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**World Bank Financed Hubei Yichang Three  
Gorges Modern Logistics Center Infrastructure  
Project**

**Environmental and Social Impact  
Assessment Report  
(Final Version)**

**Central-Southern Safety & Environment Technology Institute Co. Ltd.**

**November, 2016**

WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project

## **Environment and Social Impact Assessment Report**

(Final Version)

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**The certificate is only valid to be used by “WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project”.**

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**Appendix 1: Overview of Site Selection of Changjiang Yichang Chinese sturgeon Natural Reserves**

**Appendix 2: Statements of Sources of Borrowed Earth in the Project**

**Appendix 3: Approval of Navigation Safety by the Maritime Management Bureau**

**Appendix 4: Phase I Borrow Pit Agreement**

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# 1 Introduction

## 1.1 Background

Located in the southwestern Hubei Province and in the middle reaches of Yangtze River, Yichang Municipality has a total population of 4.15 million. The urban built-up area is 150 km<sup>2</sup> with a population of 1.55 million. In 2014, the GDP of this city has reached RMB 313.22 billion and its public revenue reached RMB 27.15 billion. Playing a vital role in the strategic development of economic belt along the Yangtze River, Yichang Municipality is famous for the transshipment over the Three Gorges Dam and the logistics center that provides convenient access to ports, highways, railways and airports, serving as the logistic corridor between the eastern and western China.

The WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project was proposed by Yichang Municipal Government to be programmed for USD 200 million (equivalent to RMB 3,333 million) in the *WB Programs List 2015-2017*. The PDO (project development objective) is to promote logistics services and multi-modal transportation along the Yangtze River in Yichang Municipality. The construction content consists of Baiyang Port Operation Area, Baiyang Logistics Park, Road infrastructures, information center and project management and institutional capacity improvement, totally 5 primary subcomponents and 17 secondary sub-components.

Entrusted by Yichang Transportation Investment Co., Ltd, Central-Southern Safety & Environment Technology Institute Co. Ltd. (hereby the EA Consultant) has undertaken environmental and social impact assessment of the proposed Project. The EA Consultant visited the site and had meetings with PMO and the consultants in June 2015. Through on-site survey, the EA Consultant collected baseline data of natural conditions, distribution of environmental protection objectives and environment functional divisions. The EA consultant also reviewed some documents on social and environmental conditions and development plans related to the project. Additionally, Wuhan Central Quality Test Co., Ltd is entrusted to conduct the additional environmental quality monitoring on surface water, ambient air and acoustic environment. This *Environmental Impacts Assessment Report of WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project* was accomplished by the assessment unit in July 2016.

## 1.2 Regulatory and legal framework

### 1.2.1 Laws and regulations

The report is prepared on the basis of the most important environmental protection laws of China, including: *Law of the People's Republic of China on Environment Protection*, the basic law of environmental protection; *Special Regulations of Environment and Resources Protection*, the direct basis for environment management and disputes resolution with general but detailed regulations; *Law of the People's Republic of China on Environmental Impacts Assessment*, is focused on the control of environment impacts from the source from a wider view, to protect the ecological environment and take measures timely to shoot future troubles.

- 1) *Law of the People's Republic of China on Environmental Protection*, revised

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on April 24, 2014, coming into force on January 1, 2015;

2) *Law of the People's Republic of China on Environmental Impacts Assessment*, coming into force on September 1, 2003;

3) *Law of the People's Republic of China on the Prevention and Control of Water Pollution*, revised on February 28, 2008, coming into force on June 1, 2008;

4) *Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution*, revised on April 29, 2000, coming into effectiveness September 1, 2000;

5) *Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise*, issued on October 29, 1996, coming into force on March 1, 1997;

6) *Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Wastes*, revised on December 29, 2004, coming into force on April 1, 2005;

### **Administration regulations**

As the project is located along the Yangtze River, water quality protection is critical. The administration regulations which have universal impacts on the project shall be placed as the basis of project preparation.

1) *Regulations for Prevention and Control of Inland Water Pollution from Ships*, issued in 2006, revised in 2015

2) *Notice of the Ministry of Environmental Protection on Further Strengthening Environmental Impact Assessment Administration and Preventing Environmental Risks* (No.77 [2012] of the Ministry of Environmental Protection);

3) *Notice of the General Office of the People's Government of Hubei Province on Forwarding the Provisions of the Department of Environmental Protection of Hubei Province on "Environmental Function Categories of Surface Water in Hubei Province"* (No. 10 [2000] of the General Office of the People's Government of Hubei Province);

### **Technical specifications**

The technical specification is aimed to regulate the techniques and regulations of environmental impacts assessment. It is also the direct and effective tool on environment management in China, the most basic and operational standards for the guidance of the project, hereby, the selected technical specifications are listed as follows:

1) *Technical Guidelines for Environmental Impacts Assessment – General Provisions* (HJ2.1-2011);

2) *Technical Guidelines for Environmental Impacts Assessment – Ambient Environment* (HJT2.2-2008);

3) *Technical Guidelines for Environmental Impacts Assessment – Surface Water Environment*(HJ/T2.3-93);

4) *Technical Guidelines for Environmental Impacts Assessment – Groundwater Environment* (HJ610-2011);

5) *Technical Guidelines for Environmental Impacts Assessment – Acoustic Environment* (HJ/T2.4-2009);

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6) *Technical Guidelines for Environmental Impacts Assessment – Ecological Impact* (HJ19—2011);

7) *Technical Guidelines for Environmental Impacts Assessment of Construction Projects* (HJ/T169-2004);

8) *Norms of Environmental Impacts Assessment for Inland Navigation Construction Projects* (JTJ227-2001);

9) *Norms of Environmental Impacts Assessment for Port Construction Projects* (JTS105-1-2001);

#### **Project documents**

1) *Letter of Entrustment* on the Environmental Impact Assessment by Yichang Transportation Investment Co., Ltd, November 2015;

2) *WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project Proposal*, T.Y. Lin International, September 2015;

3) *Approval of the WB-Funded Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project Proposal* by Yichang Municipal Development and Reform Commission (Y.F.G. S.P. [2015] 320), on September 13 2015;

4) *Environmental Impact Report of Yichang Port Overall Plan*, Transport Plan and Design Institute, December 2008;

5) *Feasibility Study Report on the WB-Funded Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project Proposal (Draft)*, T.Y. Lin International, October 2015;

#### **WB's Safeguard Policy**

After the preliminary review of the WB, the applicable safeguard policies and relevant guidelines are determined as follows:

- 1) Environmental Assessment (OP/BP4.01,1999.1),
- 2) Natural Habitats (OP4.04, 2001.6).
- 3) Physical Cultural Resources (OP4.11,1999.8);
- 4) Involuntary Resettlement (OP4.12, 2001.12)
- 5) Good Practice Handbook Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets;
- 6) IFC/WB Environmental, Health, and Safety Guidelines;
- 7) Environmental, Health, and Safety Guidelines, for Ports, Harbors, and Terminals;
- 8) Environmental, Health, and Safety General Guidelines (for shipping);
- 9) Disclosure of Information (BP17.50, 1993.9).

### **1.3 Function zoning and applicable standards**

Based on the initial environmental investigation of project site, construction scale, main characteristics and environmental function zoning along the roads, the EIA standards of the assessment unit are listed as follows in accordance with the requirements of *Environmental Quality Standard for Noise (GB3096-2008)*, *Technical*

Specifications Applicable for Dividing the Areas for Environmental Noise of urban area (GB/T15190-94), and Notice on Noises of Road and Railway (including Light Rail) issued by the national EPB (No. 94 [2003]),

## Ambient air

### (1) Quality standard

The quality of the ambient air is classified as Class II, and applicable to the requirements of Class II of *Ambient Air Quality Standard* (GB3095-2012). *Ambient Air Quality Standard* (GB3095-2012) is specified in Table 1.3-1.

**Table 1.3-1 Ambient Air Quality Standard (GB3095-2012)**

Pollutant	Sampling time	Class II Standard Value (mg/Nm <sup>3</sup> )	Class I Standard Value(mg/Nm <sup>3</sup> )
NO <sub>2</sub>	Day average	0.08	0.08
	Hour average	0.2	0.2
SO <sub>2</sub>	Day average	0.15	0.05
	Hour average	0.5	0.15
TSP	Day average	0.30	0.12
PM <sub>10</sub>	Day average	0.15	0.05

### (2) Emission standards

The air emission applies to the standards of Class II of *Integrated Emission Standard of Air Pollutants* (GB16297-1996) as specified in Table 1.3-2. The emission of automobile exhaust applies to *Emission Limits and Measurements for light vehicles* (National standards Class V) (GB18352.5-2013) and *Value Limits and Measurements for Exhaust Pollutants from Compression Ignition and Gas Fueled Positive Ignition Engines of Vehicles (Phase III, IV, V in China)* (GB17691-2005). The standard emission limits of Class IV and V in China are seen in Table 1.3-3.

**Table 1.3-2 Emission Standards of Air Pollutants (GB16297-1996)**

Pollutant	Maximum permitted emission concentration (mg/m <sup>3</sup> )	Maximum permitted emission rate (kg/h)		Value limit for fugitive emission concentration (mg/m <sup>3</sup> )
		Height of exhaust funnel (m)	Class II	
Particulates	120	15	3.5	Maximum at 1.0 at boundary
		20	5.9	
		30	23	

**Table 1.3-3 Value Limits on Emission of Class IV and Class V standards**

Pollutant	Class V	Class IV
NO <sub>x</sub> g/km	0.18	0.25
HC+NO <sub>x</sub> g/km	0.23	0.3
concentration of Particulates g/km	0.0045	0.025
Particulates Number (PN) g/km (PN is a new addition to Class	6.0×10 <sup>11</sup>	-

Pollutant	Class V	Class IV
V)		

**Note: currently Hubei Province is implementing the standards of Class IV and will upgrade it to Class V since January 2017**

**Acoustic environment**

**1) Baseline analysis**

For newly constructed roads along the villages, the standards of *Class I of Environmental Quality Standard for Noise (GB3096-2008)* shall prevail; for residential area within 40m of existing national roads, the standards of Class 4A shall apply; for residential area beyond 40m of existing national roads, the standards of Class II shall apply. Refer to Table 1.3-4 for the standards of baseline analysis for acoustic environment.

**Table 1.3-4 Environmental Quality Standards for Noise (GB3096-2008)**

Class	Day time(dB(A))	Night time(dB(A))	Applicable area
2	60	50	Residential area
3	65	55	Industrial area
4a	70	55	Certain areas along the trunk roads

During the construction period, the *Environmental Emission Standards for Noise at the boundary of construction site (GB12523-2011)* shall apply. See Table 1.3-5.

**Table 1.3-5 Emission Standards for Noise at Construction Site at Boundary (GB12523-2011)**

Noise limits [dB (A) ]	
Day time	Night time
70	55

During the operation period, the standards of Class 4A shall be applied in the area nearby the Yangtze River; the standards of Class 4A shall prevail for the area nearby the residential area within 40m nearby G318 Road, and Class II for the areas beyond 40m; Class 4A shall be applied for the waterway of Yangtze River; Class III for the remaining boundary of the Logistics Parks, whilst Class II for the sensitive spots outside the boundary. The emission standards are shown in Table 1.3-6.

**Table 1.3-6 Emission Standards for Noise of Industrial Enterprises at Boundary (GB12348-2008)**

Class	Daytime	Nighttime	Applicable area
2	60	50	Residential area
3	65	55	Industrial area
4a	70	55	Certain areas along the trunk roads

**Water environment**

**(1) Environmental quality standards**

According to No. 10 Document [2000] issued by Hubei provincial government , the quality of the water body of Zhijiang Section of Yangtze River is Class III. The standards are shown in Table 1.3 -7.

**Table 1.3-7 Environment Quality Standards of Surface Water (GB3838-2002), mg/L (except for pH)**

No.	Item	Class III
1	pH	6 ~ 9
2	BOD <sub>5</sub> ≤	4
3	DO ≥	5
4	COD ≤	6
5	TP (P value) ≤	0.2
6	NH <sub>3</sub> -N	1.0
7	Oil ≤	0.05

## (2) Discharge standards of pollutants

### a) Industrial wastewater and domestic wastewater

The domestic wastewater produced during the implementation period will be used for fertilizing farmlands after being disposed by the septic tanks; industrial wastewater produced during the implementation period will be recycled after oil segregation and precipitation; wastewater generated during the operation period will be discharged to sewage plants through urban sewage pipelines. The standards of Class III of *Integrated Waste Water Discharge Standard (GB8978-1996)* shall apply for wastewater discharge. The specific standard values are listed in Table 1.3-8.

**Table 1.3-8 Integrated Waste Water Discharge Standard (GB8978-1996)**

Standard No.	Title	Class	Pollutants	Standard value (mg/L)
GB8978-1996	<i>Integrated Wastewater Discharge Standard</i>	Class III	pH	6 ~ 9
			SS	400
			BOD <sub>5</sub>	300
			COD	500
			Oil	20
			Animal and vegetable oil	100
			NH <sub>3</sub> -N	/
			LAS	20

### b) Wastewater discharged by vessels arrived at the port

For the wastewater discharged by vessels arrived at the port, *Discharge Standards of Pollutants from Ship (GB3552-83)* shall apply. However, if the standards are not compatible to the local environment such as integrated domestic water source or economic fishery zone, the local standards for pollution discharge, which are

prepared in accordance with national regulations, shall prevail. The applicable water quality of water body is Class III or even lower. The standards are shown in Table 1.3-9.

**Table 1.3-9 Effluent Standards of Pollutants from Ship (GB3552-83) Unit: mg/L**

No.	Item	Discharge concentration and regulations
1	Oily water from vessels	Oil $\leq$ 15
2	BOD	BOD <sub>5</sub> $\leq$ 50
3	SS	SS $\leq$ 150
4	Food or other wastes	Shall not be discharged into the water area

## 1.4 Factors and Scope for Assessment

### 1.4.1 Identification of environmental impacts

The key factors and types of project impacts are identified with regards to project scale, processing schemes, pollution's types, distribution and control measures. The good impacts on natural environment, social environment and human benefits will be determined. See Table 1.4-1 for details.

**Table 1.4-1 Matrix Table of Environmental Impacts**

Evaluation period	Evaluation factor		Indexes					Remark
			Possibility	Degree	Duration	Scope	Reversibility	
Construction phase	Natural environment	Surface water	--	-	-	-	Reversible	a) "+": positive impact; "-": negative impact; "□": no impact b) Description of impacts "+": possibility of impacts: small; degree of impacts: general, duration of impacts: short; scope of impacts: small; "++": possibility of impacts: large; degree of impacts: large, duration of impacts: long; scope of impacts: large; "-": possibility of impacts: small; degree of impacts: small, duration of impacts: short; scope of impacts: small; "---": possibility of impacts: large; degree of impacts: large, duration of impacts: long; scope of impacts: large;
		Ambient air	--	-	--	-	Reversible	
		Noise	--	-	--	-	Reversible	
		Land resources	-	---	---	---	Irreversible	
	Ecological environment	Terrestrial organisms	--	--	--	--	Irreversible	
		Aquatic animals and plants	---	---	-	-	Reversible	
Social environment	Transportation	-	-	-	-			
	Socio-economy	++	+	+	++			
	Job Opportunities	++	+	+	+			
Operation phase	Natural environment	Surface water	--	---	---	---	Reversible	
		Ambient air	---	-	---	---	Reversible	
		Noise	---	-	-	-	Reversible	
	Ecological environment	Land resources	□	□	□	□		
		Terrestrial organisms	---	---	---	---	Reversible	

Evaluation period	Evaluation factor		Indexes					Remark
			Possibility	Degree	Duration	Scope	Reversibility	
	Social environment	Aquatic animals and plants	++	++	++	++		
		Transportation	++	++	++	++		
		Socio-economy	++	++	++	++		

### Screening of assessment indicators

The assessment indicators of environmental impacts are identified based on the environment baseline research, the environmental impacts and comparable researches of similar projects. The pollutant assessment indicators are shown in Table 1.4-2.

**Table 1.4-2 Identification of Pollutants and Assessment Indicators**

Evaluation period	Environmental factors	Pollutants	Assessment Indicators
Construction period	Air	TSP, NO <sub>2</sub> , SO <sub>2</sub>	TSP
	Water	SS, COD, BOD <sub>5</sub> , NH <sub>3</sub> -N, oil	SS, COD, BOD <sub>5</sub> , NH <sub>3</sub> -N, oil
	Noise	Transportation or mechanical noises	L <sub>eq</sub> (Equivalent continuous A-weighted sound level)
	Solid waste	Construction wastes and domestic wastes	Construction wastes and domestic wastes
	Ecological environment	Vegetation and aquatic ecosystem	Vegetation and aquatic ecosystem
Operation period	Air	TSP, PM <sub>10</sub> , NO <sub>2</sub> , SO <sub>2</sub>	TSP, PM <sub>10</sub> , NO <sub>2</sub> , SO <sub>2</sub>
	Water	River regime, hydrology, flood control, COD, oil, etc.	River regime, hydrology, flood control, COD, oil
	Noise	Traffic noise, mechanical noises	L <sub>eq</sub> (Equivalent continuous A-weighted sound level)
	Solid waste	Ship waste, land-based domestic and industrial waste, hazardous wastes	Ship waste, domestic waste, hazardous waste
	Ecological environment	Impact on aquatic ecosystem	Aquatic ecosystem
	Environmental emergency accident	Oil leakage	Oil

### Scope of Assessment

Apart from the project site (see Table 1.4-3 below), the scope of assessment also includes Shawan WWTP(the facilitating equipment), Shibaoshan Domestic Solid Waste Landfill in Zhijiang City (receptor of solid wastes) and Baiyang New City(as the borrow pit). Baiyang New City is also where the resettlement houses are located.

**Table 1.4-3 Evaluation scope of the project**

Evaluation Indicators	Evaluation scope
Surface water	Water area about 5.0 km from Berth 13# downstream
Ambient Air	The circular area with the radius of D10% or 2.5km, centering on Baiyang Port Land-based Operation Area
Noise	Sensitive receptors at 1m or 200m away from the project boundary

Evaluation Indicators	Evaluation scope
Acoustic environment	The evaluation area is within the scope of 300m outside project area; evaluation scope of water area and surface water are the same.
Environmental risks	Water area of 5.0 km from Berth 13# downstream
Social environment	Directly influenced area by the project

## 1.5 Relationship with the master plan

### Urban Master Plan of Yichang Municipality

In accordance with the requirements of *Urban Master Plan of Yichang Municipality (2011- 2030)* (revised in 2011), the Three Gorges Hub is positioned for transshipment port, industrial output, the Three Gorges tourism, and coastal harbor to the west. It has functions such as loading, unloading and storing materials, transshipment over dams and multi-modal transport, port industries development, industrial output, tourism, etc. According to function zoning and positioning, Yichang Port is divided into 6 port areas along the Yangtze River in Yichang Municipality, i.e. Zhongxingshan Port Area, Zigui Port Area, Major urban port area, Changyang Port Area, Yidu Port Area, Zhijiang Port Area.

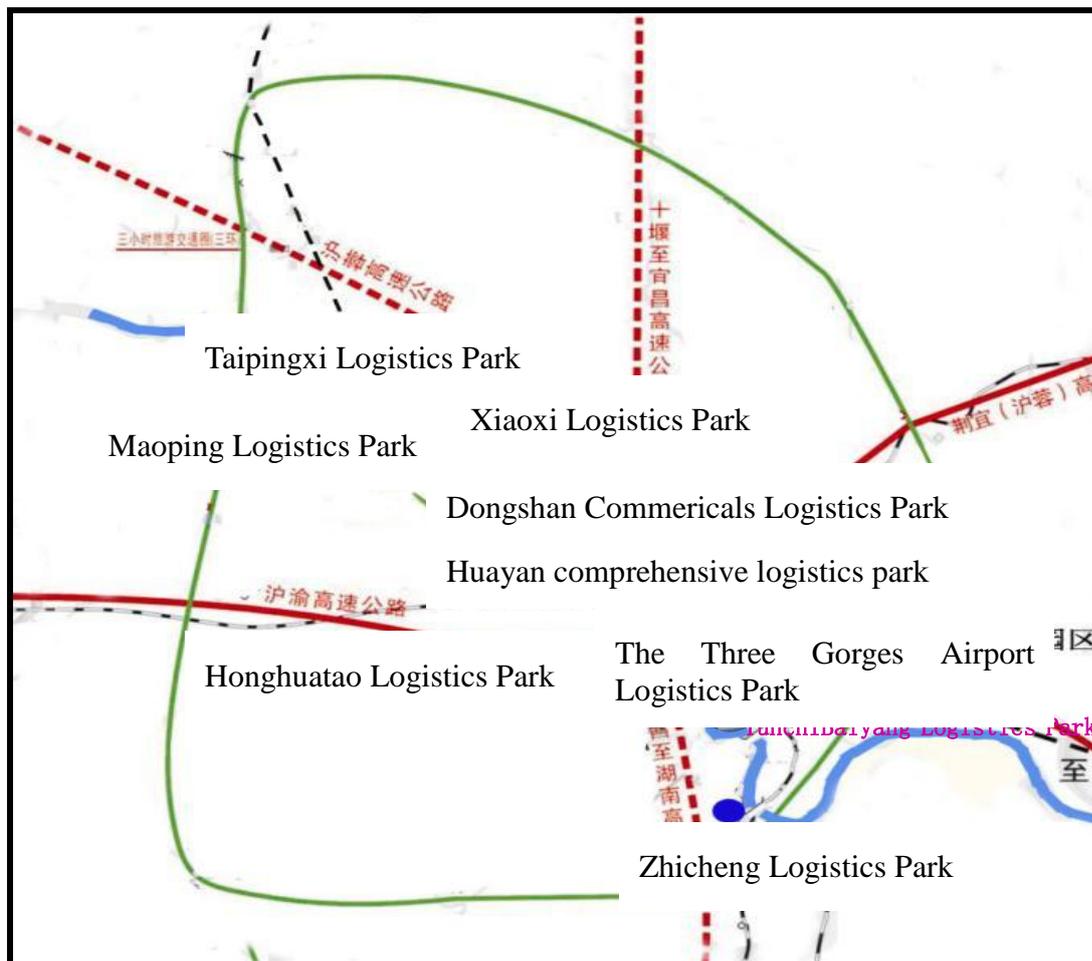
Major urban port area mainly serves for urban production and daily life. The major operation area includes Taipingxi Operation Area, Baiyang-Yunchi Operation Area. Yunchi-Baiyang Operation Area will be mainly responsible for logistics transshipment, and also an important multi-functional Port Operation Area. Transshipment over dam is mainly concentrated in Taipingxi Operation Area, Baiyang-Yunchi Operation Area, Tianjiahe Operation Area, Maoping Operation Area, Honghuatao Operation, and Zhicheng Operation Area. Moreover, Baiyang-Yunchi Operation Area, Tianjiahe Operation Area, Zhicheng Operation Area and Qixingtai Operation Area will be mainly for industrial output, to give full play of the advantages of resources distribution of port and low costs of water transport; Baiyang-Yunchi Operation Area, Tianjiahe Operation Area and Zhicheng Operation Area will be mainly served for access to sea, so as to construct the coastal port to the west, the logistics hub of the middle and upstream of Yangtze River, the key city of regional logistics in China..

### Development Plan for the Three Gorges Modern Logistics Center

To accelerate the construction of the Yangtze River golden waterway shipping system, enhance the transportation capacity and efficiency of the Three Gorges, and faster up the construction of Three Gorges Logistics Center centering on Yinchang municipality, the *Development Plan for Three Gorges Modern Logistics Center (2010—2020)* is prepared by Integrated Transportation Institute of NDRC. With the improvements of the navigation and shipping capacity of the Three Gorges as the core, the promotion of golden waterway navigation service capacity as the purpose, the Three Gorges Logistics Center focuses on the construction of national logistics node and channels, supported by the logistics service system and relevant facilities of Yichang. It takes Yichang Municipality as the carrier to establish the modern logistics organization and management system featuring in high efficiency and

network-orientation, for the purpose of becoming the important regional logistics hub of the country.

In the plan, there are 9 logistics parks namely Huayan, Tianpingxi, Maoping, Yunchi, Honghuatao, Xiaoxita, Dongshan, Zhicheng, the Three Gorges Airport logistics parks. The locations are shown in Figure 1.5-1. Yunchi-Baiyang Logistics Park is one of the 9 integrated logistics parks. The proposed Project is located in the Baiyang Logistics Park and Baiyang Port Operation Area which is located in the Baiyang Industrial Park of Yichang national high-tech industrial development area. With the geological advantages of bordering the port, roads, railway and airports, Baiyang Port Operation Area will play the historical role as regional logistics hub. They will also promote the development of Yichang Three Gorges Modern Logistics Center.



**Figure 1.5-1 Layout of the Three Gorges Logistics Center**

### 1.5.3 The 12th Five-Year Plan for the development of Hubei Modern Logistics Industry

The *12th Five-Year Plan for Developing Hubei Modern Logistics Industry (2011-2015)* is prepared by Hubei Provincial DRC to guide the development of Hubei's modern logistics industry. An integrated network of "Logistics Circle (Belt)-Key Logistics Node Cities-Logistics Hub-Logistics Center" will be built during the period of the 12th FYP. The Logistic Circle (Belt) is centering at Wuhan and radiating to the neighboring cities. It includes the Eco-cultural Tourism Circle of the western Hubei and is supported by two sub-center cities of Hubei-Yichang Municipal and Xiangyang, which radiates to the western and surrounding areas of Hubei Province; it also includes the Yangtze

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River Logistics Belt that radiates the surrounding area of the Yangtze River. In short, Wuhan is a national logistics node, while Xiangyang and Yichang are the regional logistics nodes and other 14 cities are the key logistics nodes.

