffic, villagers, industrial enterprises, and institutions. The increase in construction traffic and use of heavy machinery on existing roads can lead to traffic congestion and road accidents, particularly in urban areas. Meanwhile, construction of the subproject could accidentally damage above-ground or underground public utilities assets such as pipelines for the supply of water, gas, heating as well as drains, power cables and communication cables.

- A traffic control and operation plan will be prepared by the contractor and discussed with the relevant local traffic management authority before construction. The plan will include provisions for diverting or scheduling construction traffic to avoid sensitive areas and peak traffic hours, controlling traffic at road crossings with an emphasis on public safety through clear signs, selecting transport routes to reduce disturbance to regular traffic, including alternative routes strategy for emergency traffic management, reinstating roads, and opening them to traffic as soon as the construction is completed;
- An assessment of underground facilities will be conducted before pipeline construction where appropriate.
- Villagers, residents, institutions and other affected parties will be informed in advance schedule and duration of construction works, and expected traffic and other disruptions;
- Warning signs will be placed along roads to indicate potential dangers such as moving vehicles, open-cut trenches and excavations. Safety flags will be used if appropriate;
- Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential areas, schools and hospitals.
- Construction warning lights will be used at night;
- Roadside earthworks should be completed and spoil should be backfilled or removed as quickly as possible; and
- Fencing shall be used to prevent unauthorised people accessing the construction sites

C. Environmental Impacts and Mitigation Measures during Operations

1. Impacts on ambient air quality

Anticipated sources of air pollution include emission and odour from sewage, and odour from anaerobic sewage treatment processes.

The major pollutants of odour from sewage and wastewater treatment processes are NH3 and H2S. Emission of these two pollutants form the project does not exceed regulatory requirements under normal operation. Health protection zone that meets the atmospheric environment protection distance requirements will be set up at appropriate distance in accordance with Guidelines for Environmental Impact Assessment Atmospheric Environment (HJ2.2-2008) and Standard for Pollution Control on the Storage and Disposal Site for General Industrial Solid Waste (GB18599-2001). Biofilter deodourization is also adopted to meet the maximum allowable concentration of NH_3 and H2S according to Emission Standards for Odour Pollutants (GB14554-93).

The emission sources are classified as point sources and non-point sources. Table IV-3 shows the emissions from the wastewater treatment plant. The impacts from short term and long term phases are shown in Table IV-4 and Table IV-5.

The concentration was modelled according to Guidelines for Environmental Impact Assessment Atmospheric Environment (HJ2.2-2008). The modelling methodology adopted was AERMOD 3.0 with the meteorological input using AERMET 6.4 based on the meteorological data of 2014 from Yulin Meteorological Station. Data used included wind direction, wind speed, dry bulb temperature, low cloud amount etc.

Table IV-6 Emissions from the wastewater treatment plant

Phase	Source	NH3			H2S		
		Emission Amount (t/a)	Emission concentration (g/s)	Emission Standard (mg/m³)	Emission Amount (t/a)	Emission concentration (g/s)	Emission Standard (mg/m³)
Point Source				0.2			0.01

Short term (till 2020)	Height of chimney: 20m Inner diameter: 0.5m Outlet gas temperature: 30℃ Outlet flow rate:3.54m/s	**1.57**	**0.083**		**0.02**	**0.0011**	
Long term (2020-2030)		1.12	**0.059**		0.01	**0.0005**	
Non-point Source							
Short term (till 2020)	Area: 10.89ha Height of emission: 4m	**2.75**	**0.096**		**0.03**	**0.0011**	
Long term (2020-2030)		1.96	**0.069**		0.02	**0.0007**	

Table IV-7 NH3 concentration at sensitive receivers during operation

Air Sensitive Receivers	**Maximum allowable Concentration (mg/m3)***	**Short Term**			**Long Term**		
		Project Contribution（mg/m3）	**Background（mg/m3）**	**Cumulative（mg/m3）**	**Project Contribution (mg/m3）**	**Background（mg/m3）**	**Cumulative(mg/m3）**
Dongshancun	0.2	0.02504	0.05	0.07504	0.018	0.05	0.068
Dushi Dong		0.02401	0.04	0.06401	0.01725	0.04	0.05725
Wangzhiwu		0.03694	0.03	0.06694	0.02655	0.03	0.05655
Hengjiang		0.06427	0.05	0.11427	0.04619	0.05	0.09619
Lianghe Pond		0.07866	0.04	0.11866	0.05654	0.04	0.09654
Chang Bay		0.03246	0.03	0.06246	0.02333	0.03	0.05333
Maximum Ground Concentration Point		0.15474	0.04	0.19474	0.11122	0.04	0.15122

*Hygienic Standards for the Design of Industrial Enterprises (GBZ1-2010)

Table IV-8 H2S concentration at sensitive receivers during operation

Air Sensitive Receivers	**Maximum allowable Concentration (mg/m3)***	**Short Term**			**Long Term**		
		Project Contribution（mg/m3）	**Background（mg/m3）**	**Cumulative（mg/m3）**	**Project Contribution (mg/m3）**	**Background（mg/m3）**	**Cumulative(mg/m3）**
Dongshancun	0.01	0.00029	0.004	0.00429	0.00018	0.004	0.00418
Dushi Dong		0.00028	0.004	0.00428	0.00018	0.004	0.00418
Wangzhiwu		0.00042	0.003	0.00342	0.00027	0.003	0.00327
Hengjiang		0.00074	0.004	0.00474	0.00047	0.004	0.00447
Lianghe Pond		0.0009	0.004	0.0049	0.00057	0.004	0.00457
Chang Bay		0.00037	0.003	0.00337	0.00024	0.003	0.00324
Maximum Ground Concentration Point		0.00177	0.003	0.00477	0.00113	0.003	0.00413

*Hygienic Standards for the Design of Industrial Enterprises (GBZ1-2010)

Mitigation measures for odour includes the followings.

- Sources of odour such as adjustment tank should be covered and sealed; and
- Adoption of biofilter deodourization for structures that cannot be sealed.

The combined head and power system, related facility of the project, is expected to contribute SO2 and NOx during operations Selective Non-catalytic Reduction (SNCR) technology will be applied for flue gas desulphurisation, dust collector filter bags will be also used to ensure that the concentration level of air pollutants could meet the requirements of the "Emission Standard of air pollutants for thermal power plants" (GB 13223-2011).

2. Impacts on surface water quality

Wastewater generated during the operational phase includes effluent from water treatment system and domestic sewage from workers living on-site. All industrial and domestic wastewater collected will be treated in the subproject by using a 3-stage wastewater treatment process. Treated wastewater (100000m^3/d) will be discharged to 380m downstream of Hengjiang Hydrological Station. Out of the 50000m^3/d treated wastewater for the first phase, no discharge will be for water reuse purpose. In the final phase, it is expected that 30% (30000m^3/d) will be for water reuse purpose.

Projections of pollutants concentrations of effluent quality parameters are presented in Table IV-9. The results show that the effluent will meet Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002).