The plan requires Yichang Municipality to take full advantages of shipping and transportation to upgrade itself into a regional logistics center that integrates railway, waterway, highway and airway transportation with efficient logistics services, particularly for industries such as the agricultural products and by-products processing, power sector, chemical industry, food, medicine, equipment manufacturing, tourism, etc., and realize the integrated logistics operation mode between segmented transportation and direct transportation. This project will effectively promote the transshipment over the Three Gorges Dam through varied transportation modes such as railways, expressway and water ways. The professional and modernized Baiyang Logistics Node will become a pivotal logistics node of Yichang Municipality.

#### **1.5.4 Master plan of Yichang Navigation Hub and special plan on adjustment of Major urban port area**

##### **(1) Master plan of Yichang Navigation Hub**

Yichang Navigation Hub is a major inland port of China, and a vital transportation hub in the middle and upper reaches of Yangtze River to exchange of goods between Yichang and the neighboring cities. It also plays a vital role in economic and social development as well as aquatic tourism. With transport of containers, coals, roll-roll shipment and tourism transportation by inland river as the focus, Yichang Port will actively develop freight transport including oil products, raw materials, construction materials, etc, accelerate the cultivation of port logistic, bonded warehousing services and trade, promote the establishment of port industrial area, to develop itself into a modernized multi-functional port and the portside region into an industrial park.

Currently, Yichang has planned to construct 72 port lines along the Yangtze River and its major branches has a total length of 104,780 m, of which 32,960 m has already been in service.

Yichang Navigation Hub will be developed into six port districts: Major urban port area, Zigui port area, Xingshan port area, Yidu port area, Zhijiang port area, and Changyang port area. Among them, the main urban port area is the main body of Yichang Navigation Hub, and it contributes to the export-oriented economic development, riverside industrial development, urban construction and resources development of Yichang City and neighboring cities. It also provides transshipment services over the Three Gorges Dam. Major urban port area mainly provides transportation of trade containers, non-metallic ores, mineral building materials, manufactured goods and passengers. The major urban area includes Taipingxi operation area, Binjiang operation area, Linjiangping operation area, Gulaobei operation area, and Yunchi operation area. Zigui port area is located in Zigui County, along the reservoir area of the Three Gorges Project and it mainly provides service for transshipment of the reservoir area, such as transportation of passengers, miscellaneous accessories and roll-roll cargo. Xingshan port area is located in the backwater area of Xiangxi River of the reservoir area of Three Gorges. It mainly provides transportation services of passengers, Phosphate, coal, cement, hazardous goods and miscellaneous accessories. The proposed Baiyang operation area is under the Main Urban Ports District. It is located in the Baiyang Industrial Park. Its

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function is mainly a container transferring hub. The industrial park includes port operation, logistics and storage, and trade and commerce subareas etc. Supported by the Yichang-to-Zhangjiajie Express Way, G318 and Ziyun Railway, the park can provide integrated services for port loading/unloading, logistics, storage and processing. Yidu port area is located in the right bank of Yangtze River of Yidu city, and mainly provides transport services of coal, non-metallic ores and other bulk goods. Changyang port district is located along Qingjiang in Changyang County, and it mainly transports coal, cement and passengers. Moreover, Yichang Navigation Hub also outlines several wharves to provide services for tourism in counties and villages to promote tourism development.

## **(2) Special planning on adjustment to Major urban port district of Yichang Navigation Hub**

To the needs of economic and social development of Yichang Municipality, support the development of industrial park, portside industry layout and urban construction, Yichang Administration for Port and Waterway led the preparation of *Special Planning on Adjustment to Major urban port district of Yichang Navigation Hub (2010-2020)*. This plan makes some adjustments to the plan and layout of operation areas and workshops in major urban port district from two aspects, namely utilization of shoreline resources and overall arrangement of port area, in accordance with new status of economic and social development of Yichang Municipal and its new requirements on construction and development of Major urban port district under the premise of not exerting substantive impacts on nature and function of Yichang Navigation Hub, division and functional orientation of various port districts that are described in reply to *Master plan of Yichang Navigation Hub*.

In order to support development of Baiyang Industrial Park, the riverbank of upper section of Baiyang, namely the riverbank from the location which is 600 meters in upper reaches of Yangjiazui to the location which is 600 meters in lower reaches of Yangjiazui, and the riverbank of lower section of Baiyang, namely the riverbank from the location which is 1000 meters in upper reaches of Guixihu to the location which is about 2,500 meters in lower reaches of Kubaxi, are increased as riverbank of the port.

### **1.6 Comparison and gap analysis with WB standards**

All the applicable domestic laws, regulations, technical standards, specifications, and related documents of this project have been listed and explained in Section 1.2. The differences between domestic EIA system and that of the WB policies have been well studied<sup>1</sup> by others. Due to limits in project schedule and budget, we will only focus on the national laws and standards that are most important and related to this project and have not yet been compared against WB policies and standards.

#### **1.6.1 Regulations on Prevention and Control of Pollution of Inland Waterway**

The applicable regulations about ports and ships environmental management in China is the *Management Regulations on Prevention and Control of Pollution of*

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1. X. Ren, Implementation of Environ Impact Assessment in China, *Journal of Environ Assessment Policy and Management* (Eng), Imperial Colleague Press, No.3, V15, 2013

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*Inland Waters Environment from Ships*. It was first issued as an order (Order No. 11, 2015) from the Ministry of Transportation (MOT). As the original order cannot cope with the new situation, MOT revised it and approved it in the 25<sup>th</sup> session of ministry meeting on December 15, 2015. It became effective on May 1, 2016. The main contents related to the project are as follows:

### **(1) Objective of the regulations**

The objective of these regulations is to prevent and control the pollution of inland waters from ships and their operational activities, and protect inland water environment;

### **(2) Management authorities**

The Ministry of Communications is in charge of nationwide prevention and control of the pollution of inland waters from ships and their operational activities.

The National Maritime Management Department is responsible for supervision and management of the nationwide prevention and control of pollution of inland waters from ships and their operational activities.

The maritime management agencies are specifically responsible for the supervision and management of the prevention and control of the pollution of inland waters from ships and their operational activities within the jurisdictional area in accordance with their respective duties and powers.

### **(3) Responsibilities of the operating and management bodies**

Ports, wharves, loading and unloading stations as well as units engaged in ship building, repairing and dismantling overwater, salvage and other operating activities shall be equipped with corresponding facilities which remain in sound conditions for pollution prevention and control with relevant national norms and standards (such as *Port Construction Project Environmental Impact Assessment Specification* (JTJ105-2011), *Regulations on the Prevention of Environmental Pollution by Ship Scrapping*, *Port Engineering Environmental Protection Design Specification* (JTS149-1-2007), *Management Regulations on the Prevention of Environmental Pollution from Scrapping*, *Supervision and Management Regulations on Ship Disassembling of the Ministry of Communications of People's Republic of China*). The units with the same port, harbor district, operation area or adjacent port can realize the unified deployment of the facilities, installations and equipment for pollution prevention and control by building defense mechanisms.

Ports, wharves and loading/unloading stations should receive ship pollutants generated by the production and operation of the wharfing ships.

Operators of ports, wharves and loading/unloading stations as well as related operating units should formulate emergency plan on the prevention and control of the pollution of inland waters from ships and their operational activities, and organize at least one emergency drill every year and keep records.

Additionally, Article 10 also specifies that, as for the units covering special protected waters on the pollution control of inland water environment, the maritime management department should be consulted in advance to issue navigational notices (warnings). The units with established special protected waters shall also equip facilities for receiving and disposing vessel pollutants.

The ships that sail, berth and operate in special protected waters shall comply with

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the provisions and standards relating to anti-pollution in special protected waters.

#### **(4) Emission and reception of ship pollutants**

**Article 13:** the ships that sail, stock and operate in inland waters shall not discharge pollutants into inland waters against the laws, norms, standards or regulations of the Ministry of Transport. The ship pollutants that do not meet the emission standards shall be received and disposed by the ports, wharves, loading and unloading stations or qualified units.

Ships shall be prohibited from discharging noxious liquid substances and residues or ballast water, tank washings or other mixtures containing such substances into inland waters.

Ships shall be prohibited from using incinerator in inland waters.

Ships shall be prohibited from using soil leakage dispersant in inland waters.

**Article 15:** Litter Notices should be set up in ships with a length of 12m or more to inform the crew and passengers about waste management requirements.

As for the Ships with the capacity of more than 100 tonnage, carrying 15 and more staffs, and travel more than 15 minutes with the distance of more than 2km per single voyage, they shall hold *Ships Waste Management Plan* and *Ships Waste Record Book* which was endorsed by the maritime administrative institutions. The waste collection and disposal process shall be recorded in *Ships Waste Record Book* according to the facts and specifications. *Ships Waste Record Book* should be readily available for inspection, and retained on board for 2 years after use.

The waste collection and disposal process of ships other than Article 2 should be recorded in the Log Book.

**Article 16:** The discharge of waste from ships to inland waters is prohibited. Ships shall be equipped with waste storage containers with lids or bag packed in case of any leakage or spill. The waste generated shall be classified, collected and stored according to the *Ships Waste Management Plan*.

When a ship discharges wastes containing toxic and hazardous substances or other dangerous ingredients into port reception facilities, or the ship entrusts ships pollutant receiving unit, the name, nature and quantity of the materials contained in such wastes shall be informed to the other party in advance.

**Article 17:** When ships are sailing on the inland waters, the sound equipment shall be subject to the specifications as required by the prevention and control of noise pollution.

**Article 18:** The fuel used by ships should comply with the relevant laws, regulations and standards. Use of clean energy is encouraged in ships.

Ships mustn't emit exhaust gas generated during operation of the power plant and volatile organic compounds that exceed standard limits to the atmosphere.

**Article 19:** Shipping waste, ballast water, sewage and other pollutants from infected areas shall not be received and disposed until have passed the quarantine inspection.

**Article 20:** Shipping pollutants receiving unit shall issue the certificate of pollutants reception and disposal upon the acceptance of pollutants. Then the unit shall transfer

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the ship pollutants received to relevant units ashore for disposal in accordance with the regulations.

The certificate shall indicate the name of the operators, time periods and location of operation, and types and quantity of pollutants shall be indicated in the certificate of ship pollutants reception. The shipping party shall sign on it for confirmation. The certificate of ship pollutants reception and relevant record books shall be kept together for future reference.

### **(5) Disposal of shipping pollution emergency**

Shipping pollution emergency will be disposed in accordance with the provisions of the Chapter Five:

**Article 32:** The maritime management department shall cooperate with the local government to formulate shipping pollution emergency plans as the basis of emergency disposal.

**Article 33:** When the pollution accidents take place, the shipping party must report the facts to the nearest maritime management department immediately, start pollution emergency plan or program and take appropriate measures to control and eliminate the pollution. After the initial report, the ship party should also provide the supplementary report in accordance with the disposal progress of the pollution accidents.

The maritime management department shall immediately verify the status after receiving the report, and report to its upper department and the local government or above. The maritime management department and relevant departments shall carry out appropriate emergency countermeasures according to the assignments required by the unified management of the local government.

### **(6) Annex**

**Article 54:** If the provisions related to the prevention and control of shipping pollutants in border waters conflict with the international conventions and agreements that China has concluded or acceded, the latter shall prevail.

### **1.6.2 WB Regulations**

The WB policies and standards on ports and navigations are reflected in the EHS(Environment, Health and Safety) Guidelines below.

#### **(1) EHS Guidelines for ports, harbors and wharves**

***EHS Guidelines for Ports, Harbors and Wharves*** is applicable to the commercial ports and wharves for freight and passengers transport. There are mainly two important issues: environmental problems and occupational health and safety.

##### **1) Environmental problems**

The environmental problems during the construction and operation period for ports and wharves include:

Dredging materials management, biodiversity, atmospheric emissions, general waste reception, wastewater, noise, solid waste management, hazardous materials and oil management, etc

##### **2) Occupational health and safety**

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The occupational health and safety problems during the construction and obsolescence period in the ports are the same as major infrastructures and industrial facilities. The prevention and control of these operation activities can be seen in the *General Guidelines for EHS*. The occupational health and safety problems related to port operations include: physical damages, chemical hazards, closed space, exposure to organic and inorganic dust, and noise.

## **(2) EHS Guidelines for Shipping Environment**

*EHS Guidelines for Shipping Environment* only includes the information about ships during the operation and de-commissioning, which mainly contains two problems: environmental problems and occupational health and safety.

### **1) Environmental problems**

The environmental problems in the construction and operation of ports and wharves include:

Dredged materials management, biodiversity, atmospheric emissions, general waste reception, waste water, noise, solid waste management, hazardous materials and oil management

### **2) Occupational health and safety**

Occupational health and safety problems include: accommodation and workplace for the crews, physical hazards, narrow space, chemical hazards (including fire and explosion risks) and safeguard issues.

#### **1.6.3 Analysis of similarity and gaps**

*Management Regulations on Prevention and Control of Pollution of Inland Waters Environment from Ships* are mostly stipulated from the perspective of managers, the more macroscopic view, and mainly on wastewater, solid waste and accidents other than physical health and safety management. The record is tracked and management is compulsory to some extent; Timing is mainly during the operation period; the existing vessels also cover the pollution control of the operations of both the ships and wharves.

Similarly, *WB Guidelines* also emphasize environmental problems and human health and safety. As for environmental problems, the operability of environmental elements is stipulated and illustrated with more emphasis on the main responsibilities of the operating ships, while the operating party (like wharves) shall also prepare appropriate facilities to meet the environmental requirements of the docking ships. The management cycle covers the whole process, including the construction and operation period.

Both encourage the centralized disposal of wastewater and solid waste ashore, with the principles of the large-scale, centralized, economy, efficiency-orientation.

Both attach great importance to accident risk management and emphasize prevention. Specifically, *WB guidelines* emphasize regular practices whilst the *Regulations* emphasize the emergency management and regional coordination of administrative departments.

*Regulations* are gradually leaning towards the international conventions, particularly on the aspects of management of waste water, exhaust gas and solid waste. The attached Annex also clearly states that, if the provisions related to the prevention and

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control of pollution from ships in border waters are inconsistent with the international conventions and agreements that China has concluded or acceded, the latter shall prevail.

The illustrations in the preface of the Guidelines: In accordance with the EHS Guidelines, the problems should be flexibly handled in accordance with the hazards and risks identified in each project. The basis shall be the results of the environmental assessment. Specific variables of the site (for example, the specific circumstances and the absorption capacity of the environment of the host country) and other factors of the project should be taken into account. Whether the specific technical recommendations are applicable should be subject to the professional, qualified and experienced staff.

When national standards differ from the standards and measures as specified in EHS Guidelines, the more demanding one shall prevail. If less demanding targets and measures are believed to be more suitable when compared with the provisions in the EHS Guidelines and the specific conditions, the detailed demonstration of the proposed alternatives will be needed in the environmental assessment of the site. The demonstration should indicate that the revised targets can protect human health and the environment.

EHS Guidelines indicate that the ports differ from traditional industries in that, there are few fixed sewage discharge sources (wastewater and rainwater) in the port, so that most of the exhaust gas and wastewater are difficult to be continuously monitored. Please refer to the *General EHS Guidelines* for the emission quality of sanitary wastewater and rainwater. 1. As for the combustion source associated with steam and power generation activities, if the thermal power is no more than 50 MWth, its emission standard is included in the *General EHS Guidelines*. If more than 50 MWth, its emission standard is contained in the *Thermal Power EHS Guidelines*. Please refer to the *General EHS Guidelines* for guidance on how to determine the environmental impacts based on the total emission of exhaust gas.

#### **1.6.4 Gap Analysis with *General EHS Guidelines***

Both adopt the principle of implementing more strict applicable standards in the application of environmental regulations and standards. The project must comply with the requirements of both domestic and foreign standards, so that it is necessary to compare and analyze the two sets of regulations and standards. In recent EIA Reports of similar WB financed project (such as Gansu Cultural Heritage Protection Project Phase II), the national regulations and *General EHS Guidelines* are compared and analyzed.

##### **1.6.4.1 Air-related standards**

As the *Ambient Air Quality Standards* (GB3095-2012) and *General EHS Guidelines* are different in the evaluation period of ambient air quality (for example, hourly average, daily average and annual average), the data can't be compared and analyzed one by one. The *Ambient Air Quality Standard* (GB3095-2012) has more specific divisions of assessment period. Some locations of the project are within nature reserves, scenic spots, forest parks and other special protected areas, mainly for the ecological protection, therefore, the Class I standard of *Ambient Air Quality Standards*(GB3095-2012) shall be followed with a more strict concentration limit than that of the ambient air quality guidelines of WHO; the surrounding villages and residential areas are mainly for human health protection, thus the Class II standard of

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the *Ambient Air Quality Standard* (GB3095-2012) should be applied here; Some indicators are generally less demanding than those of ambient air quality requirements of WHO, but still to the requirements of the local ambient air functional zoning. From the perspective of economy, we have to contribute substantial financial and material resources if higher standards are applied anywhere; from the perspective of technique, it adds more difficulties to the implementation period. Ambient air is a regional problem, so it's not so operational to insert regional control within this project. Therefore, the implementation of *Ambient Air Quality Standard* (GB3095-2012) in the ambient air quality of the project can meet the air quality requirements in the project area.

As the construction and operation of the project have little impacts on the ambient air and the pollutants are mostly scattered randomly, the disorganized emission indicators of the *Air Pollutant Emission Standards* (GB16297-1996) are more typical and targeted. However, the emission standards of the unorganized emission of air are not provided in the *General EHS Guidelines*. Compared with the emission standards of small-sized combustion facilities, the emission standards of *Air Pollutant Emission Standards* (GB16297-1996) are stricter, thus this standard can be applied in the air pollution emissions in the project.

#### **1.6.4.2 Water-related standards**

As compared with *General EHS Guidelines*, the *Surface Water Environmental Quality Standards* (GB3838-2002) and *Groundwater Environmental Quality Standards* (GB/T14848-93) have different quality standards to be applied for different water bodies, which are more targeted. Additionally, a variety of water quality indicators are quantified for monitoring and evaluation, so that *Surface Water Environmental Quality Standards* (GB3838-2002) and *Groundwater Environmental Quality Standards* (GB/T14848-93) are implemented in the water environmental quality of the project.

As compared with the sewage disposal discharge standards in the *EHS General Guidelines*, the indicators in the *Pollutant Emission Standards for Urban WWTP* (GB18918-2002) are stricter by dividing into Class IA and IB. It is more targeted. The WWTP takeover standards are implemented in the project, which is not comparable but more suitable to the conditions of the region.

#### **1.6.4.3 Noise-related standards**

Compared with *General EHS Guidelines*, *Acoustic Environmental Quality Standards* (GB3096-2008) is more detailed and specific; meanwhile, the Class 0, 1, 2 standards in the project are stricter than *General EHS Guidelines*, and Class 4a standard is only implemented in special areas like both sides of the main lines, which is more in line with the local conditions. Therefore, the *Acoustic Environmental Quality Standards* (GB3096-2008) is implemented for the acoustic environment of the project.

Compared with the *General EHS Guidelines*, the *Environmental Noise Emission Standards for Construction Site* (GB12523-2011) is more specific to the implementation on the construction site.

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## 2 Project Profile

### 2.1 Location, Investment and Progress

*WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project* is located in Baiyang Industrial Park, Yichang Hi-tech Industry Development Zone. The project consists of the following components: Baiyang Port Operation Area, Baiyang Logistics Park, Road Infrastructures, Three Gorges Modern Logistics Information Center and Project Management & Organizations Capacity Building. The project area is in Baiyang Town, Zhijiang City, which is to the east of the central urban area of Yichang Municipal and on the northern bank of Yangtze River. The project has a total investment of RMB 3.019 billion, including: USD 200 million of WB loan (equivalent to RMB 1.27 billion, at exchange rate of 1:6.35) and 42% of total investment, RMB 851.2 million from the source of commercial bank; and RMB 898 million of loan from domestic financial counterpart fund of Yichang. The total of commercial bank loan and counterpart fund is RMB 1.75 billion, accounting for 58% of the total investment.

The planned project duration is expected 4 years from July, 2016 to December, 2020 in the feasibility study report, as detailed in Table 2.1-1.

**Table 2.1-1 Project Schedule**

<b>Project component</b>	<b>Schedule</b>
Infrastructures of Port and Operation Area	38 months from July, 2016 to August, 2019
Infrastructures of Logistics Park	42 months from December, 2016 to May, 2020
Road Infrastructures	18 months from July, 2016 to December, 2017
Three Gorges Modern Logistics Information Center	16 months from December, 2018 to March, 2020
Project Management & Institutional Capability Building	48 months from January, 2017 to December, 2020

The geographical location is seen in Figure 2.1-1, and the surrounding traffic is seen in Figure 2.1-2.

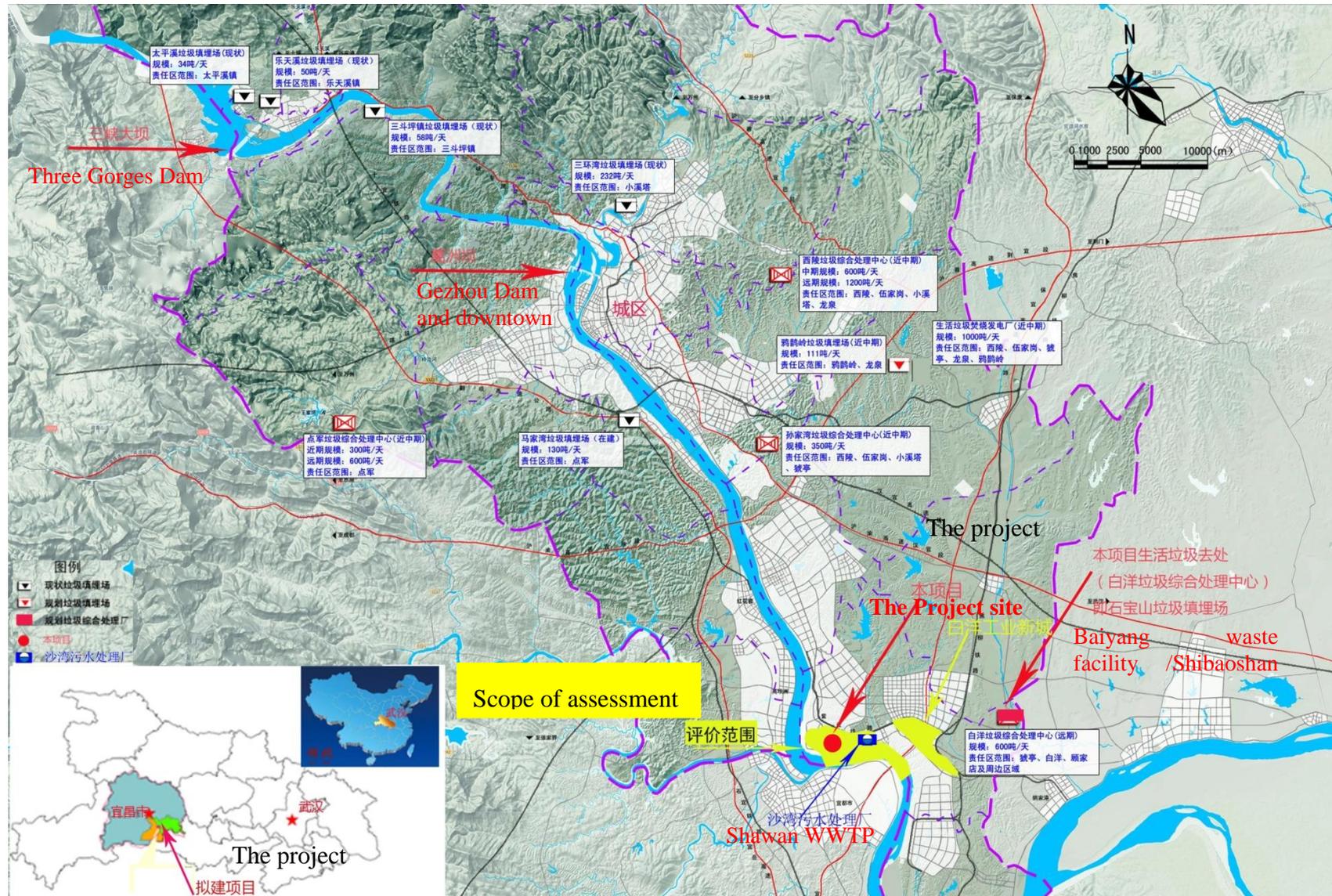


Figure 2.1-1 The Project in relation to dams and Yichang downtown (scope of EA indicated in yellow color)



**Figure 2.1-2 Current Status of Transportation Networks around the Project**

## 2.2 Project components

The project mainly consists of 5 components (Baiyang Port Operation Area, Baiyang Logistics Park, Road Infrastructure, Three Gorges Modern Logistics Information Center, and Project Management & Organizations Capability Building) and 17 sub-components. The project area covers a total area of 142.27 hm<sup>2</sup>.

Details of the components are listed in Table 2.2-1; for plane layout of the project area, see Chapter Three Alternative Schemes and Selection.