Table IV-9: Projections of Wastewater Pollutants Generated during the Operational Phase

Parameter	Effluent Concentration（mg/L）		Applicable Standard	IFC EHS standards (General and Textile Manufacturing)	Discharge standards of water pollutants for dyeing and finishing textile industry
	Short term	Long Term	Class IA standard, GB18918-2002		(GB4287-2012) Indirect Emission
pH	6 - 9	6 - 9	6 - 9	6 - 9	6-9
COD_{Cr}	80	50	50	125	200
BOD_5	20	10	10	30	50
SS	50	10	10	150	100
Chroma (dilution)	50	30	30	-	80
NH3-N	10	5	5	N/A	20
Total Nitrogen	15	15	15	10	30
Total Phosphorous	0.5	0.5	0.5	2	1.5
Sulfides	Effluent quality will comply with the national standard and IFC standard		0.5	1	0.5
Aniline			1	-	1.0
Chromium (VI)			0.05	0.1	0.5
Cadmium			0.01	0.02	-
Arsenic			0.1	-	-
Lead			0.1	-	-
Nickel			0.05	0.5	-
Benzopyrene			0.00003	-	-
AOX			1	1	15
Oil and Grease			1	10	-
Pesticides			0.5	0.05-0.1	-
Chromium (Total)			0.1	0.5	-
Copper			0.5	0.5	-
Zinc			1	2	-
Phenol			0.3	0.5	-
Temperature increase (°C)			-	<3	-
Coliform bacteria (MPN/100ml)			-	400	-
Fecal Coliform (Number/L)			10^3	-	-

Source: Industrial Park EIA report

The effectiveness of the similar processes has been well proven in local and overseas experience. Discharge from this subproject is expected to meet the requirements under normal operation. No mitigation measures are required.

3. Impacts on ground water quality

According to the EIA report, wastewater from companies in the industrial park will be collected through pipes and treated by the subproject. The treated wastewater, which will meet Class IA standard of the Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002), will be discharged to the designated water bodies while the

remaining 30% (final phase only) will be diverted into the industrial water supply plant for further treatment before it can be reused as raw water by other industrial enterprises. Under normal situation, this subproject will not have impact on groundwater quality except for mishandling of sludge and in case of pipeline leakage.

Occasions which the subproject may have adverse effect on groundwater quality include leachate from pipes or structural damage of the structure and improper management of solid waste. The following mitigations and prevention measures can be implemented.

In General:
- Construction to be carried out in strict accordance with latest design and relevant regulatory requirements;
- Proper quality control at completion and final acceptance of construction of the project;
- Selection of suitable materials for pipework to avoid corrosion of pipes, in particular, iron pipes should be avoided;
- Proper implementation of day-to-day management, enhanced supervision and investigation of the project facilities during operational stage; and
- Proper solid waste management practices as recommended in Section C5 of Chapter IV;
- Proper design, construction, management, and maintenance during operational stage will prevent negative impact on groundwater quality;
- A seepage detection system will be installed in general and key areas of pollution prevention. Interception, diversion and collection measures will be engaged in preventing groundwater pollution once detected; and
- Staff from Corporate Sustainability department will be assigned for inspection of leakage.

On Sludge handling:
- The de-watered sludge will be transported to landfill sites by enclosed vehicles, which will only follow a specified schedule and route. The transportation process must comply with relevant environmental laws and regulations to prevent secondary pollution; and
- Use impermeable concrete for construction of temporary storage of sludge.

On Pipelines:
- Adoption of shut off valve in places near the pipelines to facilitate emergency repairing;
- Measure the thickness of pipeline regularly, conduct in time maintenance and replacement;
- Bi-annual inspection of pipeline safety system (E.g. closing the valve, alarm system for leakage and positioning system); and
- Conduct regular monitoring for the pipelines to locate any collapse, leakage or third party works that might damage the safety of pipelines.

4. Noise pollution

The sources of fixed noise during the operational phase are the operation of mechanical equipment including suction machine, sewage pumps, sludge pumps, and fans. The noise impacts will be localized and the noise level will be 75 - 98 dB(A).

To ensure that the operation would be in compliance with the Category II standard of Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008) which is 60dB for daytime and 50 for night. The noise mitigation measures as follows should be implemented.

- Lowering of noise level for major noises such as blower room and fan inlet of pumping room by means of noise isolation and installation of silencer;
- Plantation of landscape noise buffers within the subproject area; and
- Application of noise insulation measures by adoption of building materials with noise absorption characteristics for noise sources such as pumping room and blowers.
- Keeping a distance of 57mbetween sensitive receivers and noise from factory facilities with sound level of over 85 dB during operation when planning the industrial park

The proposed mitigation measures are expected to be effective in keeping noise impact to acceptable level according to the Category III standard of Emission Standard for Industrial Enterprises Noise at Boundary (GB12348-2008).

5. Solid Waste

Major solid waste generated during the operational stage includes municipal solid waste, screenings and sludge. Screenings comprises mainly everyday chemicals, synthetic materials, granular materials, and suspended solids.

Table IV-10: Solid and Hazardous Waste Management

Wastewater Treatment Plant					
Solid Waste	**Source**	**Description**	**Disposal Process**	**Production Volume**	**Party responsible**
Entrained solid wastes and particulates	Screening and grit chamber	Plastic, rugs, glass, Sand, and particulate matter, flocculants	Entrained solid wastes and particulates will be managed and disposed by sanitation landfill	2.88t/d（1051.20t/a）from screening 4.50t/d（1642.5t/a）from grit chamber	Environmental and hygiene department
Municipal solid waste	Building operations	Office wastes, and food leftovers/ biodegradables	MSW will be placed at site with anti-leak protection before clearing away	0.056t/d（20.44t/a）	Environmental and hygiene department
Sludge	(1) generated from the wastewater treatment process and water supply treatment plant (2) activated sludge which will be disposed after a reasonable amount of time	Dewatered sludge (hazardous)	Sludge will be delivered to the nearby combined heat and power systems for final treatment by incineration.	159.24t/d（58122.60t/a）	Environmental and hygiene department
Hazardous waste	Process reagents, flocculants, etc)	Hazardous chemicals	Will be processed through innoxious treatment by licensed hazardous waste handling agent to ensure no secondary pollution is produced.	-	Licensed contractor

The following mitigation measures to minimise impacts from waste generation during the operational stage should be implemented:

Wastewater Treatment Plant

- Timely removal of municipal solid waste produced with the use of sanitation landfill;
- Dewatering of screenings and sludge from sewage treatment processes, the wastewater removed from this process will be sent to the coagulation reaction tank for treatment;
- Timely removal of dewatered screenings and sludge;
- Removal, management and transport of sludge waste by licensed contractor;
- At least one special vehicle for sludge transportation should be stationed in the industrial park to ensure the timely removal of sludge;
- High designed storage capacity of sludge to prevent improper storage; and
- Careful planning of transport of waste with measures to prevent leakage

Combined heat and power system

- Fly ash removal system will be installed. Each boiler of the combined heat and power system will be equipped with a Pulse Jet Fabric Filter and two ash depositories. A total of two 300m^2 ash storage tanks will be built.
- Fly ash will be regularly removed by trucks. A pump will be installed under each hopper of the Pulse Jet Fabric Filter, and these pumps share a connected transporting pipe. The collected ash from the hoppers will be transported to the ash depositories by compressed air through the pipe.
- The fly ash in the depositories will be loaded into tanker and removed directly.
- Bottom ash removal system will be also installed. All bottom ash generated from the four boilers in the combined heat and power system will be transported to the two bottom ash depositories, each with a volume of 200m^3, via belt-conveyor belt and bucket elevator. The bottom ash stored in the depositories will be finally delivered by trucks to the qualified factories for further processing.