**Table 2.2-1 List of project components**

No.	Component	Project Contents
<b>A. Baiyang Port Operation Area</b>		
A1	Water area	Two high-piled beam-slab wharves, two floating wharves, and two inclined wharves will be built in the water area in this project. The <b>high-piled beam-slab wharves</b> shall have dimensions of 216×28m and 102×28m respectively; the <b>floating wharves</b> shall be equipped with 90×16m steel barges in the front, and the <b>inclined wharves</b> shall be equipped with 65×16m steel barges in the front.
A2	Land area	One 3000-tonner <b>heavy lift cargo berth</b> , four <b>bulk berths</b> , and two <b>multi-purpose berths</b> will be built, which will stretch for 1036m along the riverbank; the total land area of the port zone will be 44.9hm <sup>2</sup> (including the levee); The port is designed with cargo handling capacity of 7 million tons per year (including general cargo handling capacity of 1.2 million tons per year, bulk cargo handling capacity of 5 million tons per year, and container handling capacity of 80,000 TEU (equivalent to 0.8 million tons/year); appropriate loading and unloading equipment shall be provided; container yard, road, production facilities and auxiliary production facilities shall be built.
<b>B. Baiyang Logistics Park</b>		
B1	Mixed-use logistics area	It is located behind Baiyang Port Operation Area and covers an area of 518 mu (1 mu = 0.0667 hectare). It includes: urban freight distribution area, food storage area, staging area, parking area, intelligent freight distribution center (third-party or fourth-party logistics enterprises), integrated management and logistics information center, living service area, and auxiliary operation area.
B2	Trade and logistics area A	It covers an area of 357 mu and includes: storage area, circulating and processing area, exhibition and trade area, auxiliary operation area, and storage yard.
B3	Trade and logistics area B	It covers an area of 473mu and includes: storage area, circulating and processing area, auxiliary operation area, and storage yard.
<b>C. Road Infrastructure</b>		
C1	External Road	<b>Shawan Road Overpass:</b> It starts from the north of Songgang Second Road, goes up and overpasses Baiyang Avenue toward the north, and ends at the entrance road in the east side of Ziyun Railway Marshaling Yard. It is an urban secondary trunk road with total length of 675m; the overpass is an aerial construction, with width of 17m and two-way four lanes, and total length of 280m; the minimum radius of horizontal curve of the overpass is 120m, the maximum longitudinal gradient of the section is 4.8%, and the minimum clearance is 5m.
C2	Internal Road	<b>Guihu Road:</b> It is in south-north direction and starts at Shawan Road and ends at Baiyang Avenue. It is an urban secondary trunk road with width of 30m, two-way four lanes, and total length of 1,126m. Integrated pipeline network infrastructures such as road drainage, lighting, and communication facilities are involved.

No.	Component	Project Contents
		<b>Songgang Second Road:</b> It is in east-west direction and starts at Guihu Road and ends at Shawan Road. It is an urban secondary trunk road with width of 30m, two-way six lanes, and total length of 900m. Integrated pipeline network infrastructures such as road drainage, lighting, and communication facilities are involved.
C3	Transport facilities	Detailed design of intersections inside the park, construction of parking facilities inside the park, construction of commuting system in the park, and traffic management in the park.
<b>D.Three Gorges Modern Logistics Information Center</b>		
D1	Business application system	Office automation system, comprehensive park supervision service, integrated logistics information service, business information service, regional logistics big data analysis platform
D2	Host and storage system	Computation server, data server, storage system, disaster recovery backup system, virtualized resource platform, network communication etc.
D3	Central Apparatus Room	Host room, space, cabinet system, power supply system, firefighting system etc.
<b>E. Project Management &amp; Institutional Capability Building</b>		

## 2.3 Construction schemes and processing

### Baiyang Port Operation Area

#### 2.3.1.1 Designed capacity and cargo categories

The designed capacity and cargo categories of Baiyang Port Operation Area are shown in Table 2.3-1.

**Table 2.3-1 Cargo categories and transport capacity**

No.	Cargo category	Unit	Amount	Remark
1	Container: food, biomedicine, textile, machinery	10,000 TEU/year	8	
2	Steel, iron and miscellaneous items	10T/year	120	
3	Bulk cargo (sand and stone, pottery clay, glass sandstone)	10T/year	260	Import
4	Bulk cargo (phosphate ore, limestone), grain, fertilizer, white wine	10T/year	240	Export (food and fertilizer, white wine, yeast)
5	Total	10T/year	700	

#### 2.3.1.2 Technological process

The proposed project includes new construction of seven 3,000-tonner berths, namely, two bulk import berths, two bulk export berths, one general & heavy cargo berth, and two multi-purpose berths. Supporting facilities such as bulk cargo storage yard, general cargo storage yard, and container storage yard are provided behind the wharves. General cargo warehouse and container freight station are both built in the transfer logistics park at the back.

Main technological schemes for loading and unloading are as follows:

## **a. Wharf and back land area at #7 berth**

#7 berth is a general & heavy cargo berth and the wharf is vertical-structured. The wharf platform is equipped with 2 sets of 40t-30m gantry cranes. Gantry cranes will be used for handling steel and iron, construction materials and mechanical equipment less than 40t, and crane ships will be rented for handling mechanical equipment from 40 t~80 t. Tractor and flatbed trucks will be used for horizontal transport of general cargo. Horizontal transport vehicles shall be provided by the owner of the cargo to carry the mechanical equipment above 40 ton.

### **Technological processing procedures:**

Steel, iron and general cargo (general & heavy cargo berth): ship ↔ gantry crane ↔ tractor, flatbed truck ↔ wheel-mounted crane, goliath crane ↔ steel, iron, and general cargo storage yard

Bulk cargo (export berth): out of port → dump truck → storage yard → single bucket loader → fixed receiving hopper → fixed belt conveyor system → arc track loader → ship

Bulk cargo (import berth): ship → floating crane → fixed receiving hopper → fixed belt conveyor system → mobile belt conveyor system → fixed belt conveyor system → mobile belt conveyor system → storage yard → single bucket loader → dump truck → out of port

Container (multi-purpose berth): ship ↔ quay crane, multi-purpose gantry crane ↔ container tractor, semitrailer ↔ container straddle carrier ↔ container straddle carrier ↔ container yard outside the embankment

Steel (multi-purpose berth): ship ↔ multi-purpose gantry crane ↔ tractor, flatbed truck ↔ wheel-mounted crane ↔ general cargo storage yard

General cargo (multi-purpose berth): ship ↔ gantry crane ↔ tractor, flatbed truck ↔ wheel-mounted crane ↔ general cargo storage yard

General cargo (multi-purpose berth): ship ↔ gantry crane ↔ tractor, flatbed truck ↔ forklift truck ↔ warehouse at transfer logistics area

### **2.3.1.3 Hydraulic structure**

#### **(1) #7 berth (general & heavy cargo)**

It consists of a wharf platform, a transformer platform and an approach bridge. The wharf platform is totally 102m long and 28m wide, and the space between framed bents is 8m. It is divided into two structural sections and structured with cantilever beam joint.

An approach bridge is established behind the pile deck to connect the land area. The elevation at the top of the approach bridge outside the embankment is 50.50m, as high as the wharf surface; it is 32.5m long and 12m wide, and has overhead framed bent structure.

## **(2) #8 and #9 berth (bulk cargo export berth)**

Both berths are structured with similar floating wharves, consisting of a barge, a steel approach bridge and a transfer station platform. The plane dimension of both barges is 90×16m; a 48×4m steel approach bridge is built at the back of each berth to connect to the abutment of the transfer station.

## **(3) #10 and #11 berth (inlet of bulk cargo)**

The wharves consist of a substantial ramp, a barge, and a steel approach bridge. The plane dimension of the barge is 65×16m. A 13×4m steel approach bridge is built in the back to connect with the substantial ramp at each berth. The two ramps are paralleled along the bank, extending to the downstream with an angle of about 11 degrees with the embankment; the horizontal projection of the two ramps is respectively 130m and 140m; both ramps are 9m wide, with a gradient of 1:10.

## **(4) #12 and #13 berth (multi-purpose berth)**

Both berths consist of a wharf platform, a transformer platform and two approach bridges. The wharf platform is 216m long in total and 28m wide; the elevation at the top of the approach bridge outside the embankment is 50.50m and is flush with the wharf surface; it is 26.8m long, the upstream approach bridge is 15m wide and the downstream approach bridge is 12m wide. The wharf, transformer platform and approach bridge structure are the same with #7 berth.

### **2.3.1.4 Land area, road and storage yard**

#### **(1) Land area**

Elevation of land area is 48.5m and earthworks are needed.

#### **(2) Road**

Road in the port is ring-shaped. Gangqu Avenue is 24.5~36m wide, and road in the port area is 7m~12m wide.

#### **(3) Storage yard**

Storage yards in the port are mainly heavy container yard, empty container yard, general cargo container yard, bulk cargo yard, general cargo yard, and parking lots, etc. All the storage yards are of interlock block structure.

### **2.3.1.5 Information and communication**

Information and communication include wired communication (automatic telephone) system, wireless communication system, and ashore communication system.

### **2.3.1.6 Water supply, drainage and firefighting**

#### **(1) Water supply sources**

Water supply sources: domestic water for the port area, the ships, and firefighting are sourced from urban tap water. The water quality meets the existing standards for *Drinking Water Quality* (GB5749-2006).

**(2) The amount of water consumption**

The amount of water consumption is shown in Table 2.3-2~Table 2.3-4.

**Table 2.3-2 Maximum daily tap water consumption of #7 ~ #11 berth and their land area**

NO	Item	Standard water consumption	Water consumption	Remark
1	Ship water supply	60m <sup>3</sup> /ship·d	240m <sup>3</sup>	Kh=1.2, T=24h
		70m <sup>3</sup> /ship·d	70 m <sup>3</sup>	Kh=1.2, T=24h
2	Domestic water of staff	50L/person·d	20.3 m <sup>3</sup>	Kh=2.0, T=24h
3	Water for production	Machine maintenance and vehicle washing	6 m <sup>3</sup>	Kh=1.2, T=6h
4	Unforeseen water demand	(①+②+③+④+⑤) ×0.25	84 m <sup>3</sup>	
5	Maximum daily water consumption	①+②+③+④+⑤+⑥	420.3 m <sup>3</sup> /d	
6	Maximum hourly water consumption		18.8 m <sup>3</sup> /h	
7	Water consumption for one firefighting event		310 m <sup>3</sup>	firefighting at one time

**Table 2.3-3 Maximum daily miscellaneous water consumption of #7~#11 berths and their land area**

NO.	Item	Standard water consumption	Water consumption	Remark
1	High-pressure spraying water for bulk storage yard	4.0L/ (m <sup>2</sup> ·d)	222 m <sup>3</sup>	Kh=1, T=8h
2	Spraying water for transfer station	8.64m <sup>3</sup> /h	86.4 m <sup>3</sup>	Kh=1, T=10h
3	Spraying water for road	0.5L/ (m <sup>2</sup> ·d)	16.9 m <sup>3</sup>	Kh=1, T=4h
4	Water for forestation	2.0L/ (m <sup>2</sup> ·d)	16.7 m <sup>3</sup>	Kh=1, T=2h
5	Unforeseen water demand	(①+②+③+④) ×0.25	85.5 m <sup>3</sup>	
6	Maximum daily water consumption	①+②+③+④+⑤	427.5 m <sup>3</sup> /d	
7	Maximum hourly water consumption		48.9m <sup>3</sup> /h	

**Table 2.3-4 Maximum daily tap water consumption of #12~#13 berths and their land area**

NO.	Item	Standard water consumption	Water consumption	Remark
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NO.	Item	Standard water consumption	Water consumption	Remark
1	High-pressure spraying water for bulk storage yard	4.0L/ (m <sup>2</sup> ·d)	222 m <sup>3</sup>	Kh=1, T=8h
2	Spraying water for transfer station	8.64m <sup>3</sup> /h	86.4 m <sup>3</sup>	Kh=1, T=10h
3	Spraying water for road	0.5L/ (m <sup>2</sup> ·d)	16.9 m <sup>3</sup>	Kh=1, T=4h
4	Water for forestation	2.0L/ (m <sup>2</sup> ·d)	16.7 m <sup>3</sup>	Kh=1, T=2h
5	Unforeseen water demand	(①+②+③+④) ×0.25	85.5 m <sup>3</sup>	
6	Maximum daily water consumption	①+②+③+④+⑤	427.5 m <sup>3</sup> /d	
7	Maximum hourly water consumption		48.9 m <sup>3</sup> /h	

### (3) Water supply system

Two water supply pipeline systems are installed for #7 and #11 berths and their land area in the port area: one is for domestic water + shipping water + production + outdoor firefighting, and the other is for the bulk storage yard and environment protection. Water for landscaping and road watering is supplied by environmental protection sprinkler. It usually comes from environmental protection recycling water pond and will be refilled with water from miscellaneous water pipelines if insufficient from water pond.

The water pipelines for domestic water + shipping water + production + outdoor firefighting is ring-shaped and paved along the road in the port area. The main pipe diameter is DN150. Domestic water for buildings is supplied from branch pipelines from the ring-shaped water supply pipelines in the port area. The water pipeline for environmental protection water in the bulk storage yard has pipe diameter of DN150-DN100, and is installed along the periphery of the bulk storage yard.

### (4) Water drainage

Rainstorm-sewage separation system will be adopted in the port area.

#### i). Rainwater drainage system

The land area of #7~#11 berth is divided into 3 water drainage areas, namely, the livelihood service area and steel storage yard, bulk storage yard, and steel storage yard outside the embankment. Buried pipeline system is provided in the livelihood service area and steel storage yard within the embankment. The rainwater will be collected to be flowed into the rainwater drainage pipelines in the port area; The outlet pipe diameter is D700; first flush rainwater (first 15 minutes) in the bulk storage yard is collected by open drain and discharged to the storage pond. It will be used as the spraying water after precipitation in the storage pond (refer to

Chapter11 EMP for details); later rainwater is discharged into the municipal rainwater pipelines via the transfer valve; the diameter of the overflow pipe is D800. Rainwater in the steel storage yard outside the embankment is directly converged into the open drain in the land area of the Baiyang Operations Area Preliminary Project. Land area of #12~#13 berth is 1 drainage section, both equipped with buried pipeline system; the outlet pipe diameter is D1200. Rainwater is elevated by the drainage pump to be discharged into the open drain in the east of the port area.

## ii). Wastewater system

**Domestic wastewater:** The port buildings will discharge sewage and wastewater together. The maximum domestic sewage discharged from #7-#11 Berths in this port area amount to 40.3m<sup>3</sup>/day. No domestic wastewater is discharged from the land area of #12~#13 Berth. Domestic wastewater will be treated in septic tanks before being discharged into the planned municipal wastewater pipeline networks.

**Production sewage and wastewater:** Production wastewater produced in the port area is primarily wastewater generated from road flushing. Such wastewater is lightly contaminated and the major pollutant is SS (suspended solids). First flush rainwater sedimentation basins have been constructed in front of the drainage outlets of storage yards in order to collect first flush rainwater and production wastewater at the yards, such rainwater and wastewater can be treated in the sedimentation basins to be reused for flushing the yards.

Bilge oil water produced comes primarily from the machine repair wastewater and the water used for flushing containers. After being desalted and treated by oil-water separator, oil content is 10~20 mg/L and reaches the Class III standard in the Table 4 of *Integrated Wastewater Discharge Standards (GB8978-1996)*. Then it enters the wastewater networks of the port area to be transferred to Shawan WWTP for further treatment.

## (5) Firefighting

An urban firefighting station will be constructed about 3km from the project site for fire control. Firefighting for this port area falls under the jurisdiction of the firefighting station. The DN200 pipelines are installed indoors and outdoors at the start of the Baiyang Port Operation Area project. Water for firefighting can be provided outdoors on land for the #7-#11 Berth of this project. In addition, automatic fire pumps are installed indoors and serve as indoor fire hydrants for firefighting in case of fire occurring on the projects berths 7-11. Starting at Shawan Road where the land area of #12-#13 Berth is located, DN400 pipes are installed to install the municipal pipeline network to supply firefighting water.

### 2.3.1.7 Production and ancillary buildings

See Table 2.3-5 for information of production and ancillary buildings

**Table 2.3-5 Production and ancillary buildings**

No.	Item	Floor area (m <sup>2</sup> )	Number of floors, height or its eave height (m)
1	Transfer Station G2-Z01	145	2 floors, 10.7m

No.	Item	Floor area (m <sup>2</sup> )	Number of floors, height or its eave height (m)
2	Transfer Station G2-Z02	110	2 floors, 12.8m
3	Weighbridge Room G2-#1-#4	17*4=68	
4	Gatehouse G#2-#3-#5	17*3=51	1floor, 3.6m
5	Substation G2-A	155	1floor, 3.6m
6	Substation G2-B	155	1floor, 5.4m
7	Substation G2-C	133	1floor, 5.4m
8	General distribution substation G2	165	1floor, 5.4m
9	Office G2	3214	5 floors, 19.2m
10	Tool Warehouse G2	333	1floor, 7.5m
11	Mobile Machine Warehouse G2	311	1floor, 7.5m
12	East Gate	485	1floor, 12m
13	Substation G2-E	130	1floor, 5.4m
	Total	5455	

### 2.3.1.8 Major technical and economic indicators

See Table 2.3-6 for the major technical and economic indicators of Baiyang Port Operation Area

**Table 2.3-6 Major technical and economic indicators of Baiyang Port Operation Area**

No.	Item	Unit	Quantity	Notes	
1	Designed throughput	10,000 t/y	700		
	Of which	Bulk cargo export	10,000t/y	240	
		Bulk cargo import	10,000t/y	260	
		Sundry iron & steel products/parts	10,000t/y	120	
		Containers	10,000TEU	8	1TEU=10t
2	Designed throughput	10,000t/y	765		
3	Number of berths (3000t)	Number	7		
4	Length of covered coastline	m	1036		
5	Area of the land	mu	674		
6	Loaded container yard	m <sup>2</sup>	43280		
7	Empty container yard	m <sup>2</sup>	10950		

No.	Item	Unit	Quantity	Notes
8	Sundries, container yard	m <sup>2</sup>	/	
9	Bulk cargo storage yard	m <sup>2</sup>	63247	
10	Sundry cargo storage yard	m <sup>2</sup>	46368	
11	Area of roads	m <sup>2</sup>	69641	
12	Parking lot	m <sup>2</sup>	18838	
13	Supporting areas	m <sup>2</sup>	8829	
14	Personnel quota in the port area	Number	506	

### 2.3.2 Construction plan for Baiyang Logistics Park

Baiyang Logistics Park consists of the integrated logistics zone, commerce & logistics District A, and commerce & logistics District B. See Table 2.3-7 for details.

**Table 2.3-7 Functional areas of Baiyang Logistics Park**

	Function zoning	Functional area	Floor area (m <sup>2</sup> )	Planned floor area (mu)
Baiyang Logistics Park	Integrated Logistics Zone (493mu of planned area)	Food Warehouse	19497	84
		Transit Express Shipment	11600	86
		Urban Distribution Center	15075	75
		General Management and Logistics Information Center	32100	67
		Intelligent Freight Distribution Center	21000	90
		Parking Lot	—	27
		Supporting Area	1650	25
		Livelihood Service Area	22954	39
	Commerce & Logistics District A (272 mu of planned area)	Warehouse Area	22188	83
		Distribution/Processing Zone	12376	46
		Storage Yard	—	91
		Exhibition/Trade Area	—	24
		Supporting Area	—	8
		Parking Lot	—	20
	Commerce & Logistics District B (384 mu of planned area)	Warehouse Area	16668	62
		Distribution/Processing Zone	25211	94
		Storage Yard	—	199
		Supporting Area	—	9

	Function zoning	Functional area	Floor area (m <sup>2</sup> )	Planned floor area (mu)
		Parking Lot	—	20
Total (except for the roads in the Park)			—	1149

### 2.3.2.1 Production process

#### (1) Integrated logistics zone

The integrated logistics zone is divided into two distribution warehouses, four food warehouses, two express cargo yards, and other supporting facilities for production and daily life, processing workshops and warehouses.

**i). Distribution warehouse** Distribution Center W11-1-#, is installed with two continuous spans with a size of 162m×18m×2. This center is equipped with 4 sets of 16t-16.5m bridge cranes; under each span there are 2 bridge cranes with the support of forklifts. Vehicles may drive into the center where cargos can be loaded or unloaded from these vehicles. Distribution Center W1-#2 (168m×48m) has a cargo loading platform on its two sides. Both this center and its platform are 1.35m higher than outdoor ground. A gangway connection is installed on the platform for loading and unloading cargos. Vehicles are parked vertically to the platform. Forklifts are used in this warehouse.

**ii). Food warehouse:** Food Warehouse1-#1 and 1-#2 (both 180m×24m) have a cargo loading platform on one side. Each of Food Warehouse#1-#3 and Food Warehouse1-4# is 180m×36m and has a cargo loading platform on two sides. Both food warehouses and their platforms are 1.35m higher than the outdoor ground. A gangway connection is installed on the platform for loading and unloading cargos. Vehicles are parked vertically to the platform. Forklifts are used in the warehouses.

**iii). Express cargo yard:** Express cargo yard W#1-1# is equipped with a 16t wheel-mounted crane and express cargo yard W#1-2# is equipped with a 30t wheel-mounted crane.

**iv). Production supporting facilities:** Workshop W1 and Tool Library W1 are jointly constructed with the size of (60+30) m×18m. The maintenance workshop and the tool warehouse share one 5t-16.5m electric mono-beam crane.

**v). Sundries Warehouse:** Warehouse #3-1 and Warehouse #2 are both 168m×42m. Each of the two warehouses has a cargo loading platform on two sides. Both the warehouses and their platforms are 1.35m higher than outdoor ground. A gangway connection is installed on the platform for loading and unloading cargos. Vehicles are parked vertically to the platform. Forklifts are used in the warehouses.

**vi). Processing plant:** W3-1#, 2# processing plants shall be structured in 3 successive span mode. The dimension for warehouse W3-1# is 132m×24m×3m. The dimension warehouse W3-2# is mainly 216m×24m×3m. The span of each plant is equipped with 2 bridge cranes (16t-22.5m). Vehicles for loading and unloading operations in the plant shall also be considered. The processing only involves physical processing and deformation, so as to process the longer one into the standard pieces for easy package and transport. Painting, coating or cleaning are not involved.

### **2.3.2.2 Land formation, roads and storage yards**

#### **(1) Land formation**

In consideration of the topographic & geologic conditions of the site and investment, land formation uses backfill with earth materials from open cutting. The site shall be cleared before backfill. After backfill, the backfilled earth shall be compacted by layers by vibrating compactor, 300mm thick each layer, to reach the compactness of 93%~96%. Then, the structural layer of storage yard and roads are constructed. The backfill materials are the earthworks generated through open cutting and leveling in the site of Baiyang Industrial Park.

#### **(2) Roads**

Roads are made in ring shape. Trunk roads in the port are 24.5 ~ 36m wide and common roads are 7m~12m wide.

#### **(3) Storage yards**

Storage yards in the port area mainly include heavy container yard, empty container yard, break bulk yard and parking lot. All yards and sites are interlocking blocks.

### **2.3.2.3 HVAC and lighting**

#### **(1) HVAC**

Electricity, rather than boilers will be used for heating and hot water supply.

#### **(2) Lighting**

Outdoor illumination standard is 15Lx for bulk yard and 20Lx for container yard. The lighting equipment is provided in the following: 25m 24×400W sodium lamps at yards, 9m LED 135W lamps on main roads, and 15m high 6×400W sodium lamps at parking lot and main crossroads.

Offices shall be installed with three-band fluorescent lamps with illumination standard 300Lx; warehouses and workshops shall be provided with high-power energy-saving lamps, with illumination standard 100Lx.

Three-band fluorescent lamps shall be provided with illumination standard 200Lx at the high/low-voltage distribution room of power substation and with illumination standard 300Lx at control room.

### **2.3.2.4 Water supply & drainage and fire control**

#### **(1) Water supply source**

The logistics park provides watering cart to wet roads and irrigate green belt. The water for this purpose comes from the first flush rainwater collected after sedimentation from storage yards. It is also from tap water if the rainwater is not enough. The tap water quality meets the requirements of the existing *Sanitary Standard for Drinking Water* (GB5749-2006).

The tap water source is the DN800-DN400 municipal water pipeline under surrounding municipal roads. DN250 pipes will be used to draw water from different

sections of the municipal water pipeline. At pipe connection points, the permanent pressure shall be not below 0.55MPa and the permanent flow shall be not below 73L/s.

## (2) Water consumption

Water consumption in this component mainly includes domestic water, water for industrial production and water for roads and landscaping, as shown in Table 2.3-8.

**Table 2.3-8 Tap water consumption of the logistics park**

No.	Category	Water consumption criteria	Daily water consumption (m <sup>3</sup> /d)
1	Domestic water (including the canteen)	150L per person each day for people living in the logistics park; 50L per person each day for people not living in the logistics park	136
2	Roads and landscaping	3L/d·m <sup>2</sup>	300
3	Unforeseen water consumption and water leakage		87
4	Maximum daily water consumption		523
5	Maximum water consumption in one hour		64m <sup>3</sup> /h
6	One-time water consumption for fire control	1314m <sup>3</sup> /time	Warehouses

## (3) Water supply system

There are two water supply pipeline systems: one for automatic sprinkler + indoor fire hydrants in tall buildings, with trunk pipelines in ring-shaped, pipe diameter DN250, and the other at outdoor for other purposes, paved in ring-shaped along roads, diameter of pipes: DN250-DN150.

## (4) Water drainage

Outdoor drainage adopts rainwater-sewage separation system, whilst indoors domestic wastewater adopts joint discharge of sewage and wastewater.

### a) Rainwater system

Rainwater flows into the storm water drainage pipelines through gutter inlets and finally is discharged into open ditch.

### b) Wastewater system

Domestic wastewater system: in one building, domestic sewage and wastewater are discharged through the same pipeline. After treated in septic tank, domestic sewage is discharged into the municipal sewage pipeline networks.

Industrial wastewater system: the industrial wastewater in the logistics park mainly comes from road surface flushing water and other lightly polluted water, and the major pollutant is SS. Sedimentation pond is set before drainage outlet at storage

yards to collect first flush rainwater and industrial wastewater. The sedimentation water will be recycled for floor flushing at storage yards.

The industrial wastewater produced by machine maintenance workshop is treated at oil trap and then discharged into the sewage pipe of the logistics park and finally into the Shawan WWTP.

### (5) Firefighting

Water supply is conveyed through DN800–DN400 municipal ring-shaped pipelines nearby the project site. It will serve as the water source of this project.