6. Occupational Health and Safety

Potential hazards for workers during operation include falls from heights, moving machinery accidents, vehicle accidents, falling materials or objects, slips, trips and falls, drowns, splashes of hazardous liquids, hazards associated with working in confined space, electrocute, exposure to hazardous chemical agents, repetitive motion injuries, heat strokes, and fires and explosions.
Operators should implement adequate precautions and preventive measures to protect the health and safety of workers. These measures include the followings.

- Carried out comprehensive health and safety risk assessment before operation to provide sufficient safety instruction for all circumstances, work processes, occasions, workplace, and staff of all duties;
- Provide sufficient safety signage and warnings;
- Ensure chemical agents are stored properly and fixed in a position that is free from the risk of falling during transportation;
- Ban unsupervised mixing of chemicals by certified personnel;
- Ban smoking, drinking, and eating in the area where risk of contamination is present;
- Perform regular check for all electrical equipment;
- Provide comprehensive safety instructions concerning entry into confined spaces;
- All workers are required to wear PPE such as safety goggles, gloves, safety shoes, ear mufflers, chemical resistant clothing, respiratory protection equipment when certain tasks are being performed;
- Provide medical insurance coverage and pre-employment physical examination for all workers;
- Ensure first aid kits are always accessible;
- Guarantee clean and adequate supplies of drinking water;
- Avoid scheduling labour intensive and outdoor works for a time when the temperature is extremely high or when the weather is in bad condition; and
- Provide adequate training to workers on occupational health and safety, proper use of PPE, and emergency response.

V. Information Disclosure, Consultation, and Participation

A. Legislative Framework for Public Consultation and Information Disclosure

Relevant provisions of the PRC Environmental Impact Assessment Law (2003) and the Regulations on the Administration of Construction Project Environment Protection (No. 253 Order of the State Council, 1998) require that an Environmental Impact Assessment (EIA) shall solicit opinions from concerned stakeholders of the proposed project, including affected residents.

Further, the Safeguard Policy Statement (2009) from the ADB outlines the requirements for a meaningful public consultation with affected people and information disclosure.

The public consultation process for this subproject, therefore, follows both the PRC requirements and the ADB requirements.

B. Information Disclosure and Public Consultation to Date

Following the requirements from both the PRC and ADB, the public consultant of this proposed subproject will be divided into three phases, including:

1. Initial public consultation - Information of the proposed subproject will be disclosed to public for the first time within seven days after the organisation who is responsible for preparing the EIA report is confirmed;
2. Second public consultation – environment characteristics and preliminary findings of the proposed subproject, together with the comments collected during the initial public consultation stage (if any), will be disclosed to public after the completion of the draft EIA report; and
3. Public survey - Collect views of the proposed subproject from units and individuals of the sensitive areas during the second consultation

The scope of the information disclosure and public consultation includes nearby communities that maybe affected by the subproject, such as Shangquan Village, Shengli Village, Taiping Village, Shenming Village, Xinfa Village, Zhangmuzhen area, and Zhong Village.

C. Initial Public Consultation

Initial public consultation was conducted on 24 August 2016. Notices were posted on Yulin city environmental protection bureau website (http://www.yulin.gov.cn/info/415427) and in major affected locations nearby the proposed subproject site. The following information was mentioned in the notice:

- Name and summary of proposed subproject;
- Work process and major aspects of the EIA;
- The scope and major items of public consultation;
- Channels and time frame for public feedback; and
- Name and contact method of the construction unit and EIA consultant.

General public has 10 working days to express their views and comments on this proposed subproject by mail, fax or email.

Figure V-1: Public notice at affected areas during initial public consultation

Shangquan Village

Zhong Village

Zhangmuzhen Primary School

Zhangmuzhen area

Xinfa Village

Diaoma Village

Taiping Village

Shengli Village

Shangquan Village

Zhong Village

Zhangmu First Secondary School

Figure V-2: Information disclosure on Yulin City official website

No feedback or opinions on the notice were received from stakeholders during initial consultation.

D. Second Public Consultation

The second consultation was started on 23 September, 2016 on the foundation of the initial consultation and the preliminary conclusions of environmental characteristics analysis of the proposed subproject. Notices and the summary of the EIA report were posted on Yulin city environmental protection bureau website (http://www.yulin.gov.cn/info/421879) and in major affected locations nearby the proposed subproject site. The following information was mentioned in the notice:

- Summary of the progress of the proposed subproject;
- Potential environmental impacts during the construction and operation stages;
- Prevention and mitigation policies and measures of the potential environmental impacts during the construction and operation stages;
- Major conclusions of the EIA;
- Channels and time frame for public access of the summary of EIA report;
- The scope and major items of public consultation;
- Detailed format of public consultation;
- Channels and time frame for public feedback; and
- Name and contact method of the construction unit and EIA consultant.

Figure V-3: Public notice at affected areas during second public consultation

Shangquan Village

Xinfa Village

Zhangmuzhen Primary School

Zhangmuzhen area

Zhong Village

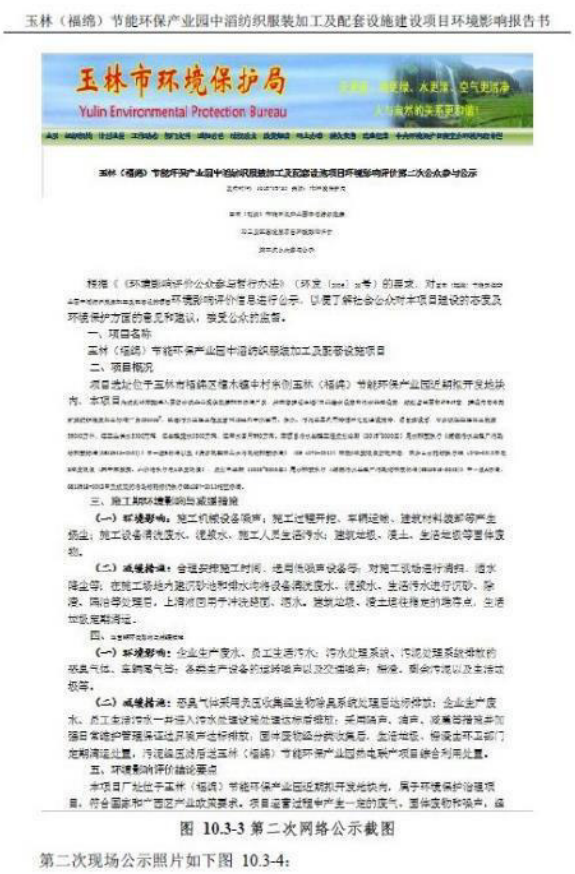
Diaoma Village

Taiping Village

Shengli Village

Xinfa Village

Figure V-4: Information disclosure on Yulin City official website


玉林（福绵）节能环保产业园中滔纺织服装加工及配套设施建设项目环境影响报告书

玉林市环境保护局
Yulin Environmental Protection Bureau

图 10.3-3 第二次网络公示截图

第二次现场公示照片如下图 10.3-4：

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E. Public Survey

During the third stage, questionnaires have been distributed to village committee, villagers and units nearby the subproject site on 24 September, 2016. The questionnaires, both individual and group versions, are used to analyse interviewers understanding on the subproject and the potential environmental impacts to the neighbourhood, as well as to obtain their feedback on the environmental prevention measures for the subproject.

Questionnaires were distributed to all 15 units within the affected area (100% of all affected units), which complies with the "Temporary Methods of Public Consultation for EIA". Of these, 15 valid questionnaires were received, with a validity rate of 100%. The background information of questionnaire respondents and the results of the questionnaires are shown in table V-1 and table V-2.

Table V-1: Background Information of Questionnaire Respondents (Group)

#	Name of unit	Attitude towards proposed subproject	Comment and recommendation
1	Zhangmu Food and Drugs Administration	Agree	-
2	Yulin City Fujin Area Zhangmuzhen People's Government	Agree	-
3	Yulin City Fujin Area Zhangmuzhen Shangquan Village Committee	Agree	-
4	Yulin City Fujin Area Zhangmuzhen Taiping Village Committee	Agree	-
5	Yulin City Fujin Area Zhangmuzhen Shenming Village Committee	Agree	-
6	Yulin City Fujin Area Zhangmu Centre Health Station	Agree	-
7	Yulin City Fujin Area Zhangmuzhen Zhong Village Committee	Agree	-
8	Yulin City Fujin Area Zhangmuzhen Xinfa Village Committee	Agree	-
9	Zhangmuzhen Primary School	Agree	-
10	Yulin City Fujin Area Zhangmuzhen Tangji Village Committee	Agree	-

11	Yulin City Fujin Area Zhangmuzhen Diaoma Village Committee	Agree	-
12	Yulin City Fujin Area Zhangmuzhen Aquatic Products Animal Husbandry and Veterinary Bureau	Agree	-
13	Yulin City Fujin Area Zhangmuzhen Shengli Village Committee	Agree	-
14	Yulin City Fujin Area Zhangmuzhen Zhangmu Village Committee	Agree	-
15	Yulin City Fujin Area Zhangmuzhen Xinlong Village Committee	Agree	-

Table V-2: Results of the Questionnaires (Group)

#	Questions	Options	No. of respondents	%
1	What does your unit think about the environmental quality of the area?	Very Good	12	80.00
		Good	3	20.00
		Neutral	0	0.00
		Poor	0	0.00
		Very poor	0	0.00
2	What does your unit think is the major environmental problem of the area?	Atmospheric environment	9	60.00
		Water	6	40.00
		Noise pollution	0	0.00
		Physical environmental	0	0.00
		Natural landscape	0	0.00
3	How well does your unit know about the proposed subproject?	Very comprehensive	7	46.67
		Heard about it	8	53.33
		Not familiar	0	0.00
		Unsure	0	0.00
4	Does your unit think that the proposed project will contribute to the development of local economy and community?	Yes	15	100.00
		A little bit	0	0.00
		No impact	0	0.00
		Unsure	0	0.00
5	Which of the following environmental problem(s) does your unit care about the most? (May choose more than one item)	Air pollution	14	93.33
		Water pollution	15	100.00
		Noise	0	0.00
		Solid waste management	1	6.67
		Soil erosion	0	0.00
		Destruction to the landscape	0	0.00
		Environmental risk	5	33.33
6	If all the mitigation measures are implemented effectively, what is your attitude towards the project?	Support	15	100.00
		Don't mind	0	0.00
		Not support (please provide reason)	0	0.00

For individuals, questionnaires were distributed to affected areas including Zhangmu Area, Shangquan Village, Taiping Village, Shengli Village, Zhong Village, Xinfa Villa and Shenming Village. A total of 116 questionnaires were distributed. 116 questionnaires were received (return rate 100%). Of these, 115 questionnaires were valid (validity rate of 99.14%). The results are summarized in table V-3 and V-4.

Table V-3: Background Information of Questionnaire Respondents (Individuals)

Basic information		No. of respondents	%
Gender	Male	91	79.13
	Female	24	20.87
Age Group	16-30	15	13.04
	31-40	27	23.48
	41-50	39	33.91
	51-60	23	10.00
	61 or above	11	9.57
Educational background	College degree or above	5	4.35
	High school	22	19.13
	Secondary or below	88	76.52
Occupation	Farmer	103	89.57
	Worker	4	3.48
	Education	0	0.00
	Government	0	0.00
	Business	1	0.87
	Social work	1	0.87
	Others	6	5.22
Residency	Local residents	100	100.00
	Foreign tenants	0	0.00
	Others	0	0.00

Table V-4: Results of the Questionnaires (Individuals)

#	Questions	Options	No. of respondents	%
1	What does your unit think about the environmental quality of the area?	Very Good	38	33.04
		Good	39	33.91
		Neutral	36	31.30
		Poor	2	1.74
		Very poor	0	0.00
2	What does your unit think is the major environmental problem of the area?	Atmospheric environment	42	36.52
		Water	70	60.87
		Noise pollution	16	13.91
		Physical environmental	24	20.87
		Natural landscape	6	5.22
3	How well does your unit know about the proposed subproject?	Very comprehensive	55	47.83
		Heard about it	54	46.96
		Not familiar	6	5.22
		Unsure	0	0.00
4	Does your unit think that the proposed project will contribute to the development of local economy and community?	Yes	107	93.04
		A little bit	3	2.61
		No impact	1	0.87
		Unsure	4	3.48
5	Which of the following environmental problem(s) does your unit care about the most? (May choose more than one item)	Air pollution	79	68.70
		Water pollution	95	82.61
		Noise	27	23.48
		Solid waste management	34	29.57
		Soil erosion	3	2.61
		Destruction to the landscape	3	2.61
		Environmental risk	27	23.48
6	Which of the following pollution control measures do you think should be improved?	Wastewater management	105	91.30
		Air pollution management	90	78.26
		Noise pollution management	27	23.48
		Solid waste management	40	34.78
		Others (please specify)	0	0.00
7	If all the mitigation measures are implemented effectively, what is your attitude towards the project?	Support	114	99.13
		Don't mind	1	0.87
		Not support (please provide reason)	0	0.00