### 2.3.3 Construction scheme

#### 2.3.3.1 Bridge works

The bridge over Shawan Road starts from station No. K0+199 and ends at station No. K0+467 with a total length of 268m, including 8 spans: (4×30+35+40+35+30) m as a whole. The section from Bridge Pier P5 to P6 extends across Baiyang Avenue, with net clearance not less than 5.0m. With the net width of 17.0m, the bridge uses equal cross-section pre-stressed concrete continuous beam structure. Refer to Figure 2.3-4 for vertical layout of the bridge and Figure 2.3-5 for cross-sectional layout of the bridge.

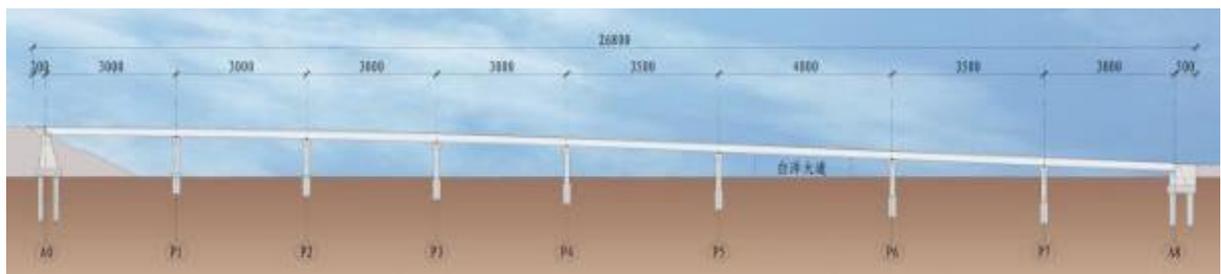


Figure 2.3-4 Vertical layout of the bridge

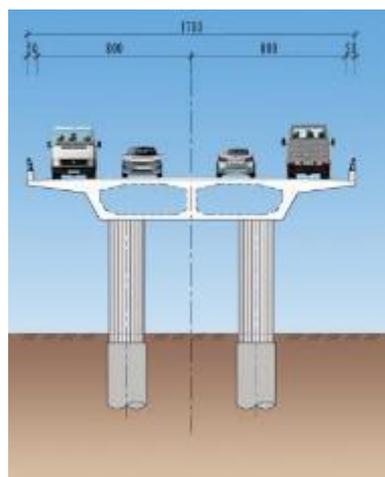


Figure 2.3-5 Sectional layout of the bridge

#### 2.3.3.2 Road works

Standard cross-section of Guihu Road: 7.5m (sidewalk) + 16m (carriageways) + 7.5m (sidewalk) =30m; Standard cross-section of Songgang Road: 3m (sidewalk) +

24m (carriageways) + 3m (sidewalk) = 30m.

### 2.3.3.3 Forecast of traffic volume

According to the FSR of the project, the results of long-term (Year 2023) forecast of road traffic volume are as shown in Table 2.3-9.

**Table 2.3-9 Traffic volume of roads (unit: pcu/d)**

No.	Roads	Traffic volume		
		Short term	Mid-term	Long term
1	Guihu Road	156	200	298
2	Second Songgang Road	576	735	1097
3	G318	2477	3161	4718
4	Bridge over Shawan Road	303	387	578
Ratio of large, medium and small vehicles=22:33:45				

**Remarks: calculated by the FSR**

### 2.3.3.4 Pipeline works

Pipeline works include water supply & drainage pipelines, communication pipelines, power pipelines and gas pipeline on Songgang Second Road and Guihu Road.

## 2.4 Objectives of Environment Protection

### Sensitive receptors for surface water protection

The water intakes is located near the site of this project, including water intake quantity and distance from wharf, are given in Table 2.4-1 and Figure 2.4-1.

**Table 2.4-1 Sensitive receptors for surface water protection**

Water intakes	Distance from wharf	Water intake quantity	Purposes	Remarks	Protected area
Baiyang Town Water Supply Plant	1.5km downstream from berth 11	5,000t/d	Domestic water	existing, but plans to be cancelled	Class-I protected area: 1000m upstream and 100m downstream;  Class-II protected area: 3000 m upstream and 300m downstream
Tianjiahe Water Supply Plant	3.8km downstream from berth 11	250,000t/d	Domestic & industrial water	Planned	
Requirements	For Class-I protected surface waters as drinking water source, the limit of basic indicators of water quality shall be not below the class-II standards of GB 3838-2002 and the limit of additional and special indicators shall meet the requirements of this standard; for grade-II protected surface waters as drinking				

Water intakes	Distance from wharf	Water intake quantity	Purposes	Remarks	Protected area
					water source, the limit of basic indicators of water quality shall be not below the Class-III standards of GB 3838-2002 and if flowing into Grade-I protected area, the water quality must meet the criteria of Class-I protected area; for the surface waters as drinking water source planned to be protected areas, the water flowing into Class-II protected area shall meet the criteria of Class-II protected area.

This project is within the Class-II protected area of Baiyang Town Water Plant as drinking water source. In accordance with the *Explanation of the Construction Management Office of Baiyang Industrial Park, Yichang High-tech Zone on the Construction of Supporting Facilities of Baiyang Port and Baiyang Logistics Park*, the office has determined to cancel Baiyang Town Water Plant and incorporated it into Xiaoting WTP by December 2011. Now the two plants are operating jointly and existing water intake of Baiyang Town Water Plant is used as backup water source.

#### 2.4.2 Target of ambient air and acoustic environment

Some residents of Yazishan Village and Guixihu Village are within the red line of the proposed project and included in the scope of land acquisition and structure demolition. The dwellings at Baiyang Town, Guixihu Village, Yazishan Village and Wanfunao Village within the radius of 2,500m and out of the boundary lines of land acquisition are taken as sensitive spots for atmospheric and acoustic environment protection.

Atmospheric and acoustic sensitive receptors in and near the site of the proposed wharf are shown in Table 2.4-2 and Figure 2.4-1.

**Table 2.6-2 List of sensitive spots**

Environment	Sensitive receptors	Scale	Relative location	Remarks
Acoustic environment	Guixihu Village, Baiyang Town	10 households, about 30 persons (mainly 2-3 storey brick-concrete structure buildings)	Locating to the west of the port, about 50m from west boundary wall of the port	demolished
	Yazishan Village, Baiyang Town	500 households, about 1670 persons (mainly 2-3 storey brick-concrete structure buildings)	Locating to the north of the port, about 60m from north boundary wall of the port	Partial demolition, 200 households stay
Atmospheric environment	Baiyang Town	300 households, about 980 persons (mainly 2-3 storey brick-concrete structure buildings)	Locating to the east of the port, 1.30km from the site of the project according to the shortest path	
	Guixihu Village, Baiyang Town	600 households, about 2089 persons (mainly 2-3 storey brick-concrete structure buildings)	Locating within the site of this project	Buildings plan to be demolished

Environment	Sensitive receptors	Scale	Relative location	Remarks
	Yazishan Village, Baiyang Town	500 households, about 1670 persons (mainly 2-3 storey brick-concrete structure buildings)	Locating to the north of the port, about 60m from north boundary wall of the port	200 households remain and all others move out
	Wanfunao Village, Baiyang Town	700 households, about 2547 persons (mainly 2-3 storey brick-concrete structure buildings)	Locating to the west of the port, about 1.00km from west boundary wall of the port	

### 2.4.3 Ecological sensitive receptors

According to our investigation, the wharf of this project locates at the periphery of the Chinese sturgeon protection area (refer to Annex 1: *Letter on Explaining the Issues Concerning Site Selection of the WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project*). The ecological sensitive receptor is the Chinese sturgeon protection area in Yichang section of Yangtze River, a provincial level natural reserve as shown in Figure 3.6-1. More details are provided in Section 6.4.3.

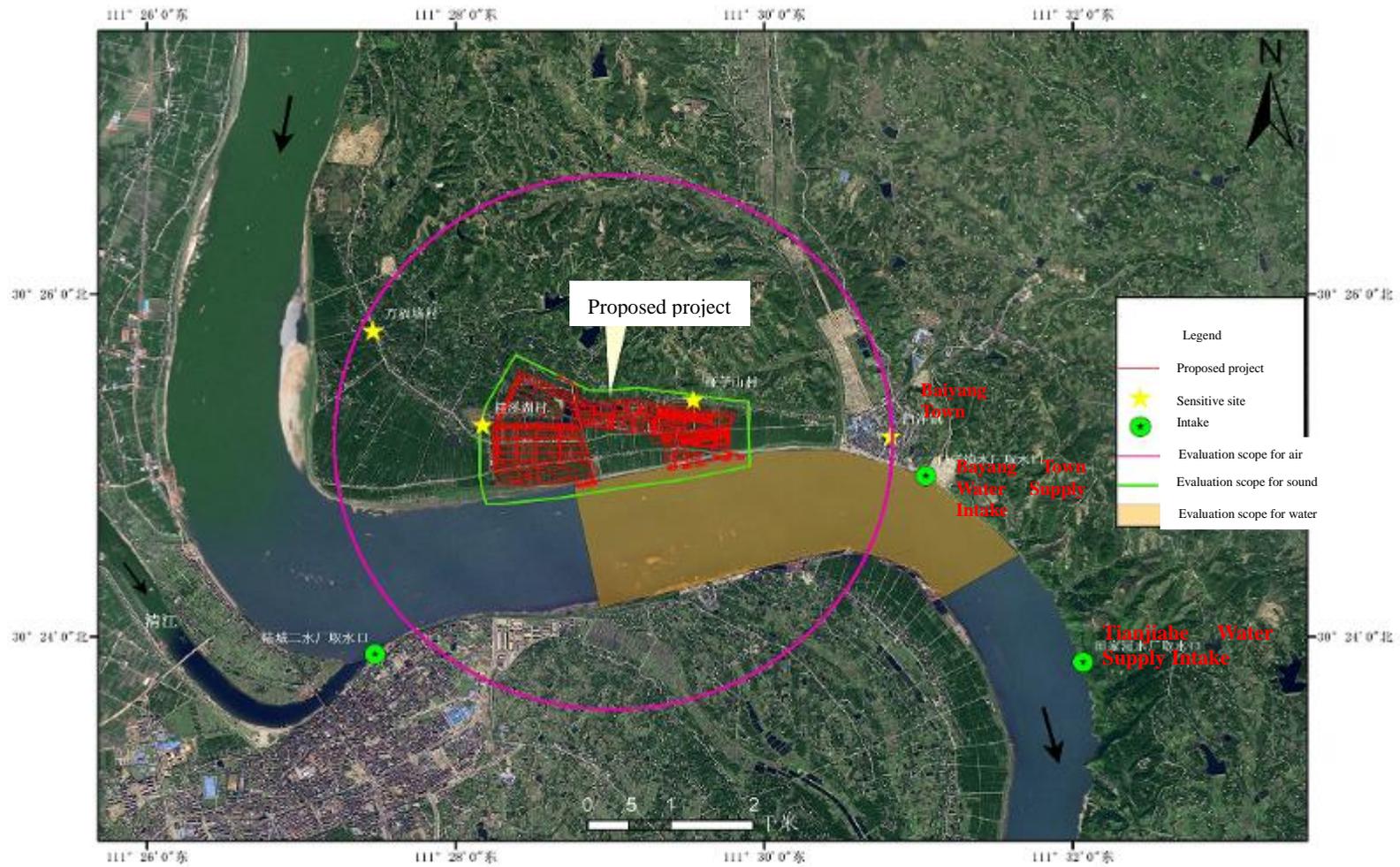


Figure 2.4-1 Atmospheric and acoustic sensitive receptors

## 2.5 Associated facilities

The wastewater produced during this project will be treated by Shawan Wastewater Treatment Plant about 200 m away from the project site. Solid waste will be disposed in the urban solid waste management system. The excess earth from the construction of Baiyang industrial new area will be used for the earthworks backfill of the project.

### 2.5.1 Baiyang Township Shawan WWTP

Baiyang Township Shawan WWTP is located at one side of the Yangtze River to the east of Baiyang port and to the south of Baiyang Avenue. The construction content of Phase I includes the main works of the plant with a capacity of 50,000m<sup>3</sup>/day and the 14010m sewage collection pipeline. This plant uses the improved A<sup>2</sup>/O biological pond system to serve an area of 21.37 km<sup>2</sup> and a population of 74,000, with a total investment of RMB 201.2 million.

The construction of this plant was approved by Yichang Municipal Environmental Protection Bureau with the issuance of the document No. 248 of [2012]. Phase-I have been completed for now. However, the WWTP hasn't been officially put into operation. since surrounding enterprises haven't operated and no wastewater needs to be treated. The capacity of this plant can treat all the wastewater generated from the Project. The location and service area of the WWTP are shown in Figure 2. 5-1.

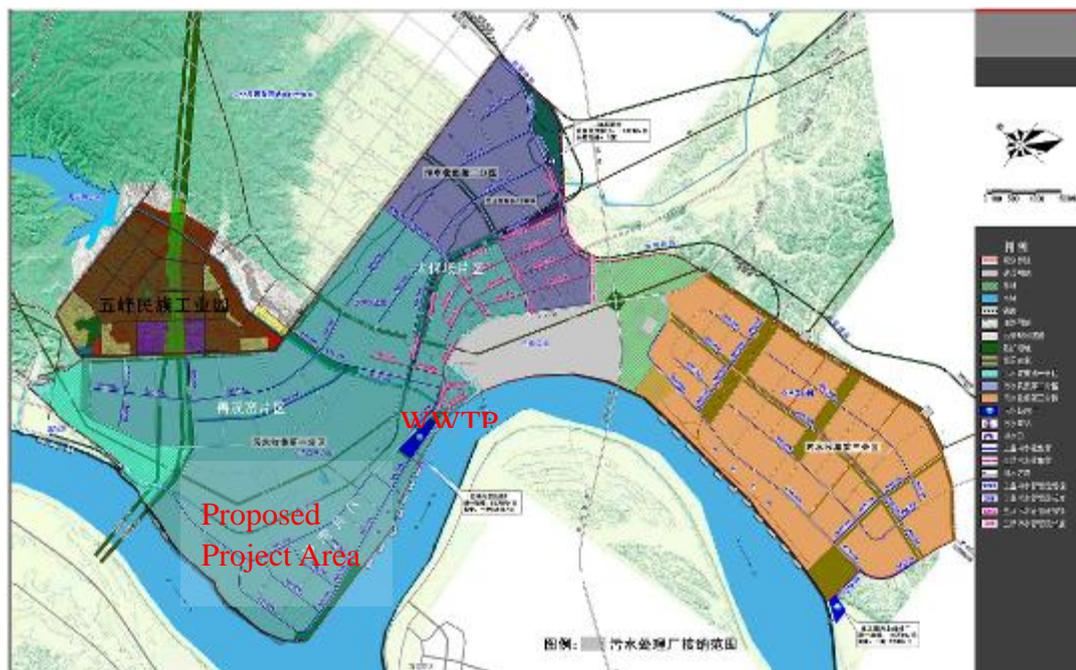


Figure 2.5-1 Location and service area of Shawan WWTP

### 2.5.2 Landfill

The solid waste generated from this Project will be transferred to the Shibaoshan sanitary Landfill which started operation in 2009 in Zhijiang City. The Shibaoshan Landfill is located 15 km away to the south-east of the proposed project site, as shown in Figure 2.1-1. It has been constructed and put into operation since 2009. This landfill covers an area of 380 mu and has a total storage capacity of

183×10<sup>4</sup>m<sup>3</sup> and daily disposal capacity of 250t/d. (Class III with the volume between 2 million to 5 million m<sup>3</sup>; Class III with the daily disposal capacity from 200 to 500 m<sup>3</sup>). For drainage in the landfill, rainwater-sewage separation system is adopted. The leachate is collected and transferred to leachate treatment station (2.5 mu; Processing: MBR (external ultrafiltration membrane) +NF +RO; treatment capacity: 100 m<sup>3</sup>/d; The effluent will reach the standards of Class I of the *Pollution Control Standards for Sanitary Landfill* (GB16889-2008)). The bottom lining uses thin membrane for seepage control. Landfill gas is collected through stone cages (collection for future use in the plan). The service period is from 2005 to 2020. The service scope and capacity shall meet the requirements of solid waste areas such as the main urban area of Zhujiang City, Jiangkou District and Yaojiagang District, as well as the general industrial area of Yaojiagang Industrial Park, Zhijiang City Industrial Park. Currently, all the environmental protection facilities are in good condition. No pollution has taken place and no complaints have been received.

Since May 1, 2016, the landfill has begun to receive the domestic solid waste from Baiyang district. The status of landfill is shown in Figure 2.5-2.

	
<p style="text-align: center;">Landfill</p>	<p style="text-align: center;">Layered backfill</p>
	
<p style="text-align: center;">Compaction</p>	<p style="text-align: center;">Landfill site</p>



Leachate treatment

**Figure 2.5-2 Overview of Landfill**

### **2.5.3 Baiyang Industrial New City**

With the implementation of integrated plan and construction, Baiyang Industrial New City is established after the workers and local resettlement residents from industrial areas moved in. It centers on Baiyang township and expands towards to the east up to Jiaoliu Railway. The planned residential area is 341.50 ha. At present, some residential areas have been constructed as the relocation sites of project impacted persons. Some of them have already moved in. The infrastructures have been completed, such as water supply and drainage and solid waste collection. The built-up industrial new area is shown in Figure 2.5-3.



**Figure 2.5-3: Status of Built-up Industrial New City**

## **2.6 Linked projects**

In accordance with World Bank policies, the linked projects refers to those directly associated and constructed at the same time. In this project, the linked project is mainly Baiyang Port Operation Area Phase I project an G318 roa(about 3.0km connction line rehabilitation from the park to the highway). Therefore, WB has required to carry out due diligence to review the status of compliance of WB environmental requirements. The report combines two methodologies: data collection and review, field survey.

## 2.6.1 Survey methodology

### (1) Data collection and survey

We mainly collect the necessary documents of the linked project to review its compliance. The documents include the EIA, approval of EIA, tendering and bidding documents, construction documents, current data of regional environment status, etc. The phase I project has completed the EIA in November 2011 and received the approval of provincial EPD. After review of the EIA and considering the requirements of WB, we consider the basic environment protection measures of Phase I project are feasible, especially the impacts mitigation measures on water environment for its feasibility and compliance with WB standards. Additionally, Phase I doesn't occupy the coastal line and land area in the back of Baiyang Port Operation Area. The project coastline is in accordance with the *Master Plan of Yinchang Port* and *Special Plan of Adjustment of Main Urban Port Area*.

### (2) Site Survey and Monitoring

The actual impacts are assessed by way of site survey and monitoring of current status. The biggest impacts from Phase I Project are possibly on the water body of the Yangtze River, to be reflected by monitoring. As for the impacts of solid waste, we mainly conduct survey on soil borrow pits and spoil pits. We have taken pollution control measures during the operation period, such as wastewater collection facilities and collection tank under construction in the site. However, as Phase I Project is still under conduction, the pollution control measures for operation period could only be implemented by the end of project construction.

### (3) Gaps and counterpart measures

As some construction teams haven't watered the earth sufficiently during the construction period, the loading and unloading will result in dust pollution in windy days. Sometimes the dust pollution expands about 100m in the downwind; Other construction teams may fail to follow the requirements of transportation speed and road watering that they cause dust pollution with fast vehicle speed, influencing the air environment in the surrounding villages.

In view of mismanagement of some construction teams, we urge the construction units to strengthen supervision on the construction teams and inspect them on a regular basis. In terms of bad weather, we should enhance supervision to 24 hours all day and night, so as to mitigate the dust pollution and safeguard people's livelihood.

## 2.6.2 Baiyang Port Phase I Project

According to actual site survey, Baiyang Port operation area (Baiyang Port operation area phase I) is carrying out the preliminary works at some segments of the shoreline. The construction procedures are in accordance with the national requirements. At present, the main physical works and wading operations have been completed basically and the requirements of EIA have been complied during the construction period. Based on the monitoring of surface water in the surrounding, the quality of surface water can meet the requirements of Class III. No complaints from residents or enterprises have been received during construction.

**Borrow pit and spoil pit:** the borrow pit is located in Wanfunao Village. The

earthworks reserve of the village is 4 million m<sup>3</sup>. The soil borrowed in Phase I is about 2.072 million m<sup>3</sup> (see Annex 4). As there is no spoil in the project, so there is no borrowing pit.

**Rehabilitation of borrow pit:** since the borrow pit is also used by other projects except for the Baiyang Port Project, the rehabilitation of soil in the borrow pit is basically natural rehabilitation (soil erosion is not handled properly). According to *Law of on Water and Soil Conservation of PRC*, the construction units shall be responsible for soil erosion caused by project construction or other production activities. Therefore, Phase-I borrow pit shall undertake ecological restoration as required by local water and soil conservation departments. See Figure 2.6-1 for the borrow pit.

Baiyang Logistics Park Project (this project) will not use this borrow pit. The required earthworks will come from the earthworks of Baiyang New City. See Chapter Five (5.5 Impact Assessments of Solid Waste) for details.



Figure 2.6-1 Ecological rehabilitation of borrow pit in Wanfunao Village

### 2.6.3 Sections of National Highway G318 Upgrade

National Highway G318 passes outside the north boundary of the WB project area. Its section connecting the project site to the nearby express way nearby is about 3 km. It is built on the basis of old G31 by cutting the curves and selecting the straight lines. The section of 3km is being upgraded into a four-lane road (15 m) from a two-lane road (9 m).

The design standard of the road is Class I. Its design speed is 80km/h. The subgrade width is 21.5m. About the composition of the width: intermediate zone 1m (double yellow line with a spacing of 0.5m); lane width: 2 x 2 x 3,75 m; hard road shoulder: 2 x 2.0m; soil shoulder: 2 x 0.75m. Both sides of the subgrade shall consider drainage facilities.

The reconstruction project of G318 completed its environmental impact report and it was approved by provincial environmental protection bureau in 2009. The main part has been completed now. The construction process meets relevant requirements in environmental impact assessment. Local environmental protection and construction department have not received any complaints from local residents (according to the inquiry of local environmental protection and construction department). Up to 2016, most of the road sections are accessible to traffic. A small portion of the road needs to be paved with asphalt and ancillary works such as greening, street lights, and isolation belt have not been fully implemented. There is no dump pit for this activity but there is a borrow pit. The ecological rehabilitation of the borrow pit is ordinary. See Figure 2.6-2 for some details.



Figure 2.6-2 Current status of road sections linked to National Highway G318

## **3 Environmental and Social Conditions**

### **3.1 Natural Environment**

#### **3.1.1 Geography**

The project is located in the east of the urban area of Yichang Municipality. It is about 35km away from the central urban area of Yichang in the west and borders on Yangtze River in the south (see Figure 2.1-1).

#### **3.1.2 Topography**

Yichang's topography is complicated and elevation differs greatly. Its mountainous area in the west accounts for 69% of total area of the whole city, which mainly covers Xingshan County, Zigui County, Changyang County, Wufeng County and west Yiling District. Most mountains are about 1,000 meter but many mountains are over 2,000 meters tall. Xiannv Mountain in Xingshan County has an elevation of 2,427m and is the tallest one in the city. There are many gorges in the mountainous area. Some mountains are magnificent with steep cliffs reaching to the sky. Some gorges are deep, beautiful and full of twists and turns. Such gorges are located in the basins of Yangtze River, Qing River, Xiangxi River, and Huangbo River, for example, Xiling Gorge, one of the world-famous Three Gorges of Yangtze River. The hilly area in central Yichang is a transitional zone between the mountainous area and the plain area, which consists of low hills or stretches of high terraces with gentle slopes that have been weathered, denudated or dissected for a long time; the hilly area has an elevation of 100m~500m and incline of 5 degrees~25 degrees, and accounts for 21% of total area of the city. It covers Yuan'an County, Yidu City, east Yiling County and north Dangyang City. The plain area in east Yichang is located in the west end of Jiangnan Plain with an elevation of below 100m. Yanglin Lake in Zhijiang City has an elevation of 35m and is the lowest point in the city. The plain area accounts for 10% of total area of the city, and covers Zhijiang City, southeast Dangyang City, southwest part of the urban area of Yichang, and the area on the banks of Yangtze River, Qingjiang River, and Juzhang River in Yidu City and Yuan'an County. Besides, there are many areas featuring in karsts in the city, mainly in the mountainous area and hilly area of Wufeng County, Changyang County, Xingshan County, Zigui County, and Yidu City. The karsts vary a lot. Many places have strange mountains, beautiful rocks, intriguing caves, and clear waters, and are good tourism destinations.

#### **3.1.3 Climate**

Yichang is located in the transitional zone between the middle subtropics and the northern subtropics and has humid subtropical monsoon climate. It has four distinct seasons, with wet season overlapping hot season and dry season overlapping cold season. The annual average precipitation is 1,215.6 mm. Average temperature is 16.9°C, extreme maximum temperature is 41.4°C (in July), and extreme minimum temperature is -9.8°C (in January). The total of daily average temperature above 10°C is over 5200°C, and the total number of days when daily average temperature

is above 10°C is above 250. The frost-free period is 250~300 days. Annual average radiation quantity is 100.7kals/cm<sup>2</sup>. Annual average sunshine duration is 1,538~1,883 hours, and the sunshine rate is 40%.

### 3.1.4 Surface water

Surface water in the region where the logistics center is located is mainly the Yangtze River.

Yangtze River is the main water source and pollutant-receiving water of Zhijiang City. Zhijiang section of Yangtze River has abundant water with good water quality, and it has enormous environmental capacity. According to hydrological statistic data for many years, its annual average flow rate is 14,300 m<sup>3</sup>/s; the maximum flow rate in wet season is 70,800 m<sup>3</sup>/s, the average flow rate is 29,600m<sup>3</sup>/s, and the minimum flow rate in dry season is 2,770 m<sup>3</sup>/s; its annual average sand output is 526 million tons. After the Three Gorges Project is completed, the annual average flow at the Yichang monitoring station is supposed to change; yet it is reported that under the normal regulation mode of the reservoir, the change of water level is not big and within the range of changes for natural average water level.

### 3.1.5 Soil and minerals

The soil type detected is suitable for a wide range of plants and is very favorable for the development of agriculture and forestry.