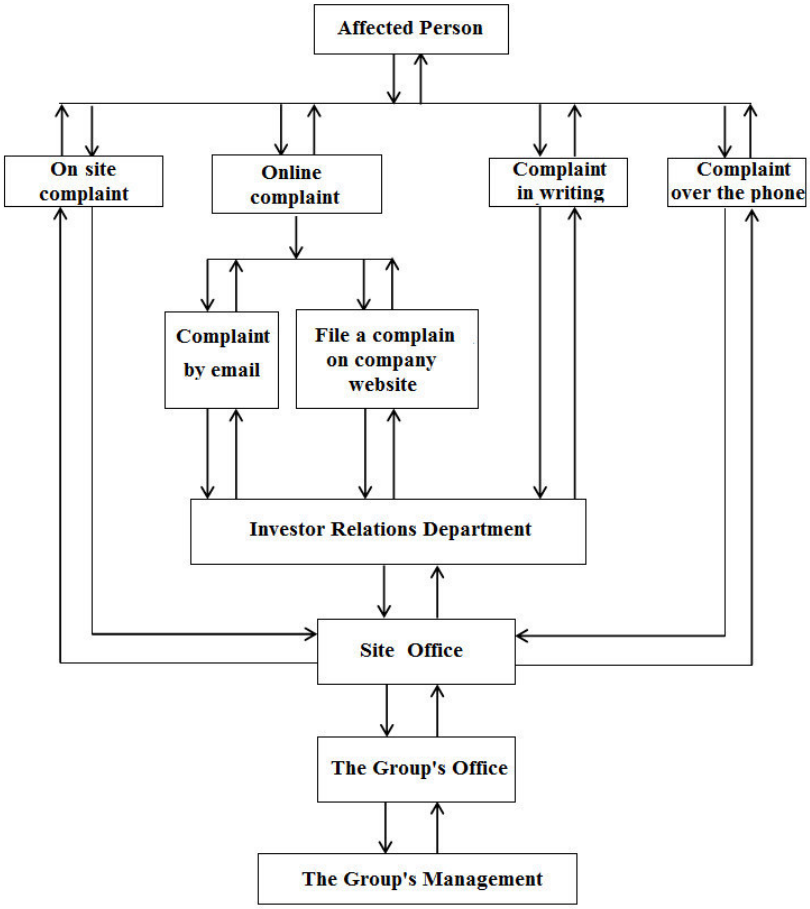
No opposition is received from unit or individual during all the three stages of public consultation. Of all 131 questionnaires received, 99.24% of the respondents show support to the subproject, while the remaining 0.76% of the respondents are neutral towards the subproject.

VI. Grievance Redress Mechanism

CTEG will establish a grievance redress mechanism (GRM) on site for handling environmental and social complaints, including complaint recording, consultation, issue investigation, mitigation action, follow-up, general timeframe for resolution and delegation of responsibilities. The GRM will address any possible concerns and dissatisfaction of affected groups regarding the social and environmental impact of its subprojects, and seek a proper solution. It should be able to promptly respond to the affected groups, be transparent and free of gender discrimination, and adapt to the cultural traditions of the affected groups and communities. Moreover, it should enable different affected groups to express their opinions, with no fear of reprisal. The E&S General Manager will be responsible for (i) resolving appeals, complaints, and disputes concerning the environmental and social impacts of subprojects which have not been resolved by the plant managers at the subproject level, and (ii) for coordinating, guiding and supervising the subproject companies in handling appeals, complaints, and disputes.

Letters and Calls office will be established to receive and handling complaints. A bulletin board will be set up onsite to show the location of the Letters and Calls office and complaint handling hotline so that general public will be informed with the way of lodging their the complaints. During the operation stage, site office will take the responsibility to handle stakeholder complaints and grievances. The target response time is 2 weeks from receipt of the complaints.

Figure VII-1: Grievance Redress Mechanism



For subprojects with involuntary resettlement impacts, the CTEG subproject companies will establish local level complaints and grievance procedures in each RP to be handled by the general office. The grievances will be redressed at the village level in a consultative manner and with full participation of the affected households, or their representatives, along with CTEG project staff and local government representatives. The basic grievance procedures include the following steps.

Stage 1. If any AP is aggrieved by any aspect of the land acquisition and resettlement, he/she can state his/her grievance and appeal to the village committee or in oral or in written form. If an oral appeal is made, the village will record it on paper and process it. Village committee will make decision on or resolve it in two weeks. The AP will be informed of the result via written notice.

Stage 2. If the aggrieved AP is not satisfied with the decision in Stage 1, he/she can appeal to the subproject local office after receiving the decision; the subproject local office will reach a decision in two weeks. The AP will be informed of the result via written notice.
Stage 3. If the aggrieved AP is still not satisfied with the decision of CTEG subproject local office, he/she will appeal to the CTEG E&S General Manager and/or relevant municipal land resources bureau (LRB) after receiving the decision. CTEG E&S General Manager and/or municipal LRB will reach a decision in two weeks. The AP will be informed of the result via written notice.
Stage 4. If the aggrieved AP is still unsatisfied with the decision of CTEG E&S General Manager or LRB, he/she will appeal to the provincial LRB after receiving the decision. The provincial LRB will reach a decision in two weeks. The AP will be informed of the result via written notice.
Stage 5. If the AP is still dissatisfied with the decision of the provincial LRB, he/she will appeal to the civil division of a people's court according to the civil procedural law after receiving the decision from the provincial LRB. The AP will be informed of the result via written notice.

Alternatively, the aggrieved person(s) may submit a complaint to the ADB's Project Team to try to resolve the problem. If good faith efforts are still unsuccessful, they may submit their complaint to ADB's Accountability Mechanism, which is a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance with ADB's operational policies and procedures.

Each subproject company will inform the local community and the AP of the grievance and appeal procedure through public information meetings, the resettlement information brochure and other media, so that they can fully understand their rights for grievance and appeal.

If a subproject affects indigenous peoples or ethnic minority communities, a grievance mechanism will be established that will promptly respond to the concerns and dissatisfaction of the affected indigenous peoples. It should also adopt an easy-to-understand and transparent procedure, be free of gender discrimination, and adapt to the cultural traditions of the affected indigenous people. News of the system's establishment should be promptly sent to the affected indigenous people and community.

VII. Environmental Management Plan

A. Objectives

An EMP has been prepared for this subproject to address the potential impacts and risks identified by the environmental assessment. This section deals with the set of mitigation and management measures to be taken during the subproject's construction and operation stages to avoid, reduce, mitigate, or compensate for adverse environmental impacts.

The key objective of the EMP is to ensure all activities associated in the subproject will not cause any significant adverse environmental and social impacts as well as comply with all applicable laws, standards and regulations in the PRC and ADB's SPS. Institutional arrangements and responsibilities are also discussed in this section.

B. Institutional Arrangements and Responsibilities for EMP Implementation

The E&S General Manager reports to CTEG's senior management. The General Manager has oversight for environmental and social issues, ensures that resources are made available for environmental and social management, and should sign and submit the annual environmental and social performance report to ADB. S/he should ensure that ADB is notified if and when there is material environmental or social safeguards non-compliance. S/he should ensure that ADB is notified if and when the responsible staff has been changed or replaced with new staff.

At the corporate office, an E&S officer will assist the E&S General Manager in effective safeguards planning and implementation. During subprojects preparation and implementation period, the safeguards team at the corporate office and the general office will be responsible for the environment and social issues, and will prepare IEE, IPP, and RP, supervise the effective implementation of the EMP; coordinate periodic environmental and social impact monitoring according to the approved monitoring plan; coordinate the project level GRM; prepare annual environment progress reports and submit them to ADB; conduct public consultation and inspect implementation of mitigation measures. Implement the ESMS system at both the holding company and subproject company levels.

In each subproject company, an E&S Manager is appointed to implement the environment and social safeguards at subproject company and prepare and submit the annual environment and social impact monitoring report to the E&S General Manager.

C. Summary of Potential Impacts and Mitigation Measures

Potential environmental impacts during construction and operation phases as well as their mitigation measures are summarised in Table VII-1 and Table VII-2. The effectiveness of the mitigation measures will be reviewed on a regular basis to determine if further improvement and adjustment are required.

Table VII-1: Potential Impacts and Mitigation Measures during Construction Phase

Category	Potential Impacts	Mitigation Measures	Responsibility		Estimated Cost
			Implemented by	Supervised by	
Biodiversity	Vegetation loss, change of the condition of the habitat.	Mainly focus on planning of greening of the area: • Conservation of top soil by storing the topsoil separately before excavation and utilize it for greening purpose; • Timely implementation of greening and paving of roads after cut and fill to prevent further soil erosion due to explosion. • Enhancement of greening effort using multi-layer greening of trees, shrubs, and grass for compensating the loss of habitat, increase biodiversity, biomass, and attract fauna especially birds;	Contractors	CTEG, Project company	Greening of the subproject area: RMB 120,000
Water Quality	Muddy water from excavation work, cooling water from construction machinery, water effluent from construction process and cleansing, and domestic wastewater from the workforce	• Install temporary diversion ditches and drains. Surface runoff will be diverted to sedimentation tank for removal of SS and then reused for dust suppression; and • During the construction stage, wastewater and solid waste will be treated on-time, temporary storage site should also be covered accordingly to reduce the impacts on ground water quality due to surface runoff.	Contractors	CTEG, Project company	Rain and sewage diversion: RMB 120,000 Anti-seepage and cement strengthening: RMB400,000 Monitoring systems: RMB450,000
Ambient Air	Dust and emission generated by construction activities	• Spray water on construction site to reduce dust from earthwork excavation, transport, loading and loading; • Dust fence shall be installed around the construction site and be maintained in good condition; • Cover construction materials if they are temporarily stacked outdoor; • No earthworks, and other construction activities during strong windy days; • Excess construction materials and construction waste should be removed from sites regularly; • Vehicle transporting construction materials and soil should be installed with anti-spill devices. Loading should be carried out carefully to ensure that there will be no spilling during transportation; • Routing and schedule of construction vehicles should be carefully planned without passing through sensitive zones such as residential areas; • The speed of the vehicles within the construction site should be controlled at 20kph; • All construction vehicles should be covered with tarpaulin. Vehicle cleaning facilities will be provided. All vehicles will be cleaned properly	Contractors	CTEG, Project company, local environmental authorities	Biofilter deodourization and sealing: RMB1,125,000 Natural plant extract deodourization system: RMB56,000

Category	Potential Impacts	Mitigation Measures	Responsibility		Estimated Cost
			Implemented by	Supervised by	
		before they enter or leave the construction sites to prevent soil, mud and other dirt being deposited on access roads; • Spills of soil, mud or other materials on the road should be cleared; • Use of environmentally-friendly decoration materials. Maintain good ventilation in places where painting and other activities that could release volatile organic compounds (VOC) or toxic gas are undertaken; • Burning of construction and demolition waste as fuel is not allowed will be prohibited and • Replanting and rehabilitation of the area will be conducted once the construction work is finished.			
Noise	Noise generated from construction activities	• Adopt advanced construction method, for example using hydraulic pile driver instead of diesel hammer pile driver, to minimise noise impacts; • Develop proper construction schedule, minimise each construction equipment's time of operation as practical as possible. Equipment with high noise shall be avoided for being used simultaneously as practical as possible. Construction activities shall not take place at night if they are close to environmental sensitives sites such as residential area; • Low noise equipment will be chosen as practical as possible. Location shall be fixed for earth excavation equipment, machinery and transportation. Noise shall be reduced by exhaust muffler and insulating the vibration part of the engine. Idle equipment shall be turned off. Speed of vehicles and horning shall be reduced while entering the site; • Noisy construction activities will be avoided during lunch break and the night time as practical as possible. No pile driving will be allowed during the nightime. Avoid transportation at night as practical as possible. Maintain lower speed for heavy vehicles as possible, especially when entering into environmental sensitive areas; • Minimise the number of construction machines running in the same place and at the same time as practical as possible; • Training shall be provided to construction workers. Construction materials shall be transported by crane or manually while throwing down from vhiecles is not allowed. Loud noise should be avoided when piling up steel materials. • PPE for hearing protection such as earplugs/earmuffs, noise-cancelling headphones will be provided to workers who will work around heavy machinery. • Limit the noisy activities (e.g. pile driving) during daytime and • Communities which may be affected by construction noise shall be informed prior to construction activities. During construction, they shall be informed with construction progress and noise reduction practices, certain compensation shall be provided to those parties which are under significant impact.	Noise	Noise generated from construction activities	Sound insulation: RMB80,000 Sound absorption: RMB100,000
Solid Waste	Solid waste generated from construction activities and workers	• Excavated earth/soil will be backfilled and debris, gravel, broken brick will also be reused to the extent possible; • Municipal solid waste will be properly segregated. Construction solid waste such as reinforced steel should be reused to the extent possible;	Contractors	CTEG, Project company, local environmental authorities	Sludge handling: RMB2,906,000 Transportation and handling of municipal waste, entrained