There is a large amount of argil, cobbles (including various rare stones), river sand and building materials in the area.

## 3.2 Monitoring and evaluation of ambient air quality

### 3.2.1 Monitoring Measures

For location and description of the points, see Table 3.2-1 and Figure 3.2-1

**Table 3.2-1 List of air monitoring spots**

No.	Name of the spot	Position coordinates	Description
1 <sup>#</sup>	Yazishan Village, Baiyang Town	N: 30.42274°, E: 111.48913°	60 m north of the project site
2 <sup>#</sup>	Guixihu Village, Baiyang Town	N: 30.42179°, E: 111.47193°	Inside the project site
3 <sup>#</sup>	Baiyang Town	N: 30.41974°, E: 111.51280°	1,700 m east of the project site
4 <sup>#</sup>	Wanfunao Village, Baiyang Town	N: 30.43063°, E: 30.43063°	1,600 m northwest of the project site

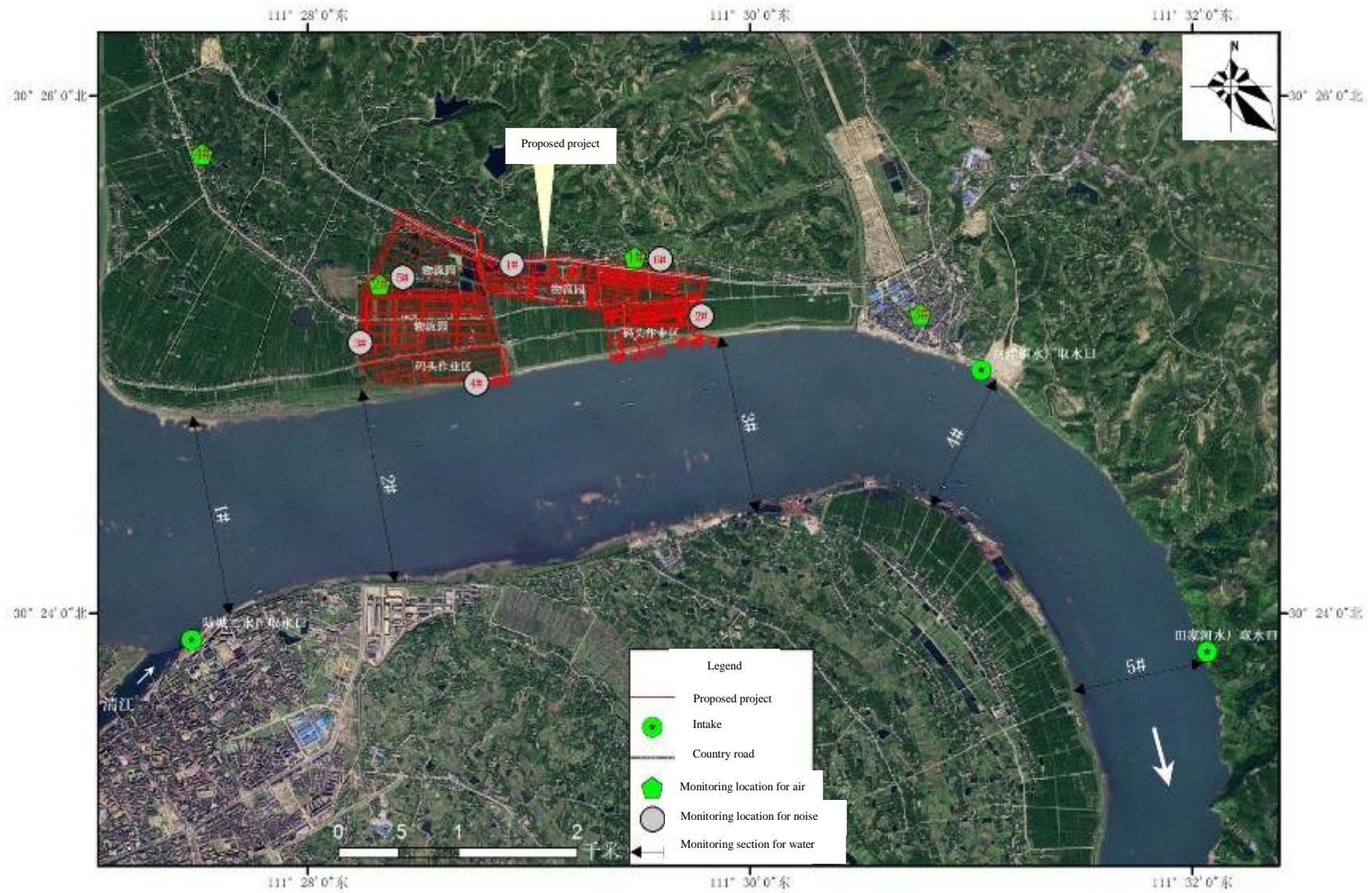


Figure 3.2-1 Location of the monitoring points

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(2) Monitoring indicators and analysis method

The monitoring indicators are SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub>, and TSP. For SO<sub>2</sub> and NO<sub>2</sub>, hourly value and daily average value shall be measured; and for PM<sub>10</sub> and TSP, daily average value shall be measured. Methods of ambient air quality monitoring and analysis are shown in Table 3.2-2.

**Table 3.2-2 List of ambient air quality monitoring and analysis methods**

Monitoring Item	Analysis method	Reference
PM <sub>10</sub>	Gravimetric method	HJ 618-2011
TSP	Gravimetric method	GB/T15432-1995
SO <sub>2</sub>	Formaldehyde absorbing – pararosaniline spectrophotometry	HJ482-2009
NO <sub>2</sub>	N-(1-naphthyl) ethylene diamine dihydrochloride spectrophotometric method	HJ 479-2009

(3) Monitoring frequency

The first monitoring was conducted in November 2015 for consecutive seven days, namely, November 18~24, 2015. TSP and PM<sub>10</sub> was measured with daily average and samples were collected 24 hours every day; SO<sub>2</sub> and NO<sub>2</sub> were measured with hourly value and daily average, and samples were collected 4 times per day for the measurement of the hourly value respectively at 02:00, 08:00, 14:00 and 20:00; for the measurement of daily average concentration of PM<sub>10</sub>, SO<sub>2</sub>, and NO<sub>2</sub>, samples were collected continuously for 20 hours each day. For the daily average concentration of TSP, samples were collected for the period of 24 hours each day.

**3.2.2 Assessment method and analysis**

(1) Assessment Method

Single factor index method is adopted.

The formula is:  $P_i = C_i/S_i$

In the formula:

P<sub>i</sub> --the single quality indicator of a certain pollutant

C<sub>i</sub>-- the measured concentration of the pollutant, mg/m<sup>3</sup>;

S<sub>i</sub>--the evaluation standard limit of the pollutant,, mg/m<sup>3</sup>.

(2) Statistical analysis

Based on the monitoring data of the consecutive seven days at the monitoring points and according to the statistical requirements of *Guidelines for Environmental Impact Assessment-Atmospheric Environment* (HJ 2.2-2008), the results of statistical analysis are shown in Table 3.2-3 and Table 3.2-4.

**Table 3.2-3 Statistics of Hourly Concentration of Pollutants in Ambient Air**

N o.	Sampl ing place	Monitor ing item	Level II standard value of hourly concentra tion (mg/Nm <sup>3</sup> )	Variation range of hourly concentra tion (mg/Nm <sup>3</sup> )	Maximu m hourly concent ration (mg/Nm <sup>3</sup> )	Average hourly concent ration (mg/Nm <sup>3</sup> )	Ratio of maximum concentra tion to standard value (%)	Comp liance	Over-li mit rate %
1 <sup>#</sup>	Yazishan Village	SO <sub>2</sub>	0.50	0.011~0.033	0.033	0.021	6.6	Yes	0
		NO <sub>2</sub>	0.20	0.014~0.038	0.038	0.026	19	Yes	0
2 <sup>#</sup>	Guixihu Village	SO <sub>2</sub>	0.50	0.013~0.029	0.029	0.019	5.8	Yes	0
		NO <sub>2</sub>	0.20	0.018~0.031	0.031	0.024	15.5	Yes	0
3 <sup>#</sup>	Baiyang Town	SO <sub>2</sub>	0.50	0.011~0.057	0.057	0.024	11.4	Yes	0
		NO <sub>2</sub>	0.20	0.013~0.027	0.027	0.022	13.5	Yes	0
4 <sup>#</sup>	Wanfuna o Village	SO <sub>2</sub>	0.50	0.009~0.028	0.028	0.019	5.6	Yes	0
		NO <sub>2</sub>	0.20	0.017~0.034	0.034	0.023	17	Yes	0

**Table 3.2-4 Statistics of Daily Concentration of Pollutants in the Ambient Air**

N o.	Sampl ing place	Monitor ing indicato r	Level II standard value of daily concentra tion (mg/Nm <sup>3</sup> )	Variation range of daily concentra tion (mg/Nm <sup>3</sup> )	Max. daily concent ration (mg/Nm <sup>3</sup> )	Average concent ration (mg/Nm <sup>3</sup> )	Ratio of max. concentra tion to standard value (%)	Meet the stand ard or not	Over-li mit rate %
1 <sup>#</sup>	Yazishan Village Guixihu Village	SO <sub>2</sub>	0.15	0.016~0.028	0.028	0.021	18.67	Yes	0
		NO <sub>2</sub>	0.08	0.016~0.034	0.034	0.026	42.5	Yes	0
		PM <sub>10</sub>	0.15	0.041~0.113	0.113	0.064	75.3	Yes	0
		TSP	0.30	0.055~0.15	0.15	0.085	50	Yes	0
2 <sup>#</sup>	Baiyang Town Wanfuna o Village	SO <sub>2</sub>	0.15	0.015~0.024	0.024	0.019	16	Yes	0
		NO <sub>2</sub>	0.08	0.019~0.027	0.027	0.024	33.75	Yes	0
		PM <sub>10</sub>	0.15	0.032~0.102	0.102	0.064	68	Yes	0
		TSP	0.30	0.043~0.133	0.133	0.087	44.3	Yes	0
3 <sup>#</sup>	Yazishan Village Guixihu Village	SO <sub>2</sub>	0.15	0.014~0.048	0.048	0.025	32	Yes	0
		NO <sub>2</sub>	0.08	0.019~0.023	0.023	0.021	28.75	Yes	0
		PM <sub>10</sub>	0.15	0.038~0.104	0.104	0.064	69.3	Yes	0
		TSP	0.30	0.051~0.136	0.136	0.089	48.3	Yes	0
4 <sup>#</sup>	Baiyang Town	SO <sub>2</sub>	0.15	0.014~0.022	0.022	0.019	14.67	Yes	0
		NO <sub>2</sub>	0.08	0.020~0.032	0.032	0.024	40	Yes	0
		PM <sub>10</sub>	0.15	0.035~0.109	0.109	0.064	72.7	Yes	0

No.	Sampling place	Monitoring indicator	Level II standard value of daily concentration (mg/Nm <sup>3</sup> )	Variation range of daily concentration (mg/Nm <sup>3</sup> )	Max. daily concentration (mg/Nm <sup>3</sup> )	Average concentration (mg/Nm <sup>3</sup> )	Ratio of max. concentration to standard value (%)	Meet the standard or not	Over-limit rate %
		TSP	0.30	0.048~0.145	0.145	0.088	48.3	Yes	0

According to the analysis of monitoring data, the daily average concentration and hourly average concentration of SO<sub>2</sub> and NO<sub>2</sub> and the daily average concentration of PM<sub>10</sub> and TSP have all met the standards of Class II of *Ambient Air Quality Standards* (GB3095-2012).

### 3.3 Monitoring and assessment of acoustic environment quality

#### 3.3.1 Monitoring methods

##### (1) Arrangement of spots and indicators

6 monitoring spots are established to cover the whole project area. The 1# ~ 4# monitoring spots are set at the boundary of the project site. 1# and 4# monitoring spots are respectively set nearby the National Highway G318 and the channel of Yangtze River, with Class 4A standard; 5# and 6# monitoring spots are set at the residential area with Class 2 standard; noise monitoring cross-section is installed at 6# monitoring spot. For layout of the monitoring spots, see Table 3.3-1 and Figure 3.2-1.

**Table 3.3-1 List of the environmental sound monitoring points**

No.	Location of monitoring spot	Implementation Standards
1#	North of the project site	Class 4a, 70dB (A) at daytime and 55 dB (A) at night
2#	East of the project site	Class 2, 60dB (A) at daytime and 50 dB (A) at night
3#	West of the project site	Class 2, 60dB (A) at daytime and 50 dB (A) at night
4#	South of the project site	Class 4a, 70dB (A) at daytime and 55 dB (A) at night
5#	Guixihu Village	Class 2, 60dB (A) at daytime and 50 dB (A) at night
6#	Yazishan Village	Class 2, 60dB (A) at daytime and 50 dB (A) at night

The equivalent continuous Class A-weighted sound at daytime and at nighttime is measured.

##### (2) Time and frequency

Wuhan CQT Co. Ltd conducted monitoring for 2 continuous days from November 19 to 20th 2015 at the noise monitoring spot at daytime and nighttime. Daytime: 06:00~22:00; nighttime: 22:00~06:00 (the next day).

##### (3) Monitoring method

Principles and methods shall be determined in accordance with *Environmental Quality Standard for Noise* (GB3096-2008), *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008) and *Technical Guidelines for*

*Environmental Impact Assessment – Acoustic Environment* (HJ/T2.4-2009), to monitor the current status of noise and data processing

### 3.3.2 Monitoring results and Analysis

The monitoring results of noise is shown in Table 3.3-2

**Table 3.3-2 Monitoring results of acoustic environment**

No.	Location of monitoring spots		Main sound source	Monitoring date	Day time	Night	Excess of standard		Evaluation Standard
							Daytime	Night	
1#	North of the project site		Traffic noise	Nov. 19	63.1	57.0	/	+2	Class 4a
				Nov. 20	62.4	57.8	/	+2.8	
2#	East of the project site		Community noise	Nov. 19	48.9	44.2	/	/	Class 2
				Nov. 20	48.5	44.1	/	/	
3#	West of the project site		Community noise	Nov. 19	48.9	44.7	/	/	Class 2
				Nov. 20	47.6	45.2	/	/	
4#	South of the project site		Traffic noise	Nov. 19	49.4	44.5	/	/	Class 4a
				Nov. 20	47.6	45.1	/	/	
5#	Guixihu Village		Community noise	Nov. 19	46.7	44.0	/	/	Class 2
				Nov. 20	45.7	44.0	/	/	
6#	Yazishan Village	20 m away from the highway	Traffic noise, community noise	Nov. 19	59.5	53.5	/	/	Class 4a
		Nov. 20		58.5	53.1	/	/		
		40 m away from the highway		Nov. 19	58.6	52.4	/	/	Class 4a
		Nov. 20		56.5	52.4	/	/		
		60 m away from the highway		Nov. 19	56.9	51.0	/	+1.0	Class 2
		Nov. 20		55.3	51.0	/	+1.0		
120 m away from the highway	Nov. 19	54.1	49.5	/	/	Class 2			
Nov. 20	54.6	48.9	/	/					

According to Table 3.3-2, the north boundary of the project site is close to the National Highway G318 which is under construction. The daytime noise there conforms to the standard, while the night noise exceeds the standard level for 2~2.8 dB (A); Noise at the east, west, and south boundary of the project site all conforms to the standard; at noise sensitive point Guixihu Village, noise at daytime and at night both conforms to class 2 standard; Yazishan Village is 60 away from the road, the daytime noise there conforms to the standard, while the night noise exceeds the standard by 1.0 dB (A), mainly due to the noise from the National Highway G318.

## 3.4 Current quality of surface water environment

### 3.4.1 Monitoring Method

#### (1) Cross-section setting

The cross-section for water environment quality monitoring is determined with the

principles and methods of setting of sampling section and sampling spot in river water quality monitoring as specified in the *Technical Guidelines for Environmental Impact Assessment – Surface Water Environment (HJ/T2.3-93)* and based on the location of the construction project and the location of the water intakes upstream and downstream project site.

Zhijiang section of Yangtze River is involved in the proposed project, and 5 monitoring sections are determined with their locations as shown in Table 3.4-1.

**Table 3.4-1 Water quality monitoring sections of the proposed project area**

No.	Monitoring cross-section
1 <sup>#</sup>	1,800m downstream the wharf (intakes of Lucheng No.2 WTP)
2 <sup>#</sup>	Upper boundary of the wharf
3 <sup>#</sup>	Lower boundary of the wharf
4 <sup>#</sup>	1,500m downstream the wharf (intake of Baiyang Town Water Plant)
5 <sup>#</sup>	3,800m downstream the wharf (intake of Tianjiahe Water Plant)

## (2) Monitoring indicators and methods

There are 9 monitoring indicators: pH, water temperature, dissolved oxygen (DO), chemical oxygen demand (COD), permanganate index, five-day biochemical oxygen demand (BOD5), suspended solids (SS), NH3-N, and petroleum. Collection, storage, and transport of water samples shall be subject to *Regulation for Water Environmental Monitoring (SL219-98)*, and sample analyzing methods shall be subject to the national standards. Analyzing methods of the monitoring items are shown in Table 3.4-2

**Table 3.4-2 Water quality monitoring indicators and analysis method**

Monitoring indicators	Analyzing method and basis	Test limit	Main instruments
pH	Portable pH meter method	0.1 pH unit	FE20 pH meter
Water temperature	Thermometer method GB/T13195–1991	0.1°C	—
DO	Electrochemical Probe method HJ 506-2009	0.2	HQ30d dissolved oxygen meter
Petroleum	Infrared spectrophotometry HJ637-2012	0.01	F2000-IK Infrared photometric oil content analyzer
SS	Gravimetric method GB11901-89	—	All-glass nuclepore membrane filter
NH3-N	Nessler's reagent colorimetric method HJ535-2009	0.025	Ultraviolet-visible spectrophotometer (TU1900)
COD	Potassium dichromate titration method GB/T11914–1989	5	Burette
BOD5	Dilution and inoculation method HJ505-2009	0.5	HQ30d dissolved oxygen meter
Permanganate index	Titrimetric method GB 11892-89	0.5 mg/L	Burette

## (3) Monitoring time and frequency

From November 18th to 19th 2015, we conducted two-day monitoring with the frequency of once per day.

### 3.4.2 Monitoring time and frequency

#### (1) Monitoring results

The monitoring result of surface water quality is shown in Table 3.4-3.

**Table 3.4-3 Water quality monitoring result**

Unit: mg/L, no measurement for pH

Item		pH	SS	COD	BOD <sub>5</sub>	NH <sub>3</sub> -N	Petroleum	Permanganate index	DO
1,800m upstream the wharf	Nov. 18	7.04	5	10	2.2	0.798	ND	3.0	8.13
	Nov. 19	7.06	5	10	2.3	0.786	ND	2.8	8.14
Boundary upstream the wharf	Nov. 18	7.10	6	10	1.3	0.706	ND	2.4	8.12
	Nov. 19	7.15	5	12	1.4	0.616	ND	1.8	8.14
Boundary downstream the wharf	Nov. 18	7.08	5	10	1.6	0.724	ND	2.7	8.36
	Nov. 19	7.03	5	11	1.9	0.536	ND	2.2	8.38
1,500m downstream the wharf	Nov. 18	7.21	5	10	2.0	0.394	ND	2.2	8.61
	Nov. 19	7.28	5	9	1.2	0.430	ND	2.0	8.65
3,800m downstream the wharf	Nov. 18	7.17	6	7	2.6	0.210	ND	2.2	8.46
	Nov. 19	7.14	6	11	2.6	0.272	ND	2.2	8.49

**Note: “ND” refers to “not detected”.**

#### (2) Assessment method

Based on the water quality monitoring indicators and results, the method of single-factor pollution indicators is adopted for water quality evaluation. The value of  $P_i$  is used to evaluate the water environment quality of the monitored area. Average value in the section is used for evaluation. The calculation formula is presented as follows:

$$P_i = C_i / B_i$$

In which,

$P_i$ —the environment quality index of the factor  $i$

$C_i$ —the monitoring result of the factor  $i$ , mg/L

$B_i$ —the evaluation standard of the factor  $i$ , mg/L.

The evaluation formula of pH is:

$$P_F = (7.0 - C_i) / (7.0 - C_{sd}) \quad (C_i \leq 7.0)$$

$$P_F = (C_i - 7.0) / (C_{su} - 7.0) \quad (C_i \geq 7.0)$$

In which:  $C_{sd}$ —the lower limit stipulated by the evaluation standard;

$C_{su}$ —the upper limit stipulated by the evaluation standard;

Other symbols have the same meaning with before.

Standard indicator of DO is:

$$S_{DO,j} = \frac{|DO_f - DO_j|}{DO_f - DO_s} \quad DO_j \geq DO_s$$

$$S_{DO,j} = 10 - 9 \frac{DO_j}{DO_s} \quad DO_j < DO_s$$

Of which,  $S_{DO,j}$ —the standard index of single water quality parameter DO at the point j;

$DO_f = 468 / (31.6 + T)$  The saturated DO when water temperature is  $T^\circ\text{C}$

$DO_s$ —standard value of DO, mg/L;

$DO_j$ —monitored value of DO, mg/L.

### (3) Assessment results

Assessment results are shown in Table 3.4-4.

**Table 3.4-4 Water quality evaluation result of the surface water monitoring section**

Cross-Section	Item	pH	SS	COD	BOD <sub>5</sub>	NH <sub>3</sub> -N	Oil	Permanganate index	DO
1#	Monitoring result	7.04 ~ 7.06	5	10	2.2 ~ 2.3	0.798 ~ 0.786	Not detected	2.8 ~ 3.0	8.13 ~ 8.14
	Evaluation standards (C)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.02 ~ 0.03	0.17	0.50	0.55 ~ 0.58	0.798 ~ 0.786	0	0.47 ~ 0.50	0.292 ~ 0.294
	Times of ultra standard	—	—	—	—	—	—	—	—
	Over-limit rate	0	0	0	0	0	0	0	0
2#	Monitoring result	7.10 ~ 7.15	5 ~ 6	10 ~ 12	1.3 ~ 1.4	0.706 ~ 0.616	Not detected	1.8 ~ 2.4	8.12 ~ 8.14
	Evaluation standards (C)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.05 ~ 0.08	0.17 ~ 0.20	0.50 ~ 0.60	0.33 ~ 0.35	0.706 ~ 0.616	0.2	0.30 ~ 0.40	0.292 ~ 0.297

Cross-Section	Item	pH	SS	COD	BOD <sub>5</sub>	NH <sub>3</sub> -N	Oil	Permanganate index	DO
	Times of ultra standard	—	—	—	—	—	—	—	—
	Over-limit rate	0	0	0	0	0	0	0	0
3#	Monitoring result	7.03 ~ 7.08	5	10 ~ 11	1.6 ~ 1.9	0.536 ~ 0.724	Not detected	2.2 ~ 2.7	8.36 ~ 8.38
	Evaluation standards (C)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.02 ~ 0.04	0.17	0.50 ~ 0.55	0.40 ~ 0.48	0.536 ~ 0.724	0.2	0.37 ~ 0.45	0.238 ~ 0.242
	Times of ultra standard	—	—	—	—	—	—	—	—
	Over-limit rate	0	0	0	0	0	0	0	0
4#	Monitoring result	7.21 ~ 7.28	5	9 ~ 10	1.2 ~ 2.0	0.394 ~ 0.430	Not detected	2.0 ~ 2.2	8.61 ~ 8.65
	Evaluation standards (C)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.11 ~ 0.14	0.17	0.45 ~ 0.50	0.30 ~ 0.50	0.394 ~ 0.430	0.2	0.33 ~ 0.37	0.177 ~ 0.186
	Times of ultra standard	—	—	—	—	—	—	—	—
	Over-limit rate	0	0	0	0	0	0	0	0
5#	Monitoring result	7.14 ~ 7.17	6	7 ~ 11	2.6	0.210 ~ 0.272	Not detected	2.2	8.46 ~ 8.49
	Evaluation standards (C)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.07 ~ 0.09	0.20	0.35 ~ 0.55	0.65	0.210 ~ 0.272	0.2	0.37	0.213 ~ 0.219
	Times of ultra standard	—	—	—	—	—	—	—	—
	Over-limit rate	0	0	0	0	0	0	0	0

Cross-Section	Item	pH	SS	COD	BOD <sub>5</sub>	NH <sub>3</sub> -N	Oil	Permanganate index	DO
1#	Monitoring result	7.04 ~ 7.06	5	10	2.2 ~ 2.3	0.798 ~ 0.786	ND	2.8 ~ 3.0	8.13 ~ 8.14
	Evaluation standard (class III)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.02 ~ 0.03	0.17	0.50	0.55 ~ 0.58	0.798 ~ 0.786	0	0.47 ~ 0.50	0.292 ~ 0.294
	Maximum over standard	—	—	—	—	—	—	—	—

Cross-Section	Item	pH	SS	COD	BOD <sub>5</sub>	NH <sub>3</sub> -N	Oil	Permanganate index	DO
	multiple								
	Over standard rate	0	0	0	0	0	0	0	0
2#	Monitoring result	7.10 ~ 7.15	5 ~ 6	10 ~ 12	1.3 ~ 1.4	0.706 ~ 0.616	ND	1.8 ~ 2.4	8.12 ~ 8.14
	Evaluation standard (class III)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.05 ~ 0.08	0.17 ~ 0.20	0.50 ~ 0.60	0.33 ~ 0.35	0.706 ~ 0.616	0.2	0.30 ~ 0.40	0.292 ~ 0.297
	Maximum over standard multiple	—	—	—	—	—	—	—	—
	Over standard rate	0	0	0	0	0	0	0	0
3#	Monitoring result	7.03 ~ 7.08	5	10 ~ 11	1.6 ~ 1.9	0.536 ~ 0.724	ND	2.2 ~ 2.7	8.36 ~ 8.38
	Evaluation standard (class III)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.02 ~ 0.04	0.17	0.50 ~ 0.55	0.40 ~ 0.48	0.536 ~ 0.724	0.2	0.37 ~ 0.45	0.238 ~ 0.242
	Maximum over standard multiple	—	—	—	—	—	—	—	—
	Over standard rate	0	0	0	0	0	0	0	0
4#	Monitoring result	7.21 ~ 7.28	5	9 ~ 10	1.2 ~ 2.0	0.394 ~ 0.430	ND	2.0 ~ 2.2	8.61 ~ 8.65
	Evaluation standard (class III)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.11 ~ 0.14	0.17	0.45 ~ 0.50	0.30 ~ 0.50	0.394 ~ 0.430	0.2	0.33 ~ 0.37	0.177 ~ 0.186
	Maximum over standard multiple	—	—	—	—	—	—	—	—
	Over standard rate	0	0	0	0	0	0	0	0
5#	Monitoring result	7.14 ~ 7.17	6	7 ~ 11	2.6	0.210 ~ 0.272	ND	2.2	8.46 ~ 8.49
	Evaluation standard (class III)	6 ~ 9	30	≤20	≤4	≤1.0	≤0.05	≤6	≥5
	P <sub>i</sub>	0.07 ~ 0.09	0.20	0.35 ~ 0.55	0.65	0.210 ~ 0.272	0.2	0.37	0.213 ~ 0.219
	Maximum over standard	—	—	—	—	—	—	—	—

Cross-Section	Item	pH	SS	COD	BOD <sub>5</sub>	NH <sub>3</sub> -N	Oil	Permanganate index	DO
	multiple								
	Over standard rate	0	0	0	0	0	0	0	0

As concluded from Table 3.4-4, for the three monitoring cross-sections of the proposed project, the evaluation indicators of pH, SS, Permanganate index, COD, DO, BOD<sub>5</sub>, petroleum and NH<sub>3</sub>-N are all less than 1, which shows that the water quality of this section of Yangtze River meets the standards of Class III as specified in the *Environmental Quality Standards for Surface Water* (GB3838-2002).