Category	Potential Impacts	Mitigation Measures	Responsibility		Estimated Cost
			Implemented by	Supervised by	
		• Construction waste, including hazardous construction waste, will be disposed of at the designated areas only; • Sufficient garbage collection bins and dumpsters will be installed at the construction site. Waste will be collected on a regular basis by the local sanitation departments and delivered to a licensed landfill for disposal; • Granular materials and waste will be properly sealed, wrapped, secured and covered on transport vehicles, which will follow a specified route only; and ▪ Contractor will be required to remove all temporary facilities, construction waste and muck accordingly once the construction phase is complete.			substances from screening, and sediments: RMB35,000
Soil	Soil erosion	• Avoid carrying out construction activities such as excavation during rainy season and windy period; • Excavation and backfilling will be balanced to the extent possible so as to minimise the need for fill transportation; • When excavation is conducted, remove and store topsoil at a designated area for future use in landscaping; • Properly revegetate disturbed areas as quickly as possible; • Geotextiles, plastic covers, erosion control blankets and mats shall be used to stabilise and protect soil from erosion by wind or water and • Use settling ponds, silt fences and screens to prevent sediment transport.	Contractors	CTEG, Project company, local environmental authorities	-
Physical cultural resources	Unknown archaeological resources and cultural relics could be destroyed.	Contractors are required to comply with the Law of the PRC on Protection of Cultural Relics. When unknown archaeological resources and cultural relics are discovered during construction, all construction activities will be suspended immediately and the relevant personnel will report to the local administrative department in charge of cultural relics. The construction activities will be only resumed once the investigation is completed and formal permission is obtained from the relevant government authorities.	Contractor	CTEG, Project company, local environmental authorities, local government authorities in charge of cultural relics.	-
Community Health and Safety	Temporary traffic disturbance and interruptions of public utility services.	• A traffic control and operation plan will be prepared by the contractor and discussed with the relevant local traffic management authority before construction. The plan will include provisions for diverting or scheduling construction traffic to avoid sensitive areas and peak traffic hours, controlling traffic at road crossings with an emphasis on public safety through clear signs, selecting transport routes to reduce disturbance to regular traffic, including alternative routes strategy for emergency traffic management, reinstating roads, and opening them to traffic as soon as the construction is completed; • An assessment of underground facilities will be conducted before pipeline construction where appropriate. • Villagers, residents, institutions and other affected parties will be informed in advance schedule and duration of construction works, and expected traffic and other disruptions; • Warning signs will be placed along roads to indicate potential dangers such as moving vehicles, open-cut trenches and excavations. Safety flags will be used if appropriate;	Contractor	CTEG, Project company, local transport, health authorities	-

Category	Potential Impacts	Mitigation Measures	Responsibility		Estimated Cost
			Implemented by	Supervised by	
		• Vehicles transporting construction materials or wastes will slow down and not use their horn when passing through or nearby sensitive locations, such as residential areas, schools and hospitals. • Construction warning lights will be used at night; • Roadside earthworks should be completed and spoil should be backfilled or removed as quickly as possible; and • Fencing shall be used to prevent unauthorised people accessing the construction sites			
Occupational Health and Safety	Health and safety of workers on construction sites.	• All workers will be provided with basic sanitation and safety training, including identification of specific hazards of their works. Implement HIV/AIDS and other communicable disease awareness and prevention, proper use of PPE, and emergency response training programme prior to the start of construction; • Garbage collection bins will be cleared daily by the government's sanitation department to prevent outbreak of diseases; • Provide adequate sanitation facilities such as latrines and lavatory at construction sites and workers camp following the requirements set forth by international best practices (e.g. OSHA) for a given number of workers; • Provide clean and sufficient supply of fresh water for construction sites and for all camps, offices and workshops; • Sufficient health and safety signage and warnings will be provided around the site; • Ensure material stockpiles or stacks are stable to avoid collapse and possible injuries to construction workers; • Workers will be provided with instruction and training in the use and maintenance of PPE. They will be required to wear PPE like helmet, safety gloves, safety shoes, and ear mufflers at all times when they are in the construction area. The condition of the PPE will be checked on a regularly basis; • Provide medical insurance coverage and pre-employment physical examination for all workers; • Ensure first aid kits are always accessible to the construction workers; • Avoid scheduling labour intensive and outdoor works for a time when the temperature is extremely high and the weather is in bad condition; • An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies associated with hazardous material spills and similar events and • A record management system will be implemented to maintain records of health and safety performance during construction phase. It will include documentation and reports of occupational diseases and incidents. The records will be reviewed during compliance monitoring and auditing.	Contractors	CTEG, Project company	-

Table VII-2: Potential Impacts and Mitigation Measures during Operation Phase

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
Groundwater	Groundwater pollution due to leachate from pipes and structural damage of the structure.	• Construction to be carried out in strict accordance with latest design and relevant regulatory requirements; • Proper quality control at completion and final acceptance of construction of the project; • Selection of suitable materials for pipework to avoid corrosion of pipes, in particular, iron pipes should be avoided; • Proper implementation of day-to-day management, enhanced supervision and investigation of the project facilities during operational stage; • Proper solid waste management practices as recommended in Section C5 of Chapter IV; • Clay layer (50cm thick) and HDPE (2mm) geomembrane should be laid under the sewer and structures where may have the risk of seepage so that the potential of pollution to groundwater is limited; and • Additional measures on sludge handling and against pipeline seepage	Operator	CTEG, Project company, local environmental authorities
Noise	Excessive noise level	• Lowering of noise level for major noises such as blower room and fan inlet of pumping room by means of noice isolation and installation of silencer; • Plantation of landscape noise buffers within the subproject area; • Application of noise insulation measures by adoption of building materials with noise absorption characteristics for noise sources such as pumping room and blowers and • Noise protection will be provided to workers to minimise exposure to noise sources and ensure that their exposure is within the industrial good practices (i.e. OSHA's permissible exposure limit for noise exposure is 85 dBA for an 8-hour.	Operator	CTEG, Project company, local environmental authorities
Solid and Hazardous Waste	Improper disposal of municipal solid waste and sludge management	• Timely removal of municipal solid waste produced with the use of sanitation landfill; • Dewatering of screenings and sludge from sewage treatment processes; • Timely removal of dewatered screenings and sludge; • Removal, management and transport of sludge waste by licensed contractor; • At least one special vehicle for sludge transportation will be stationed in the industrial park to ensure the timely removal of sludge; • High designed storage capacity of sludge to prevent improper storage • Careful planning of transport of waste with measures to prevent leakage; and • Off-site reuse of sludge according to relevant environmental requirements. • Fly ash removal system will be installed. Each boiler of the combined heat and power system will be equipped with a Pulse Jet Fabric Filter and two ash depositories. A total of two 300m2 ash storage tanks will be built. • Fly ash will be regularly removed by trucks. A pump will be installed under each hopper of the Pulse Jet Fabric Filter, and these pumps share a connected transporting pipe. The collected ash from the hoppers will be transported to the ash depositories by compressed air through the pipe. • The fly ash in the depositories will be loaded into tanker and removed directly. • Bottom ash removal system will be also installed. All bottom ash generated from the four boilers in the combined heat and power system will be transported to the two bottom ash depositories, each with a volume of 200m3, via belt-conveyor belt	Operator	CTEG, Project company, local environmental authorities