### 3.5 Current Conditions of Ecological Environment

This survey involves data collection, field investigation and interviews. Sampling method is used for survey of terrestrial vegetation; Survey of terrestrial animals is carried out based on interview and data collection; Survey of aquatic ecology will be sourced from existing data. Three field surveys were carried out in May, June and November 2015. The investigation covers the project area and the surrounding area.

Since land development is intensive and changes of terrestrial vegetation are enormous, plot sampling method is used for the survey. As the environment of surrounding area is similar to the project area, there are no big changes in the terrestrial species; And since the main interfering factor for aquatic species are the dams which have lasted for many years, the changes in aquatic ecosystem are very little, therefore, we use aquatic data in recent years as a reference for status description.

#### 3.5.1 Terrestrial ecology

The existing land is mainly agricultural land, some are grassland, water area and construction land. Currently the land is experiencing large-scaled development and some land has been transformed from the original conditions. The regional ecology is also gradually transforming from typical agricultural ecology to urban ecology.

##### 3.5.1.1 Flora

The assessment area of the project belongs to the northern subtropical broad-leaved evergreen forests, eastern-China (humid) broad-leaved evergreen forests, mid-subtropical broad-leaved evergreen forests, and mixed forests of mid-subtropical broad-leaved evergreen trees and deciduous trees, and is the cultivation area for rice and citrus.

Current major vegetation in the project area is agricultural vegetation that mainly consists of citrus and dry land crops as well as a small number of planted trees and natural shrubs. Common herbs also grow around the above vegetation.

#### (1) Vegetation types of the project area

The classification system of natural vegetation in *China's Vegetation* defines different vegetation types. After sampling survey, we have identified the composition and structure and communities of dominant species among the vegetation of the

area as well as the ecological environment and geographical distribution of the communities. Totally we have found 2 levels of vegetations, 3 natural vegetation types and 9 natural vegetation forms. The detailed distribution of all vegetation forms is as shown in Table 3.5-1.

**Table 3.5-1 Vegetation types in the project area**

	Vegetation type group	Vegetation type	Form		Distribution
Natural vegetation	Shrubs and herbs	I. Shrubs	1. roussonetia papyrifera	Form. <i>Broussonetia papyifera</i>	Widely distributed along roads and cottages
			2. Rubus coreanus Miq	Form. <i>Rubus coreanus Miq</i>	Around farmland
			3.Clerodendrum bungei	Form. <i>Clerodendrum bungei Sterd.</i>	At some river banks
		II. Herbs	4. Imperata cylindrica	Form. <i>Imperata cylindrica (Linn.) Beauv.</i>	Beside river embankment
			5. Cynodon dactylon	Form. <i>Cynodon dactylon</i>	Widely distributed beside river banks
			6. Artemisia princeps	Form. <i>Artemisia princeps</i>	Widely distributed along river banks
	Marsh and aquatic vegetation	III. aquatic vegetation	7. Typha orientalis	Form. <i>Typha orientalis Presl.</i>	In pond or swamp
			8. Nelumbo nucifera	Form. <i>Nelumbo nucifera</i>	In pond
			9. Phragmites australis	Form. <i>Phragmites australis</i>	In pond or swamp
Artificial vegetation	Planted forests	10. Metasequoia	Form. <i>Metasequoia glyptostroboides Hu &amp; W. C. Cheng, Melia azedarach L.</i>	Around cottages	
		11. Populus euramevicana	Form. <i>Populus euramevicana</i>	Beside cottages and roads	
		12. Citrus reticulata	Form. <i>Citrus reticulata</i>	Widely distributed between fields	
Agricultura vegetation	Crops	13. Cash crops	Oilseed rape etc.	Distributed between fields	
		14. Grain crops	Maize, paddy rice, buckwheat	Distributed between fields (buckwheat is less populated)	

	Vegetation type group	Vegetation type	Form	Distribution
		15. Vegetables	Canavalia gladiata, Raphanus sativus, Brassica pekinensis, Lactuca sativa, Brassica campestris ssp chinensis, Brassica chinensis, Allium sativum, Allium fistulosum, Ipomoea aquatica Forsk, Capsicum annuum, Vigna unguiculata etc.	Widely distributed in villages

## (2) Distribution of key protected plants and old trees

According to the field survey, no national key non-commercial forests, forest parks, or scenic spots are involved in the project area, and no rare old trees are found.

### 3.5.1.2 Survey of terrestrial animals

Based on field survey and interviews, we have referred to *Revised Checklist of Chinese Amphibia & Reptilia* (Zhao Ermi, Zhang Xuwen etc., 2000), *A Checklist on the Classification and Distribution of the Birds in China* (Second Edition) (Zheng Guangmei, 2011), *Atlas of Amphibians in China* (Fei Liang, 1999), *Atlas of Reptiles in China* (China Wildlife Conservation Association, 2002), *Atlas of Birds in China* (Qian Yanwen, 1995), *Complete Catalog of Vertebrates in China* (Liu Mingyu, Xie Yuhao, Ji Daming, Gao Zhongxin, Li Sizhong, Gao Wei etc., 2000), *Atlas of Key Protected Wildlife in Hubei Province* (Chen Wei, 1996) and relevant data of the project area, and have comprehensively concluded the animal resources in the project affected area.

We take the method of quantitative rating to indicate the abundance of each animal species: if the population of animal species per unit area accounts for over 10% of the total number of all surveyed animals, the quantitative rating of such animal species is “+++”, indicating that such species is the dominant species in the area; if the population of an animal species per unit area accounts for 1~10% of the total number of all surveyed animals, the quantitative rating of such animal species is “++”, indicating that such species is a common species in the area; if the population of an animal species in unit area accounts for below 1% of the total number of all surveyed animals, the quantitative rating of such animal species is “+”, which means that such species is a rare species in the area. The standards for quantitative rating are shown in Table 3.5-2.

**Table 3.5-2 Standards for Quantitative Rating of Animal Resources**

Status of species	Symbol	Standard
Dominant species	+++	Population of the species in unit area accounts for over 10% of the total number of all surveyed animals
Common species	++	Population of the species in unit area accounts for 1~10% of the total number of all surveyed animals
Rare species	+	Population of the species in unit area accounts for below 1% of the total number of all surveyed animals or is only 1

According to the field survey and relevant data, at present there are various terrestrial vertebrates living in the project affected area. For distribution and quantity of such species, see Table 3.5-3.

**Table 3.5-3 Quantity of terrestrial vertebrates in the project affected area**

Class	Order	Family	Species
Amphibia	1	2	5
Reptilia	2	5	9
Aves	3	13	21
Mammalia	5	6	10
Total	17	26	45

**Note: Classification is based on *Revised Checklist of Chinese Amphibia & Reptilia* (Zhao Ermi, Zhang Xuewen etc., 2000)**

**(I) Amphibians**

There are 5 species in 2 families of 1 order of amphibians in the project area, which are all protected animals of Hubei Province. Table 3.5-4 lists the amphibians in the project area.

**Table 3.5-4 List of amphibians in the project area**

Family	Species	Living environment	Fauna	Quantity	Protection level
<b>I. ANURA</b>					
(I) Bufonidae	1. <i>Bufo gargarizans</i>	Near water sources or in dark and damp grass	Polytopic species	+++	Provincial level
(II) Ranidae	2. <i>Rata guentheri</i>	Ponds, water ditches or rivulet, or in nearby grass. Its spawning season is from March to June.	Oriental species	++	Provincial level
	3. <i>Rata limnocharis</i>	Ponds, damp fields or nearby fields and wet places.	Oriental species	++	Provincial level
	4. <i>Rana nigromaculata</i>	Damp fields, brooks, ditches, lakes and ponds	Polytopic species	+++	Provincial level
	5. <i>Rana plancyi</i>	Damp fields	Polytopic species	++	Provincial level

**Note: Classification is based on *Revised Checklist of Chinese Amphibia & Reptilia* (Zhao Ermi, Zhang Xuewen etc., 2000)**

**(II) Reptilians**

Through field survey and interviews in June and November of 2015 and by referring to the published literature on the project area, we have concluded the types, quantity and distribution of reptilians in the project area as follows:

There are 9 species, 5 families and 2 communities of reptilians in the project area (see Table 3.5-5 for the list). There are 5 species of colubridae, which is the most and accounts for 55.5% of all species; other species account for 44.5%. No national key protected wildlife is found in the area. Three species of provincial key protected wildlife in Hubei inhabit there: *Elaphe carinata*, *E.taeniura*, and *Zaocys dhumnades*.

**Table 3.5-5 List of reptilians in the project affected area**

LATIN NAME OF THE SPECIES	LIVING ENVIRONMENT	FAUNA	POPULATION	PROTECTION LEVEL
<b>I. TESTUDINATA</b>				
(I) Bataguridae				
(1) <i>Chinemys reevesii</i>	Rivers, lakes, ponds, rivulets or in wet grass on the bank.	Polytopic species	+	Not listed
(II) Trionychidae				
(2) <i>Pelodiscus sinensis</i>	Rivers, lakes and ponds.	Polytopic species	+	Not listed
<b>II. SQUAMATA</b>				
<b>Lacertilia</b>				
(III) Gekkonidae				
(3) <i>Gekko japonicus</i>	It inhabits in tree cavities, under rocks or in the gaps between walls and it is nocturnal.	Oriental species	+	Not listed
(IV) Scincidae				
(4) <i>Eumeces chinensis</i>	It inhabits in trees and grass in the mountains and plains.	Oriental species	+	Not listed
<b>Serpentes</b>				
(V) Colubridae				
(5) <i>Dinodon rufozonatum</i>	It inhabits in mountain forests and plains, waterside, wall foundation and caves.	Palaearctic species	++	Not listed
(6) <i>Elaphe carinata</i>	It inhabits in forests and shrubs in hills and mountains and nearby fields.	Polytopic species	+++	Provincial level
(7) <i>E. rufodorsata</i>	It is semi-aquatic nonpoisonous snake and inhabits in rivers, ditches, wet fields, ponds and nearby.	Palaearctic species	+	Not listed
(8) <i>E. taeniura</i>	It inhabits near human houses and also appears in grassland, fields, and hills.	Polytopic species	+	Provincial level
(9) <i>Zaocys dhumnades</i>	It inhabits in the fields, in grass beside roads or waterside in hilly areas.	Oriental species	++	Provincial level

**Note: Classification is based on *Revised Checklist of Chinese Amphibia & Reptilia* (Zhao Ermi, Zhang Xuewen etc., 2000)**

## (2) Ecotype

Based on the ecological habits of the reptilians, the reptilians in the project area have the following 4 ecotypes:

- i). House-inhabited type: 1 species, *Gekko japonicus*. It mainly lives in residential area and nearby shrubs in the project area and has close relation with human activities.
- ii). Shrub and rock gap inhabited type: 2 species, *Eumeces chinensis* and *Dinodon rufozonatum*. They are widely distributed in the project area and mainly appear in grass and shrubs beside roads, and have close relation with human activities.
- iii). Water-inhabited type: 2 species, *Pelodiscus sinensis* and *Chinemys reevesii*.

They are mainly distributed along the banks of Yantgze River in the project area.

iv). Forest waterside inhabited type: 4 species of snake, *Elaphe carinata*, *E. rufodorsata*, *E. taeniura*, and *Zaocys dhumnades*. They are mainly distributed in the shrubs near water in the project area.

### (3) Fauna

Based on the fauna types, the above 9 species of reptilians are divided into 3 categories: 3 species are oriental species, accounting for 33.3%; 4 species are polytopic species, accounting for 44.4%; and 2 species are palaeartic species, accounting for 22.2%.

### (4) Introduction of the main species

*Elaphe carinata*: Inhabited in mountains, plains and hills, they are seen in river bank, pond banks, reservoirs and other places near water. There are a large number of *elaphe carinata* in the plains in the project area.

*Dinodon rufozonatum*: It inhabits in mountain forests and plains, waterside, wall foundation and caves. It is widely distributed in the project area.

*Zaocys dhumnades*: it inhabits in middle and lower mountainous areas, and usually appears nearby fields, rivers and ditches, and sometimes is also found in villages. It moves fast and is quick in action. It is docile and mainly feeds on batrachian, lizards, fishes, mouse and so on. There are a large number of *zaocys dhumnades* in the plains in the project area.

### (III) Aves

Through extensive field survey and interviewing and by referring to relevant literature on the project area, we have concluded the types, quantity and distribution of aves in the project area as follows:

#### (1) Species, quantity and distribution

There are 21 species in 13 families of 9 orders of aves in the project area and surrounding area (see Table 3.5-6 for the list). There are 8 species of gruiformes, which is the most and accounts for 38.1% of all species. There is no national key protected species of aves in the area. Eleven species of key protected aves of Hubei Province live there: *Phalacrocorax carbo*, *Egretta garzetta*, *E.i.intermedia*, *Ardea cinerea*, *Anas platyrhynchos*, *Phasianus colchicus*, *S. chinensis*, *Hirundo rustica*, *Corvus macrorhynchos*, *Pica pica*, and *Garrulax canorus*.

**Table 3.5-6 Checklist of species of aves in the project area**

Latin name	Living environment	Resident/ Migratory	Fauna	Quantity	Protection level
<b>I. PODICIPEDIFORMES</b>					
(I) Podicipedidae					
1. <i>Podiceps ruficollis</i>	Lakes, rivers, reservoirs and ponds where there are reeds or waterweeds.	Resident	Polytopic	++	Not listed
<b>II. PELECANIFORMES</b>					
(II) Phalacrocoracidae					

2. <i>Phalacrocorax carbo</i>	Rivers, lakes, ponds, reservoirs, estuaries and marshland.	Resident	Polytopic	++	Provincial
<b>III. CICONIDFORMES</b>					
(III) Ardeidae					
3. <i>Egretta garzetta</i>	Shallow waters, such as paddy fields, ponds, rivers & lakes, reservoirs and streams	Summer visitor	Oriental	+++	Provincial
4. <i>E.i.intermedia</i>	Streams, paddy fields, ponds	Winter visitor	Polytopic	++	Provincial
5. <i>Ardeacinerea</i>	Inhabiting at shallow waters, such as marshlands, beaches, and rivers & lakes, building nests at a centralized place	Resident	Oriental	+++	Provincial
6. <i>Ardeapurpurea</i>	Shallow waters, such as marshlands, rivers and reservoirs	Summer visitor	Palaeartic	+	Not listed
<b>IV. GRUIFORMES</b>					
(IV) Rallidae					
7. <i>Amaurornis phaeicurus</i>	Marshlands, ponds, paddy fields, places near a stream, and shrubs near water	Summer visitor	Palaeartic	++	Not listed
<b>V. ANSERIFORMES</b>					
(V) Anatidae					
8. <i>Anasplatyrhynchos</i>	Lakes, rivers, ponds, marshlands etc.	Winter visitor	Palaeartic	+	Provincial
9. <i>Anascreca</i>	Rivers, lakes, marshlands	Winter visitor	Palaeartic	+	Not listed
10. <i>Anaspoecilorhyncha</i>	Rivers, lakes, sandbars, marshlands	Summer visitor	Oriental	++	Not listed
<b>VI. GALLIFORMES</b>					
(VI) Phasianidae					
11. <i>Phasianus colchicus</i>	Shrub grasslands, bamboo forest, dry lands	Resident	Polytopic	+	Provincial
<b>VII. CHARADRIIFORMES</b>					
(VII) Sternidae					
12. <i>Chlidonia hybrida</i>	Marshlands, river & lake banks, and paddy fields	Summer visitor	Polytopic	++	Not listed
<b>VIII. COLUMBIFORMES</b>					
(VIII) Columbidae					
13. <i>S. chinensis</i>	Inhabiting in woods at hilly and mountainous area, at wild field with lots of trees, and near farmlands, usually appearing in small groups in fall	Resident	Oriental	+	Provincial
<b>IX. PASSERIFORMES</b>					
(IX) Hirundinidae					

14. <i>Hirundo rus</i>	Flying over farmland, especially flying in groups and preying on insects over the just ploughed lands, building nests on walls and under eave.	Summer visitor	Palearctic	++	Provincial
(X) Motacillidae					
15. <i>Motacilla cinerea</i>	Various environments near water	Winter visitor	Polytopic	++	Not listed
16. <i>Motacilla alba</i>	Farmlands, grasslands, barren slopes and road sides near water, never in woods	Resident	Polytopic	++	Not listed
17. <i>Anthuspinoletta</i>	Low mountains & hills, plains at the foot of mountain, marshlands, and grasslands & farmlands on both banks of a river	Winter visitor	Polytopic	+	Not listed
(XI) Corvidae					
18. <i>Corvus macrorhynchos</i>	Inhabiting at plains, hills and mountainous areas, usually appearing in groups at farmlands, near villages and at river beaches.	Resident	Palearctic	+	Provincial
19. <i>Pica pica</i>	Mountain forest periphery, farmlands and villages.	Resident	Polytopic	++	Provincial
(XII) Timaliidae					
20. <i>Garrulax canorus</i>	Shrubs and pygmy forests at hilly and mountainous areas, bamboo forests and yards near town or village	Resident	Oriental	+bu+	Provincial
(XIII) Passeridae					
21. <i>Passer montanu</i>	Mountain villages, valleys, river banks and farmlands	Resident	Polytopic	+++	Note listed

**Note: the classification is made in accordance with the *A Checklist on the Classification and Distribution of the Birds of China (2<sup>nd</sup> Edition)* (By Zheng Guangmei, 2011).**

#### (IV) Mammals

On the basis of filed survey, interviews and relevant literatures, a complete investigation about the species, quantities and distribution of mammals in the target area of ecological assessment was conducted, getting results in below:

There are totally 5 orders, 6 families and 10 species (see details in Table 3.5-7). Two species, *Lepus sinensis* and *Mustela kathiah*, are Hubei provincial-level protected animals.

**Table 3.5-7 List of mammal species in the target area**

Specific name	Living environment	Fauna	Population	Protection level
<b>I、INSECTIVORA</b>				
(1) Erinaceidae				

Specific name	Living environment	Fauna	Populat on	Protectio n level
1. <i>Erinaceus europaeus</i>	Living in various environments, usually building nests at tree roots, on fallen trees, in stone cracks and in shrubs	Palaeartctic	++	Not listed
(2) Soricidae				
2. <i>Anourosorex squamipes</i>	Forest lands, grasslands, farmlands and villages	Oriental	+	Not listed
<b>II.CHIROPTERA</b>				
(3) Hipposiderid				
3. <i>Pipistrellus abramus</i>	Near residences	Oriental	++	Not listed
<b>III.LAGOMORPHA</b>				
(4) Leporidae				
4. <i>Lepus capensis</i>	Mainly at farmlands or in the shrubs and grasses on both sides of channels near farmland, in shrubs on hills, and at the periphery of forestry	Oriental	++	Not listed
5. <i>L. sinensis</i>	At shallow grass slope and shrub land at the foot of mountain, and near farmlands	Oriental	+	Provincial
<b>IV.RODENTIA</b>				
(5) Muridae				
6. <i>Rattus norvegicus</i>	Widely distributed	Oriental	+++	Not listed
7. <i>R. niviventer</i>	Forest lands, shrubs, crop areas, stone cracks, and grasslands near water	Oriental	+	Not listed
8. <i>Mus musculus</i>	Villages	Polytopic	+++	Not listed
<b>V.CARNIVORA</b>				
(6) Mustelidae				
9. <i>Mustela sibirica</i>	Inhabiting in various environments, mainly forest periphery, shrubs, marshlands, valleys, hills and plains	Polytopic	++	Not listed
10. <i>M. kathiah</i>	Mainly at mountain forests, grasslands, low mountains & hills, farmlands and villages	Oriental	++	Provincial

**Note: the classification is made in accordance with the *A Complete Collection of Vertebrates* (Editor in chief: Liu Mingyu, 2000).**

#### **(V) Key protected terrestrial animals**

In the target area of ecological assessment, there is no national key protected terrestrial animals, but there are 21 Hubei provincial-level protected animals, as shown in Table 3.5-8.

**Table 3.5-8 Checklist of key protected terrestrial animals in the target area**

Species	Living environment	Protection level	Population	Distribution in target area
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Species	Living environment	Protection level	Population	Distribution in target area
1. Bufo gargarizans	Streams & gullies, shrub grasslands, villages	Provincial	+++	Near to paddy fields
2. Hylarana guentheri	In ponds, ditches or rivers, or in the grass nearby	Provincial	++	
3. Pelophylax nigromaculata	Paddy fields, streams & gullies, lakes and marshes	Provincial	++	
4. Fejervarya multistriata	Paddy fields, marshes and vegetable fields	Provincial	+	
5. Rana plancyi	Paddy fields, taro fields, or water bamboo fields	Provincial	+	
5. Elaphe carinata	Shrubs, rivers, ponds	Provincial	+++	Near to shrubs and grasslands
6. E. taeniura	Shrubs	Provincial	+	
7. Zaocys dumnades	Shrubs	Provincial	++	
8. Phalacrocorax carbo	Rivers, lakes, ponds, reservoirs, estuaries and marshes	Provincial	++	Rivers
9. Egretta garzetta	Streams, paddy fields, ponds	Provincial	+++	Rivers, paddy fields
10. E. i. intermedia	Streams, paddy fields, ponds	Provincial	++	Rivers, paddy fields
11. Ardea cinerea	Streams, paddy fields, ponds	Provincial	++	Paddy fields
12. Anas platyrhynchos	Lakes, rivers, ponds, marshes and other waters	Provincial	+	Rivers
13. Phasianus cochicus	Shrub grasslands, bamboo forests, dry lands	Provincial	+	Dry lands, shrub grasslands
14. S. chinensis	Open grounds, sparse woods	Provincial	++	Villages
15. Pica pica	Mountain forest periphery, farmlands or villages	Provincial	+	Shrubs, farmlands
16. Hirundo rustica	Villages	Provincial	+++	Near to villages
18. Corvus macrorhynchos	Inhabiting at plains, hills and mountainous areas; usually appearing in groups near farmlands and villages and at river beaches	Provincial	+	Near to villages
19. Garrulax canorus	Shrubs at hilly and mountainous areas, bamboo forests and yards near town or village	Provincial	++	Shrub grasslands, yards
20. L. sinensis	At shallow grass slopes or shrubs, or near farmlands	Provincial	+	Shrub grasslands, farmlands
21. M. kathiah	Mountain forests, grasslands, low mountains & hills, and places near to villages and farmlands	Provincial	++	Near to farmlands and villages

## (VI) Assessment of terrestrial animal resources

The assessment area is mostly plains and hilly residential areas. The density of population is not large and the topographic relief is not obvious. Ground vegetation is mostly planted. It's not a good place for wild animals. So the diversity of terrestrial animals is not sufficient. In the target area, the amphibians include 1 order, 2 families and 5 species, the reptiles include 2 orders, 5 families and 9 species, the birds include 9 orders, 13 families and 21 species, and the mammals include 5 orders, 6 families and 10 species.

In the target area, there is no national-level protected animals, but there are 21 Hubei provincial-level protected animals,

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### **3.5.2 Aquatic environment**

As the wharf of project is located in Yangtze River section as stated in *Environmental Impact Report for Jingjiang River Reach Regulation Project (2012)*. At the same time, the aquatic ecological environment of the river reach in recent years sees little changes (for example, its upper reaches see no new dam). We believe that the status quo of aquatic ecosystem mentioned in environmental impact report can represent the current situation of aquatic ecosystem of the project. Therefore, we adopt it in this section. Meanwhile, the newest data of fish are also updated and sourced from Ministry of Water Resources/Water Engineering Ecology Institute of Chinese Academy of Sciences

*Environmental Impact Report for Jingjiang River Reach Regulation Project* is carried out by the Ministry of Water Resources/Water Engineering Ecologic Institute of Chinese Academy of Sciences. The surveys for the status quo of aquatic ecosystem include site reconnaissance, data collection and site visit, etc. The survey was conducted on April 9 - 23, 2011 and July 6 - 30, 2011. The survey for larval resources of fishes is conducted from June 16 to July 15 in 2011 (prosperous period of natural reproduction for four Chinese carps).

#### **3.5.2.1 Phytoplanktons**

##### **(1) Species of phytoplanktons**

We conducted two investigations in April (dry season) and July (wet season) of 2011 in the target area. The investigation results include 7 phyla and 48 genera, covering totally 125 phytoplankton species, of which 75 species belong to bacillariophyta, accounting for 60.00%, 28 species belong to chlorophyta, accounting for 22.40%, 16 species belong to cyanophyta, accounting for 12.80%, one species belongs to euglenophyta and one species belongs to chrysophyta, accounting for 0.80% respectively, and two species belong to pyrroptata and two species belong to rhodophyta, accounting for 1.60% respectively.

In the target area, the quantity of phytoplankton species in bacillariophyta is the largest, followed by chlorophyta and cyanophyta. The common species include melosira, fragilaria, synedra, cymbella, navicula, diatoma, gomphonema, and phormidium etc, distributed as per the species.

##### **(2) Standing crops of phytoplanktons**

Investigation results show that in the target area, the average density of phytoplanktons is 287656 ind./L, of which the average density of bacillariophyta is 245016 ind./L, accounting for 85.18%, the average density of chlorophyta is 32933ind./L, accounting for 12.45%, that of cyanophyta is 7627 ind./L, accounting for 2.65%, that of euglenophyta is 1387ind./L, accounting for 0.48%, that of pyrroptata is 390 ind./L, accounting for 0.14%, and that of chrysophyta is 1092ind./L, accounting for 0.38%.

According to investigation results, the average biomass of phytoplanktons in the target area is 0.5876mg./L, of which the average biomass of bacillariophyta is 0.3632 mg./L, accounting for 61.80%, the average biomass of chlorophyta is 0.1615mg./L, accounting for 27.48%, that of cyanophyta is 0.0449 mg./L, accounting for 7.63%, that of chrysophyta is 0.0185mg./L, accounting for 3.15%, that of euglenophyta is 0.0035 mg./L, accoutning for 0.60%, and that of pyrroptata

is 0.0195mg./L, accounting for 3.32%.

### (3) Diversity of algae

Biodiversity is a critical indicator of species structure in an ecological system. It not only reflects the level of organization of the biocenosis but also shows the essential nature of the biocenosis from the relation between structure and function. Biodiversity index is ecologically significant because it reflects the richness and evenness of species in an ecological system.

By using the formula of Shannon-Wiener index, the diversity index of phytoplanktons at cross sections of Zhijiang section of Yangtze River is calculated as shown in Table 3.5-9.

**Table 3.5-9 Diversity indexes of phytoplanktons at cross sections of Zhijiang section of Yangtze River**

Time	Items	Quantity
April	Qualitative measurement of species	39
	Quantitative measurement of species	26
	Diversity index	3.56
July	Qualitative measurement of species	52
	Quantitative measurement of species	22
	Diversity index	3.45

Diversity index is designed to reflect the richness and evenness of species in an ecological system. Investigation results show a high diversity index of phytoplanktons at cross-sections of Zhijiang section of Yangtze River in the target area. This demonstrates that the target area has rich and even phytoplankton species.

Algae diversity has something to do with water quality. Shannon-Weiner index is used to assess water quality, as shown in Table 3.5-10.

**Table 3.5-10 Algae diversity index and water quality assessment**

Diversity index	0	$0 < H \leq 1$	$1 < H \leq 2$	$2 < H \leq 3$	$3 < H$
Degree of pollution	Severe pollution	Heavy pollution	Moderate pollution	Light pollution	Clean

Shannon-Wiener index is used to assess the water quality of each cross-section in the target area. Investigation results show that the algae diversity index at cross sections of Zhijiang section is larger than 3, which demonstrates that the quality of waters in the target area is clean.

### 3.5.2.2 Zooplankton

#### (1) Species of zooplankton

In the target area, there are totally 32 genera and 65 species of zooplankton (refer to Table 3.5-11), including 28 protozoa species at most, accounting for 43.08%, 19 rotifer species, accounting for 29.23%, 8 cladocera species, accounting for 12.31%, and at least 10 copepod species, accounting for 15.38%. Common protozoa species include arcella hemisphaerica and C. orbicularis, common rotifer species include brachionus calyciflorus pallas, keratella cochlearis and polyarthra trigla,

common cladocera species include daphnia hyaline and bosmina coregoni, and common copepod species include sinocalanus dorrii and cyclops strenuuss.

**Table 3.5-11 Number of zooplankton species in the target area**

Species		Protozoa	Rotifer	Cladocera	Copepod	Total
Zhijiang section	April	17	13	7	5	42
	July	21	8	4	9	42
	Total	28	19	8	10	65

## (2) Standing crops of zooplankton

### 1) Density

As shown in Table 3.5-12, the average density of zooplankton in the target area (Zhijiang section of Yangtze River) is 213.97ind./L, of which the average density of protozoa is 198.5ind./L, accounting for 92.77%, that of rotifer is 15.00ind./L, accounting for 7.01%, that of cladocera is 0.13 ind./L, accounting for 0.06%, and that of copepod is 0.335ind./L, accounting for 0.016%. The average density of zooplankton at this section is 255.81ind./L in April and 172.12ind./L in July. The average density in July is higher than that of April.

**Table 3.5-12 Density of zooplankton in the target area, unit: ind./L**

Species		Protozoa	Rotifer	Cladocera	Copepod	Total
Zhijiang section	April	225	30	0.23	0.58	255.81
	July	172	0	0.03	0.09	172.12
	Average	198.5	15	0.13	0.335	213.97

### 2) Biomass

As shown in Table 3.5-13, the average biomass of zooplankton in the target area (Zhijiang section of Yangtze River) is 0.0369mg/L, of which average biomass of rotifer is 0.018mg/L, accounting for 48.78%, the highest among the four categories, followed by protozoa (0.0099mg/L, accounting for 26.834%), copepod (0.0064mg/L, accounting for 17.34%) and cladocera (0.0026mg/L, accounting for 7.05%) in order.

**Table 3.5-13 Biomass of zooplankton in the target area, unit: mg/L**

Species		Protozoa	Rotifer	Cladocera	Copepod	Total
Zhijiang section	April	0.0113	0.0360	0.0046	0.0110	0.0629
	July	0.0086	0.0000	0.0006	0.0017	0.0109
	Average	0.0099	0.0180	0.0026	0.0064	0.0369

### 3) Diversity analysis of zooplankton

By using Shannon-Weiner index formula, the diversity index of zooplankton at Zhijiang section is calculated as shown in Table 3.5-14, Diversity index is designed to reflect the richness and evenness of species in the ecological system. Investigation results show that the diversity index of zooplankton in the target area is 1.21 in April and 0.58 in July, both of which are at low level.

**Table 3.5-14 Shannon-Weiner diversity index of zooplankton at Zhijiang**

### section

Items		Zhijiang section
April	Diversity index	1.21
	Quantitative measurement	6
July	Diversity index	0.58
	Quantitative measurement	6

#### 3.5.2.3 Zoobenthos

##### (1) Species of zoobenthos

In the target area, there are totally 26 species of zoobenthos, including 2 annelid species, accounting for 7.69%, 10 mollusk species, accounting for 38.46%, and 14 arthropod species, accounting for 53.85%. Dominant species include limnoperna lacustris, corbicula fluminea, procladius, palaemonidae, palaemonetes sinensis and freshwater shrimps, etc.

Most of zoobenthos inhabit at near-shore beaches and backwaters where water flows slowly. In main course of river, water flows fast, so number of zoobenthos is small. Since hydrological conditions are similar throughout the target area, species of zoobenthos have mostly the same structure and there is no significant difference in horizontal distribution of species, just a little richer in dry season than in wet season.

In Yangtze River, most of zoobenthos appear at near-shore beaches and shallow waters and river branches where water flows slowly. In main course of river, water flows fast, so size of zoobenthos is small.

##### (2) Standing crops of zoobenthos

Standing crops of zoobenthos in the target area are shown in Table 3.5-15. We can see from the table that the density of zoobenthos is 10ind./m<sup>2</sup>, of which the highest component is arthropod, followed by mollusk and the lowest component is annelid, and that the biomass of zoobenthos is 3.24g/m<sup>2</sup>, of which the highest component is mollusk, followed by arthropod, and the lowest component is annelid. See Table 3.5-15 for details.

**Table 3.5-15 Existing amounts of zoobenthos**

Cross sections of river		Density (ind./m <sup>2</sup> )				Biomass (g/m <sup>2</sup> )			
		Annelid	Mollusk	Arthropod	Total	Annelid	Mollusk	Arthropod	Total
Zhijiang section	April	0	5	16	21	0	3.43	0.8	4.23
	July	0	3	4	7	0	1.25	0.99	2.24

##### (3) Diversity index of zoobenthos

Diversity index of zoobenthos at Zhijiang section is 2.4 in April and 2.1 in July, both of which are at ordinary level, as shown in Table 3.5-16.

Dominant species of zoobenthos in the target area include limnoperna lacustris, corbicula fluminea, procladius, palaemonidae, palaemonetes sinensis and freshwater shrimps. Most of them inhabit at near-shore beaches and backwaters. There are few at main course of river and deep waters.

**Table 3.5-16 Diversity index of zoobenthos**

Indicators	Zhijiang section	
	April	July
Qualitative measurement	14	9
Quantitative measurement	6	5
Diversity index	2.4	2.1

#### **(4) Assessment of zoobenthos**

In the target area, there are now 35 species of zoobenthos, of which the mollusk, arthropod and annelid take up 65.71%, 20.00% and 14.29% respectively. Dominant species include *bellamya quadrata*, *semisulcospira cancellata bonson*, *limnoperna lacustris*, *corbicula fluminea*, *corbicula nitens*, *E.annandalei*, *E.modestus* and *palaemonetes sinensis* etc. The average density of zoobenthos is 27.11ind./m<sup>2</sup>, of which the mollusk, arthropod and annelid take up 4.28%, 61.16% and 34.56% respectively. The average biomass of zoobenthos is 1.2g/m<sup>2</sup>, of which the mollusk, arthropod and annelid take up 82.54%, 10.32% and 7.14% respectively.

There are rich species of zoobenthos in Zhijiang section of Yangtze River, including very few dirty resistant species, and some aerobic ephemeroptera species were detected in some positions. All these demonstrate that the water quality is good at this section of Yangtze River.

#### **3.5.2.4 Fish resources**

##### **(1) Living environment for fishes**

###### **a) Spawning ground of four major Chinese carps**

The environmental requirements for spawning of the fishes producing pelagic eggs such as four major Chinese carps include proper water temperature, river swelling as a stimulus and proper hydrological conditions. River swelling actually represents a series of hydrological changes, such as increased flow, rise of water level, increased speed, and becoming less transparent and disordered.

Spawning grounds for the fishes producing pelagic eggs such as four major Chinese carps are usually featured with tortuous and complex river channel, a strip of land extending into river center, or sandbars at river center. These features result in complicated hydrological conditions, such as change of water speed and disorder of water flow, and water waves and whirlpools are generated to provide the best conditions for spawning of the fishes producing pelagic eggs. Sperms fuse with eggs when moving up and down with water flow. Proper hydrological conditions at spawning season will stimulate parent fishes to spawn at the spawning grounds.

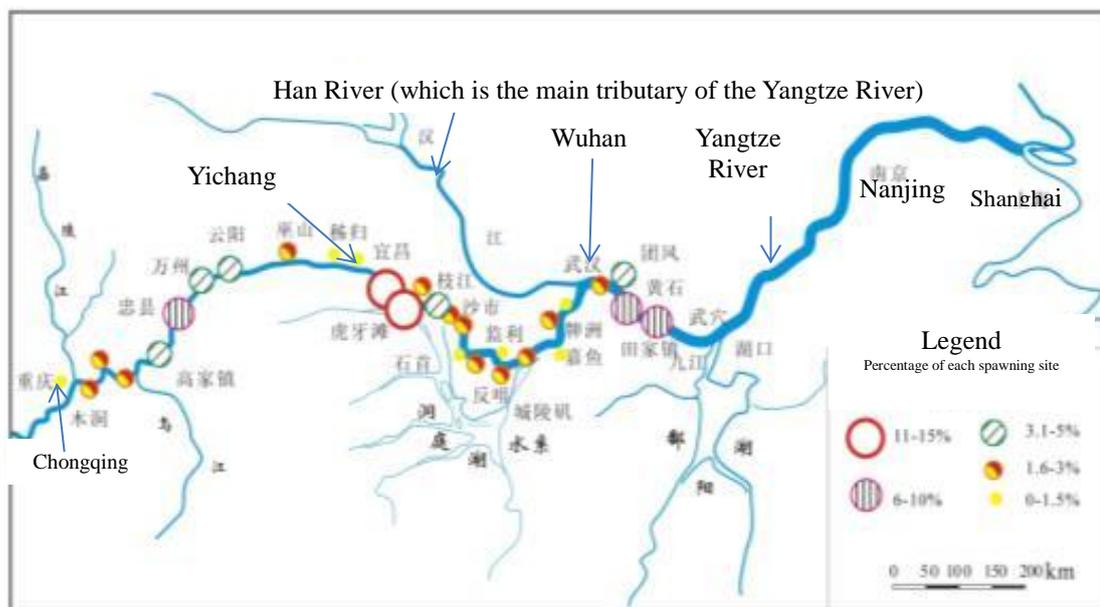
According to the survey in 1980s, there are 19 spawning grounds for four major Chinese carps (grass carp, black carp, silver carp and bighead carp) in the section from Yichang to Wuxue of Yangtze River (as shown in Figure 3.5-1).

After Three Gorges Reservoir was used for water storage in 1997, Yangtze River Fisheries Research Institute and Water Engineering Ecology Institute had continuous monitoring on the fishes producing pelagic eggs in the middle reaches

of Yangtze River and found 11 spawning grounds of four major Chinese carps in the 300km section from Yichang to Chenglingji of Yangtze River (as shown in Figure 3.5-1). During 2003~2006, the amount of eggs produced by fishes with pelagic eggs was approximately 42.7% at the middle reaches of Yangtze River. The fish eggs are mainly sourced in Yichang, Yidu, Jiangkou, Shishou and Tiaoguan, indicating that there are many spawning grounds distributed in this section and they are moving downstream.

Based on the survey in 2014, the spawning sites for four major Chinese carps are mainly located in Yanshouba-Yunchi(Honghuatao), Baiyang township-Guanzhou and Zhoujiawan Village-Zhijiang. In accordance with the surveyed data on the spawning ground in Zhijiang section by Yangtze River Fisheries Research Institute in 2015, the spawning grounds for the four major Chinese carps are mainly located in downstream Gezhou Dam-Miaozui, Yanshou Dam-Honghuatao, Zhicheng-Yaojia Port.

As shown in the results of survey from 2014 to 2015, the scope of spawning grounds for four major Chinese carps in downstream Gezhou Dam-Miaozui and Yanshou Dam-Yunchi are relatively more stable. The location of spawning grounds distributed in Baiyang Township-Zhijiang River section is relatively different, owing to the facts that the fishery resources of the Yangtze River are deteriorating, the amount of fish is decreasing and the parent fish have to choose the most suitable river sections to spawn.



In the 1980s



After Three Gorges Reservoir was used for water storage(since 1997)

**Figure 3.5-1 Spawning grounds of four major Chinese carps at the middle and lower reaches of Yangtze River**

### **b) Feeding or nursing ground**

Location of feeding or nursing ground of fishes usually depends on their foods. The fishes preying on planktons, such as silver carp and bighead carp, usually feed themselves or juveniles at clean lakes connected to river. Due to water storage in Three Gorges Reservoir, the water area downstream from the dam has clean and transparent water and has become feeding ground for the fishes preying on planktons. The fishes preying on aquatic vascular plants, e.g. grass carp, and the fishes preying on snails and mussels, e.g. black carp, also get fed mainly at lakes connected to river.

### **c) Overwintering ground**

In winter, water level falls and fishes spend winter mainly in deep waters of river.

### **(2) Biological conditions of major aquatic animals**

Refer to Section 3.6.

### **(3) Species of fish in the target area**

In the target area, there are 10 orders, 23 families, 77 genera and totally 123 species of fish, including cypriniformes (54 genera and 83 species and subspecies), siluriformes, perciformes, acipenseriformes, clupeiformes, cyprinodontiformes, synbranchiformes, beloniformes, salmoniformes, anguilliformes and tetraodontiformes. Family cyprinidae includes 46 genera and 69 species. In addition, giant salamander and finless porpoise were seen in the target area.

In general, the environment of the project area is good, in spite of local destruction of ecological environment due to large-scale development or construction.

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## 3.6 Chinese Sturgeon Nature Reserve

### 3.6.1 Ecological significance of Chinese sturgeon, *Psephyrus gladius*, Dabry Sturgeon and Bleeker

The general ecological significance of species project is presented by the preservation of biodiversity, including Genetic diversity, species diversity and ecosystem diversity. Species diversity is the core of biodiversity and the basic unit of biology category Three indicators of biodiversity cover: 1) Total amount of species, e.g., the number of species in the specific region; 2) Intensity of species, e.g.: the number of species in unit area; 3) Proportion of specific species, refers to the ratio of specific species among all species in the region. Only by protecting the species will we ensure the genes of the species will not disappear and further to maintain the diversity of eco-system.

#### (1) Protection of biodiversity in this region

Yichang is located within the natural reserve of Chinese sturgeon. The fish species in fresh water are various and abundant, totally 121 fish species, including *Pterocarya stenoptera*, *Ctenopharyngodon idellus*, *Ctenopharyngodon idellus*, *Ctenopharyngodon idellus*, *Eriocheir sinensis* and *Culter* in addition to the above-mentioned fish. In the natural reserve, there are also rare wild animals, birds and water birds. These resources are so important that China establishes natural reserve to ensure the biodiversity in the middle reaches of the Yangtze River. It is also significant to the survival of these species but also the international reputation of China on biological environment.

Species is the conveyor of genetic information. Due to the diversity of genetic information, one species cannot include all genetic information of the biological community. Each species is a database of all genetic information which cannot be replaced by other species. If one species dies out, the genetic information it carries will disappear permanently. A lot of rare fish is the precious species resources of the nature. We shall protect it and leave it to the area of study and utilization considering their particularity and uniqueness.

#### (2) Protect the completeness of the biological system

Whether the ecological process of the Yangtze River will succeed or not is subject to the completeness of the whole ecological system. Therefore, the fish that constitutes as the main food chain in water body plays a critical role. The die-out of one or several species will disrupt the physical recycling and energy moving in the system, further interrupts the ecological process. Therefore, the consequences are further deterioration of ecological environment and secondary die-out of other species. Therefore, from the perspective of ecosystem we can see the significance of biodiversity. We have to pay attention to the requirements of different biology and groups on the inhabitants, spatial distribution, food chain and levels. We should avoid the damages to the structure and completeness of biological system. The more complicated the system, higher threshold for stability it will require. On the contrary, the more stable the system, the better balance it will achieve.

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The natural reserve of the Chinese sturgeon is aimed at protecting certain species and the integrity of the whole ecological system by the protection of biological group of certain species, diversity and functions, to preserve the balance, integrity of the groups.

Apart from general biological significance, there are also significances of protecting Chinese sturgeon, Martens, sturgeon, Rouge fish, as shown below:

(1) Biological significance of Chinese sturgeon

Chinese sturgeon is the descendants of oldest vertebrate in our plane—ancient spine fish, the common ancestor of all kinds of fish, dating back to 140 million years ago. The ancient spine fish even lived in the era of dinosaurs. The Chinese sturgeon, due to a series of ancient features that they carry, they are presented as a kind of species between Cartilaginous fish (sharks, etc.) and bony fish. Also the Chinese sturgeon is the more ancient group among the bony fish that they are quite valuable in studying the evolution history of fish. Additionally, the Chinese sturgeon is playing a very important role in the classification of fishes, as it is the important reference of fish evolution history and has the scientific value on the study of biological evolution, landform, transgression, regression, as well as invaluable ecological, social and economic values. To protect and save this rare but valuable “living fossil” is very significant to the reasonable development of wild animal resources and maintenance of ecological balance. One may find some traces of biological evolution from the Chinese sturgeon, the so-called living fossils of aquatic animals.

(2) *Psephyrus gladius*

*Psephyrus gladius* is also named Chinese spoon sturgeon, Bony fish, and belonging to the subspecies of key spoon sturgeon living in the Mississippi River. Its nickname is Chinese swordfish. It is China's largest freshwater fish and belonged to the Class I wild animal protection level. The species of white gill fish is the ancient species in Cretaceous and there exists only two species in the world, namely the key spoon sturgeon in the north America and the Chinese sturgeon in China. Both are very important for the academic research on the evolution and geological distribution of fish. Currently the quantity of Chinese sturgeon is decreasing significantly. It is called “Panda in water” to indicate its values and scarcity.

(3) Dabry sturgeon

Dabry sturgeon lives in the fresh water only in the main branches of the Yangtze River. It is unique in China and ranked in Class I national wild animal protection level.

(4) Bleeker

Bleeker is one of the rare fish in China. Totally there are about 65 species of fish in the family of Bleeker but are mainly distributed in the north America. In Asia, there are only two species; one is also seen in north America, namely Yakou fish in the eastern Siberia. The other is Bleeker, the unique species in Asia. Therefore, Bleeker is very important in Fish Geography and Animal Geography, with critical

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scientific values.

As the flagship-level species in the ecosystem of the Yangtze River, the above mentioned fish can also indicate the environment features. If these fish species remain their number unchanged, it indicates human interferences on the surrounding environment are minor, the aquatic ecosystem of the Yangtze River is stable, the index of biodiversity is high. Otherwise, it indicates the human impacts on the Yangtze River are big.

The project area is about 3km away outside the boundary of the provincial level Chinese Sturgeon Nature Reserve, as shown in Figure 3.6-1.

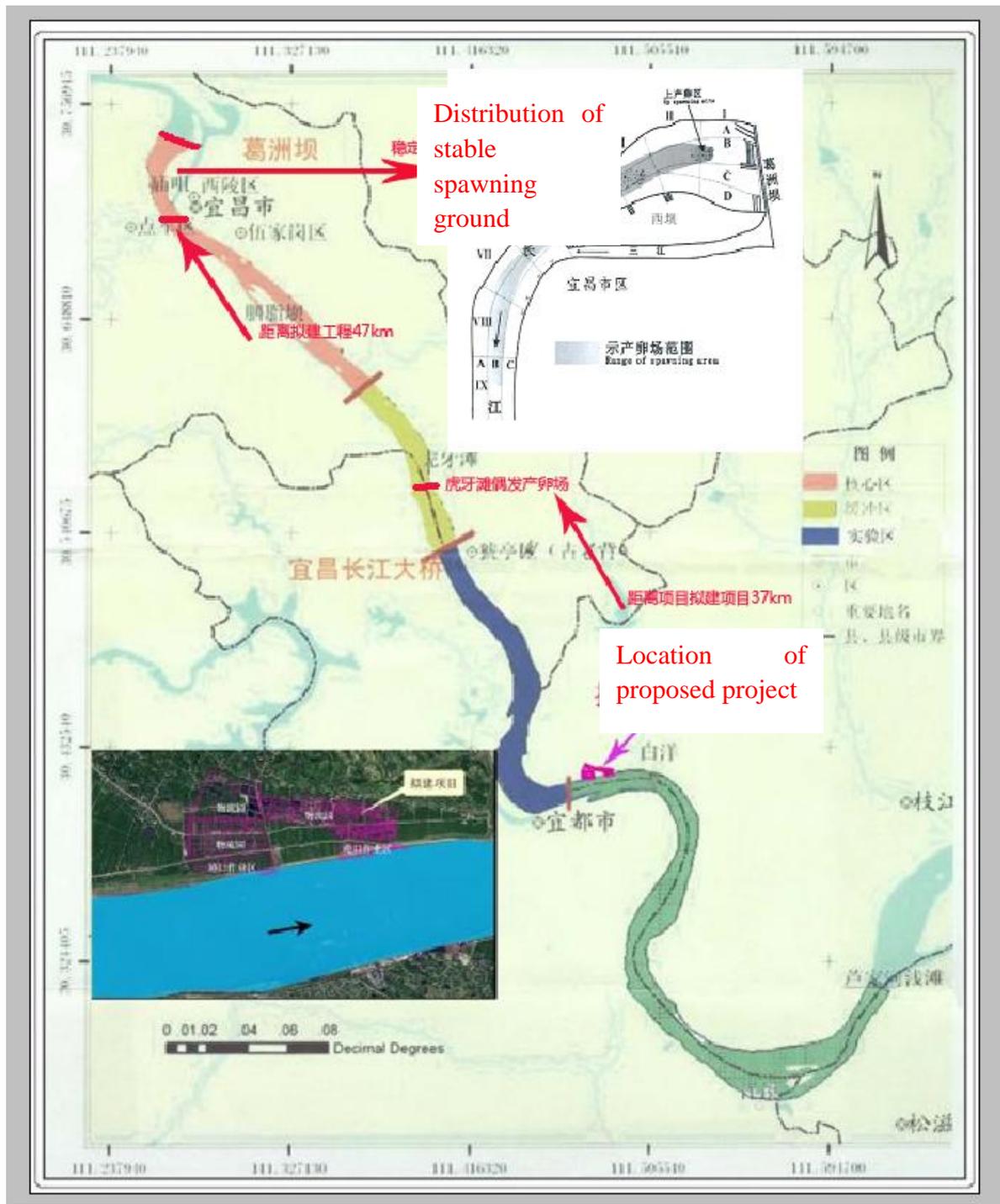


Figure 3.6-1: Relationship between Chinese sturgeon reserve and the project

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### 3.6.2 Chinese sturgeon

#### (1) Introduction

Chinese sturgeon is one kind of anadromous fish, of important significance for research. They inhabit along coastal areas of China and Japan and migrate to lower section of Jinsha River at the upper reaches of Yangtze River (3,050 km from Yangtze estuary) or upper section of Pear River for propagation. Yangtze River Chinese sturgeon spawn from mid-October to mid-November and Pearl River Chinese sturgeon spawn during March to April, so they are different ecological groups. Today, the size of spawning stock of Chinese sturgeons in Pearl River is decreasing sharply. Before 1980, the size of spawning stock of Chinese sturgeons in Yangtze River was larger than 2000 each year, but 400~500 Chinese sturgeons were harvested by people each year at the upper reaches of Yangtze River, equivalent to 60,000~80,000kg. After Gezhou Dam Water Control Project was constructed, the channel for Chinese sturgeon migrating upstream along Yangtze River was blocked and a new spawning ground for natural propagation was formed downstream from the dam. Many years' investigation shows that this is now the only spawning ground for Yangtze River Chinese sturgeon, and also the major habitat for spawning site of Chinese sturgeon.