Category	Potential Impacts	Mitigation Measures	Responsibility	
			Implemented by	Supervised by
		and bucket elevator. The bottom ash stored in the depositories will be finally delivered by trucks to the qualified factories for further processing.		
Occupational Health and Safety	Pose severe risk on health and safety of staff	• use of suitable PPE that will protect the workers from workplace hazard while maintaining their comfort at work such as safety shoes, breathing apparatus chemical resistant clothing, safety googles, mask, safety ear plugs, safety gloves etc. to avoid direct/ over exposure to harmful chemicals, emissions, liquids, hazardous waste etc.; • Prevention of electricity-related hazard includes periodic checking of equipment by qualified personnel, procurement of safe equipment that is free from fault or defect, proper maintenance of equipment and cables; • Prevention of hazard related to storage, transport, handling, management, and disposal of chemicals include keeping and updating a logbook on chemicals, lock-out system, providing safe handling procedures, education of relevant personnel etc; • Workplace management including site management such as proper storage and careful use of sharp tools, having correct postures when doing manual operations, keeping things away from floors to avoid tripping etc; • Measures against confined space related hazards include use of explosion-proof equipment, installation, and appliances, use of breathing apparatus for certain workspace, registration system for entering certain space, atmospheric monitoring, railings to avoid fall from height into and drowning in a confined space etc; • An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies; • A records management system will be implemented to store and maintain records of health and safety performance. It will include documenting and reporting of occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and audits; • Periodic health check-up for targeted workers; and • Implementation of internal safety management systems with rules, regulations, safety production guidelines, and workplace health and safety trainings etc.	Operator	CTEG, Project company, local health and safety authorities

D. Environmental Monitoring and Reporting

Environmental and social performance will be evaluated on an annual basis. The benchmark for performance will be the ongoing compliance against the applicable environmental and social safeguards requirements. CTEG will ensure that the subproject company prepares and submits an annual environmental and social performance monitoring report and will review and assess the compliance performance on environmental and social safeguard issues, including issues related to gender and development and core labour standards.

The E&S General Manager will i) communicates with the subproject company and confirms from time to time the that subproject company is undertaking the obligations of compliance with all applicable environmental and social safeguards requirements; and ii) visit the site to monitor the implementation of EMP or RP. CTEG will promptly report to ADB any actual or potential breach of the compliance requirements after becoming aware of it.

The E&S General Manager will review the annual monitoring report of this subproject prepared by the subproject company. The E&S General Manager will prepare an annual environmental and social performance report (AESPR) covering all subprojects using ADB funds.

Table VII-x shows the environmental impact monitoring plan specifically designed for this subproject at the construction site, which includes the scope, source, measures, and frequency of monitoring during operation phase.

In order to reduce the negative environmental impacts during the construction phase, a unit of 2 to 3 people will be set up responsible for managing and monitoring the environmental impacts.

- The contractor and construction unit have agreed to include environmental monitoring measures during construction phase into the contract, which the construction unit should strictly follow. Rewards and punishments system applies;
- Construction unit will follow and implement the agreements in the contracts, as well as relevant environmental regulations and rules of National and local government;
- Prepare an environmental monitoring plan for construction phase on the basis on this IEE, including a detailed description of the construction location, environmental impacts, monitoring measures and responsible unit/person. The environmental monitoring plan will be distributed to related personnel for implementation;
- Construction unit should appoint a person in charge of at each construction site responsible for monitoring all types of pollutions at sites, particularly on noise and vibrating works;
- Construction unit should proactively follow the guidance of the environmental management department;
- Construction unit should set up a hotline for complaints from the public. The complaints should be handled properly on a timely basis.

Table VII-3: Environmental Monitoring Plan during construction phase

Type	Monitoring location	Monitoring items	Monitoring frequency
Ambient air	-	TSP, PM_{10}	Three times a day for initial, mid-term, and final stage of construction. Each sampling will last for at least 12 hours.
Water	Outlets of construction wastewater	pH, SS, DO, TOP, TN, COD, BOD_5	Sampling for two consecutive days during initial, mid-term, and final stage of construction
Noise	1m away from the boundary of the subproject area	Noise level	Day and night time sampling during initial, mid-term, and final stage of construction
Solid waste	-	Disposal of construction waste	-

Table VII-4: Environmental Monitoring Plan during operational phase

Type	Monitoring location	Monitoring items	Monitoring frequency
Ambient air	Downwind of the odour source, exhaust pipes and various spots at boundary of the subproject area	SO2, NO2, CO, PM10, TSP, PM2.5, H2S, NH3 and odour	Quarterly
Water	Outlets	Temperature, pH, chroma, SS, DO, CODcr, BOD_5, TP, petroleum, animal and vegetable oils, LAS, decal coliforms, total cadmium, total copper, total led, total nickel, total chromium	Daily

Noise	1m away from the boundary of the subproject area	Noise level (LeqA)	Monthly
Groundwater	Monitoring wells at the both sides of the sludge dewatering tank	pH, permanganate index, ammonia, nitrate, nitrite, sulfate, cyanide, volatile phenols, petroleum, mercury, lead, hexavalent chromium, zinc, nickel	Once in normal and dry period

In addition, 'three-simultaneity' will be implemented and strictly followed during the construction period.

VIII. Conclusion and Recommendation

During the preparation of the FSR, domestic EIA and project IEE, potential environmental impacts were carefully assessed and addressed. The EIA was prepared by University of Zhongshan in October 2016.

This IEE provides the background and the details of the two major components of the subproject, wastewater treatment plant and water supply facilities. It describes the purpose of the subproject, the geographic location of the subproject, major processes of the two components, and the relevant physical, biological, and socioeconomic conditions within the area.

Major safeguard issues during construction phase include biodiversity, surface water quality, ground water quality, ambient air quality, noise pollution, solid waste, soil erosion, socio-economic resources, physical cultural resources, community health and safety and risks to public utilities, and occupational health and safety. There are no historical and archaeological sites within or near the subproject area. Overall, construction-related impacts are localized, short term, and can be effectively mitigated through the application of good construction and housekeeping practices. Appropriate monitoring programs have also been developed to address these issues.

The main potential adverse impacts during the operation phase include surface water quality, ground water quality, ambient air quality, noise pollution, solid and hazardous waste, and occupational health and safety. It is expected that the effluent from this subproject will meet the national effluent standards and IFC standards under normal operation and the impact on surface water is minimal. Proper design, construction, management and maintenance of the subproject will also prevent negative impact on groundwater quality. Further, mitigation measures such as the installation of fume purification system and the plantation of landscape noise buffers, will reduce the impacts on ambient air quality and noise pollution. Careful management of solid and hazardous waste is required to minimise the impacts from waste generation.

Mitigation measures and monitoring program are defined for all identified impacts and are included in the EMP of the project IEE. The EMP sets out the procedures and plants to carry out mitigation measures and monitoring during construction and operational stage. For each aspects, appropriate mitigation measures are described and monitoring programme will be undertaken to ensure that the environmental impacts will be minimised to appropriate levels, referencing to respective standards and requirements.

The subproject IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all potential adverse environmental impacts associated with the project will be prevented, eliminated, or minimised to an acceptable level.