Another main factor is the construction of the Three Gorges Dam that have influenced the Chinese sturgeon. The Three Gorges Dam was constructed by three phases. The first phase commenced from the beginning of 1993, which used the Zhongbao Island in middle of river to enclose the right-side river, then construct the Earth and rock cofferdam deep excavation foundation pit to construct the diversion channel. During this period, the river continue flowing and temporary shipping gate was constructed on the left side fo the bank. In 1997, the diversion channel commenced formal navigation. On November 8<sup>th</sup>, the river was intercepted which marked the Phase I project has reached the planned goal. The Phase II project commenced from 1998 after interception of river. It I featured by construction of earth-rock cofferdam in the river, spillway section, Zuoan Dam, Zuoan Power Plant and permanent shipping gate. In this phase, the river flow pass the diversion channel and the vessels can pass through the diversion channel or temporary gate. In the middle of 2002, the cofferdam upstream and downstream Zuoan Dam were blown up one by one, and the Three Gorges Dam began to retain water. On November 6<sup>th</sup> 2002 that the diversion channel intercepted flow marked that the river can only flow between the spillway dams. The dams of hydropower stations are all 185m tall and the water storage is 175m tall. The reservoir is as long as 600km or more.

Since 1983, commercial harvest of Yangtze River Chinese sturgeon has been prohibited. Only several licensed organizations are allowed to harvest Yangtze River Chinese sturgeon for the purpose of artificial spawning or scientific research. In spite of such measures, the quantity of Yangtze River Chinese sturgeons is decreasing continuously, only less than 1000 currently, because the size of natural propagation at the spawning ground downstream from Gezhou dam is small and artificial release is not enough to make up for the decrease of natural propagation.

In general, from 1981 to 1999, the total quantity of the Chinese sturgeon has decreased by about 90%.

To prevent extinction of Chinese sturgeons resulting from the blockage of their

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channel migrating upstream along Yangtze River by Gezhou Dam project and Three Gorges project, Research Institute of Chinese Sturgeon was established at Yichang in 1982. In the twenty years since its establishment, the institute has released more than 4,490,500 artificially-bred Chinese sturgeons into Yangtze River to effectively make up for the decrease of population of Chinese sturgeon. This activity is still being carried out every year.

At present, the spawning ground for the Chinese sturgeon in Gezhou Dam is still effective. Before 2013, we can acquire a certain amount of mature parent Chinese sturgeon during the breeding season to support artificial breeding; During the breeding season, we can collect the fertilized eggs, growing Chinese sturgeon embryos, fries being hatched out and from membrane; In 2004, we have found the parent Chinese sturgeon born after the interception of Gezhou dam among the Chinese sturgeons that we identified the age in the spawning ground. However, during the 10<sup>th</sup> FYP from 2001 to 2005, after the implementation of Adjustment Project in the downstream of Gezhou Dam Water Resources Hub, the parent fish spent less time in some spawning ground and the size of spawning decreased due to the changes of geological conditions and hydrological conditions.

In accordance with the new monitoring results, we didn't inspect any Chinese sturgeon eggs in downstream Dam spawning ground in 2013 and 2014. However, we found a lot of Chinese sturgeon fries in the mouth of the Yangtze River, with larger quantity than the previous years. However, we still don't know where the spawning ground is for these fries. At present, many institutes from Gezhou Dam to Shanghai and the mouth of Yangtze River are trying to find out the spawning ground of these larvae and juveniles.

## **(2) Migration period of Chinese sturgeons**

The migration period of Chinese sturgeons consist of two periods, i.e. pre-spawning anadromous migration and post-spawning catadromous migration.

### **1) Time of anadromous migration**

The period of anadromous migration of Chinese sturgeons is in mid-October each year.

### **2) Time of catadromous migration**

#### **a) The time of catadromous migration of adult Chinese sturgeons**

The time of **catadromous migration of adult Chinese sturgeons** is during Feb – the middle of April each year.

#### **b) The time of catadromous migration of larvae and juveniles of Chinese sturgeon**

The larvae and juveniles of Chinese sturgeons begin catadromous migration in the early to middle of December each year. Since the spawning ground is 55km from the project site, and the migration speed each day for larvae and juveniles is the

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water flow speed, i.e. 0.68m/s (low flow period), it can be seen that the time for the young fishes crossing this river section is less than one hour. Therefore, by a conservative estimate, the time of migration of larvae and juveniles during this period is during the mid to end of December each year.

### **3.6.3 Other important fishes**

The natural reserve mainly protects the family of Chinese sturgeon, their habitats and spawning grounds. Other protected target include: Martens, darcy's sturgeon, mullet and the four major Chinese carps, their habitats and spawning ground. There are more than 100 species of fish in Yichang section of the Yangtze River. The most important economic fish in the middle and downstream of the Yangtze River is the four major Chinese carp.

#### ***Psephurus gladius* (Martens)**

*Psephurus gladius* is one kind of ferocious fish swimming in middle and deep waters, listed into China level-1 protected aquatic wild animal. They inhabit in stem stream of Yangtze River, occasionally in large lakes connected to Yangtze River (e.g. Dongting Lake). They feed on other fishes (such as *Coreius heterodon* and bigmouth grenadier anchovy), shrimps and crabs, and spawn in spring.

In history, adult *psephurus gladius* were caught mainly at Leibo-Yibin section, Jiangjin section and Chongqing-Wan County section in Sichuan as well as the Yichang-Yidu section in Hubei. The adults harvested from Leibo-Yibin section were large and sexually mature. This proves that this section was a spawning ground.

After Gezhou Dam Water Control Project was constructed in 1981, the channel for *psephurus gladius* migrating upstream along Yangtze River was blocked. The population of *Psephurus gladius* at upper part of Yangtze River receives no replenishment, and through many years' investigation, we get no direct evidence of natural propagation of *psephurus gladius* at the middle and lower part of Yangtze River. In previous ten years, the population of *psephurus gladius* decreased obviously. This species may become extinct if without forceful measures. Since natural population of *psephurus gladius* is very small, it's not a good method to wait for natural restoration.

In December 2005, China Three Gorges Corporation initiated and financed the preliminary research for the project: "Research on Life History and Artificial Propagation Technologies of *Psephurus Gladius*", with the aim to explore the possibility of artificial domestication and propagation. Since then, a rare fishes rescue & rapid response system was established and many investigations were conducted to explore their major habitats. But till now, no living *psephurus gladius* has been searched and the artificial domestication and propagation technologies are under exploration.

#### ***Neophocaena phocaenoidesasiaeorientalis*(Pilleri et Gihl)**

#### **Category II Nationally Protected Aquatic Wildlife**

*Neomeris phocaenoides* are porpoise and only species of *neomeris*. Body length of adult *neomeris phocaenoides* is 120 to 190 cm and the weight ranges from 100 to 220kg. *Neomeris phocaenoides* are distributed in Western Pacific Ocean, India

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Ocean, Japan Sea, China Coastal Waters and other waters from tropical to warm Temperate Zone and are found in Bohai Sea, Yellow Sea, East China Sea, South China Sea and Yangtze River. They usually inhabit in saltwater and freshwater transitional zones and can also live in freshwater like downstream reaches of rivers. They are found even in the Yichang section of the Yangtze River. *Neomeris phocaenoides* like to go about alone or in pairs and the members in one fish group normally will not be larger than 4 or 5. However, there is also record that 87 *neomeris phocaneoides* go about together. *Neomeris phocaneoides* usually breed in Spring and their delivery takes longer time. April and May are usually the peak period for them to breed. Body length of new born *neomeris phocaneoides* is about 70 cm and *neomeris phocaneoides* usually bear one child for one pregnancy. They have wide feeding habits with fish as the main food source and eat shrimps and cephalopods.

Currently, number of *neomeris phocaneoides* in Changjiang River has decreased to less than 2000 and is decreasing constantly. Changes in natural environment, water level drawdown, deterioration of water quality, siltation of rivers and lakes and reduction of food sources threaten the breeding and growth of *neomeris phocaneoides*. Sailing and heavy fishing devastate the parent and young *neomeris phocaneoides*, causing sharp decrease in number of *neomeris phocaneoides*. Developing studies on artificial domestication and breeding, releasing young *neomeris phocaneoides* to enhance the sources and ensuring reproduction of *neomeris phocaneoides* for generations are of significant importance.

### ***Myxocyprinus asiaticus* (Bleeker)**

#### **Category II Nationally Protected Aquatic Wildlife**

The morphological characters of *Myxocyprinus asiaticus* vary greatly during different growth periods. For instance, as for the relationship of body length and height, fish larvae has a body length of about 1.6 ~ 2.2cm, which is about 4.7 times of its body height. However, as it grows up with a body length of about 12.0~28.0cm during juvenile period, its body length is about 2.5 times of its body height, i.e. the growth rate of the fish's body height is faster than that of its body length during this period. On the other hand, adult fishes have body length about 58.4 ~ 98.0 cm, about 3.4 times of its body height, i.e. the growth rate of body height slows down during this period.

*Myxocyprinus asiaticus* spawns during late March and late April, when the water temperature is low. Natural breeding can be detected when the temperature of the river water is about 13°C and 14~16 °C is the optimal temperature for spawning. The fish usually spawns on the sands and gravels on the riverbed near the beach where the water flow is turbulent. The fish eggs become sticky and the water sellable egg envelope makes it easy to stick to the sands and gravels to grow. The eggs can expand into a size with diameter of 4.0~4.5 mm after swelling up with water. In water of 13~15 °C, it takes about 7~8 days for fertilized eggs to hatch. Newly hatched larvae are unable to swim up and down in the water due to immature organs and they lie at the bottom of the riverbed with intermittent twitching. This takes about 6 ~ 8 days when they can easily be attacked and eaten by predators, resulting in a high mortality rate in this stage.

*Myxocyprinus asiaticus* feeds on benthic invertebrates such as Ephemeroptera,

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Odonata, Plecoptera, Trichoptera, Chironomidae and other aquatic insects, as well as some molluscs such as aquatic oligochaete, earthworms, *Limnoperna fortunei* and Corbiculidae, etc. Food intake is large, and the diet composition varies greatly from individuals due to the different types of benthonic animals living in the habitat environment. For instance, *Limnoperna fortunei* is the major intake of fishes found in Chongqing river section, while Odonata larvae and *Limnoperna fortunei* are the major intake of fishes found in Yichang river section.

*Myxocyprinus asiaticus* is widely seen in the mainstream and tributaries of the Yangtze system. Catching of *Myxocyprinus asiaticus* in the mainstream and tributaries (including Jinsha River, Minjiang River, Tuojiang River, Chishui River, Jialing River, Wujiang River, Qingjiang River, and the Han River) of the Yangtze River, and in Dongting Lake, Poyang lake, and other lakes along the Yangtze River has been recorded. The spawning sites were thought to be mostly located in the mainstream in the upper reaches of the Yangtze River between Yibin and Chongqing, as well as in the Minjiang River, Jialing River and other tributaries, especially in the downstream of the Jinsha River.

*Myxocyprinus asiaticus* may naturally spawn in the Yangtze segment both upstream and downstream from Yichang, with the quantity of eggs spawned in the upstream segment being slightly larger. However, the quantity of spawns in general is rather small. No evident habitats of *Myxocyprinus asiaticus* juveniles have been found in the upper reaches of the Yangtze River.

After Gezhouba Dam is built, the habitat of *Myxocyprinus asiaticus* is divided into upstream and downstream segments from the dam. We can still catch certain amount of adult fish downstream Gezhou Dam, however, the catches of *Myxocyprinus asiaticus* account for less than 1% of the total fish catches in the upper reaches of the Yangtze river. *Myxocyprinus asiaticus* may naturally spawn in the Yangtze segment both upstream and downstream from Yichang, with the quantity of eggs spawned in the upstream segment being slightly larger. However, the quantity of spawns in general is rather small. No evident habitats of *Myxocyprinus asiaticus* juveniles have been found in the upper reaches of the Yangtze River. The artificial breeding technique is relatively mature.

In accordance with the accidental catches, frequency and distribution in the record, *Myxocyprinus asiaticus* are very endangered in the Yangtze River, especially, the accidental catches in the upstream are mainly mature adult fish with larger body, mostly caught in the breeding season.

### ***Acipenser dabryanus* (Dabry's sturgeon)**

Dabry's sturgeon lives in slow-moving river waters over substrates of sand and mud with humus and benthos or in river bends/bays with pebble dams. This species takes part in a migration, but never leaves fresh water. It grows quickly to reach 0.8-1.0 m in general length and weigh 5-10kg. It falls under the category of animals under the state's first-grade protection.

Dabry's sturgeon falls under osteichthyes, belong to sturgeon family. It is 1.1m long, cylinder-shaped body is blue-gray above and yellowish white on the belly, with five rows of scutes. The head is triangular and the snout is long with the mouth located on the underside. There are two pairs of barbels. The length of a barbel is half the length between the mouth and the end from which a barbel extrudes. Dabry's

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sturgeon feeds on aquatic plants, invertebrates, and small fish. It takes part in a migration, but never leaves fresh water. Its maximum weight reaches over 15kg. Males mature at the age of 4 to 7 years old while females mature at 6-8 years old. Dabry's sturgeon is a big fish of commercial importance, but has a small quantity of spawns. It is endemic to the Yangtze River Basin in China. Its population has declined drastically over the past two decades, facing the risk of extinction. Provinces along the upper Yangtze have begun to pay attention to Dabry's sturgeon and take as much effort protecting the species as protecting Chinese sturgeon.

Among rare fish species, few Dabry's sturgeon and Chinese sturgeon has been seen for years. Chinese sturgeon juveniles have been found caught in fishing nets now and then.

### **3.7 Social economy and cultural development**

#### **3.7.1 Current status of social economy in Yichang Municipality**

Yichang Municipality has jurisdiction over five districts, five counties and three cities, i.e. Xiling District, Wujiagang District, Dianjun District, Xiaoting District, Yiling District, Yuan'an County, Xingshan County, Zigui County, Changyang Tujia Autonomous County, Wufeng Tujia Autonomous County, Yidu City, Dangyang City, Zhijiang City. Yichang has 25 counties, 62 towns, and 20 subdistricts, 1367 villager's committee, 9804 villager groups, and 260 resident's committees. By the end of 2009, there are about 4.0137 million registered populations by the end of 2009, and 4.0455 million permanent populations. The newly-born population in 2009 is 30.6 thousand, with a birth rate of 7.62‰, while the deaths is 31.3 thousand people, with a mortality rate of 7.80‰, i.e. natural population growth rate is -0.18‰. The city has a land area of 21084 km<sup>2</sup>, and the area of towns and urban area accounts for about 40.13%. Urban area is 4232 km<sup>2</sup>.

In 2014, the gross production of Yichang Municipal amounted to RMB 313.22 billion, a growth of 9.8%; the public budget revenue of this city amounted to RMB 271.5 billion, a growth of 31.6%; the fixed-asset investment amounted to 247.1 billion Yuan, a growth of 22.1%; total retail sales of consumer goods amounted to 96.45 billion Yuan, a growth of 13.3%; import & export value reached 2.7 billion Yuan, a growth of 14.8%; the income of urban residents was 25,025 Yuan and an increase over 9.6%; the income of rural residents was 11,837 Yuan, a growth rate of 13.2%. Four counties of this city, namely Yidu, Yiling, Zhijiang and Dangyang, were among the economically strongest counties of Hubei. Yidu was the second county of Hubei which was listed into China Top 100 strongest counties. Eight counties (prefecture level cities or districts) had a public budge revenue exceeding 1 million, among which two counties exceeding 2 billion and two counties exceeding 3 billion; the income of urban residents in 9 counties (prefecture-level cities or districts) exceeded 20,000 Yuan; the income of rural residents in eight counties (prefecture-level cities or districts) exceeded 10,000 Yuan.

#### **3.7.2 Cultural relics**

There are no cultural relics within the project scope. The latest cultural relics are the ancient tombs of Song Dynasty in Baiyang Town, which is more than 1.0 km away and is separated from the project area by Baiyang Town.

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### **3.7.3 Current status of Fishery industry**

The total aquatic yield of Yichang is 205,000 tons in 2015, with a net increase of 43,000 tons and an average increase of 5.3% per annual compared with 162,000 tons in 2010. The fishery in Yichang is mainly freshwater fish farming, with freshwater fishing as the auxiliary. The yield of freshwater fish farming was 170,984 tons and accounted for 89.7%. The yield of freshwater fishing was 19,592 tons, accounting for 10.3% of the total aquatic yield. Gross output value of fisheries was 4.44 billion CNY and accounted for about 1.3% of Yichang's GDP (338.48 billion CNY). Net income of fishermen is expected to reach RMB 16,000 per capita.

As the project is located in Baiyang industrial park, attention should be attached to the project impacts on the fishery in Baiyang Township. The total output of agriculture, forestry, animal husbandry and fishery in 2011 reached RMB 639.08 million, of which the output of fishery was RMB 74.74 million and accounted 2.05% of the total. The fishery industry of Baiyang Township is mainly freshwater aquaculture including pond farming and reservoir farming. Pond farming accounts for 68% and reservoir farming accounts for 32%. Therefore, the output value of fishery only accounts for a minor proportion of the overall output of economy. Also the fishery industry is not dependent on the Yangtze River. Consequently, the project has minor influences on the local fishery industry.

The residents in the project area are farmers. They are not engaged in fishery but mainly plant citrus and a small portion of corns and other dryland crops. Therefore, the project mainly influences the agricultural production of local residents.

## **4 Analysis of Alternative Schemes**

The purpose of the comparison is to find out the most environmental-friendly schemes from the perspectives of environmental, social and safety impact, mitigation measures, cost of such measures, requirements of management and training, and provide support for further scheme optimization, so as to reduce the negative impacts and the costs of implementing mitigation measures in the future.

### **4.1 Comparison Between the Situation With and without project**

#### **(1) Current Situation of Logistics Industry and Existing Problems**

The logistics industry of Yichang Municipal is awash with small-sized logistics firms and even individual businesses. These firms and individual businesses usually have incomplete logistics facilities. Only a few of them own warehouse and storage yard. Most of these logistics service providers provide only single type of logistics services, generally focusing on transportation. But most of the vehicles they use in transportation are join-operated vehicles rather than their own vehicles, and few of these firms and businesses have park lots for these vehicles. Most of logistics service providers in the market don't have advanced logistics operation technology, and the persons providing logistics service have a great potential for improvement in logistics services and logistics management.

Most of nodes in the logistic network of Yichang Municipality have the functions of transport, handling, storage & delivery and information services, but compared with

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the needs of logistics market, the logistics industry of Yichang Municipal has many problems, such as being not professional, lacking of supporting facilities, incapable of providing integrated services and insufficient information communication, and also have a lot of aspects to be improved such as multi-modal transport, swap trailer transport, cold-chain logistics services, information management, process optimization and one-stop service.

## (2) Current situation of Yichang Navigation Hub

Yichang Navigation Hub is bestowed with advantageous natural resources and has been developing rapidly in recent years; however, compared with its regional positioning to further promote the development of hinterland, there is still a big gap which makes Yichang Navigation Hub unable to meet the requirements of local economic development. At this stage, the following is the major environmental problems to be solved.

- 1) Part of Yichang Navigation Hub is within Chinese sturgeon protection area and may bring adverse impacts to the protection of Chinese sturgeon;
- 2) Some wharves for dangerous chemicals are located at water intake, reservoir area or any other areas with high requirement for water quality and may bring adverse impacts to the water quality protection at Yichang section of Yangtze River; relocation of these wharves is under way;
- 3) Some wharves are located near the urban area and may bring adverse impacts, e.g. dusts and noise, to the sensitive areas like residential areas, etc;
- 4) Collection and disposition of pollutants inside the ports shall be improved. Dusts during construction and floating wastes in the river make it unsightly to look at.

After implementation of the project, part of the wharf function of the upper reaches will be connected and some environmental problems will be solved. It will be conducive to the efficient use of shoreline resources and protect the surface water resources in Yichang section. It will be also conducive to realize large-scaled and intensive processing of pollutants in the region. Meanwhile, with the implementation of the project, the logistics industry will see rapid development, thus bringing far-reaching impacts on overall economic development. It will be able to solve the existing logistics problems, and give full play to the superb advantages of Yichang Navigation Hub.

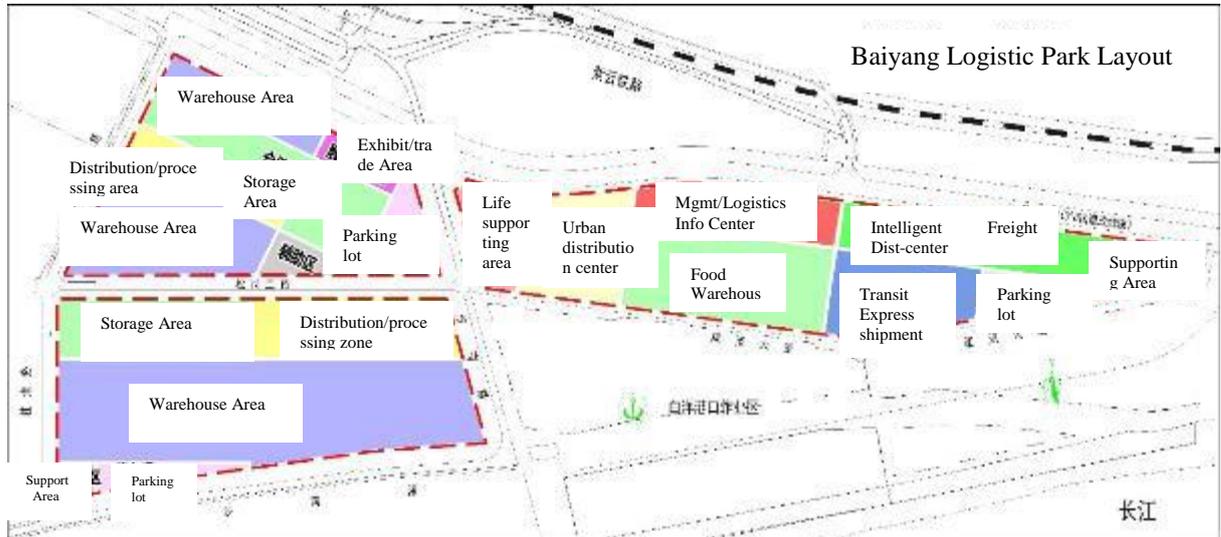
If we do not implement this project, it is neither conducive to the development of Yichang Navigation Hub nor the rapid development of logistics in Yichang City. However, the project will have some impacts on the ecological environment of existing project area, such as the layout of land use and the increase of risks resulting from water body accidents of the region.

From the perspective of environmental protection, the implementation of the project is conducive to the protection and improvement of regional environment.

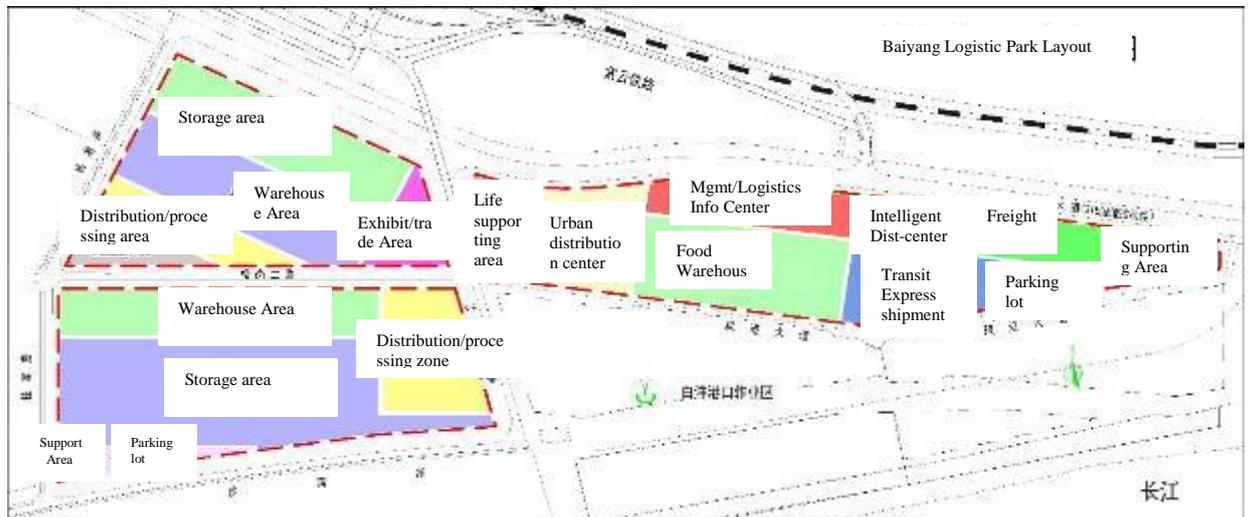
## 4.2 Layout of Baiyang Logistics Park

### (1) Baiyang Logistics Park

Two plans for the overall arrangement of Baiyang Logistics Park are provided as shown in Figures 4.2-1 & 4.2-2.



**Figure 4.2-1 Scheme I for overall arrangement of Baiyang Logistics Park**



**Figure 4.2-2 Scheme II for overall arrangement of Baiyang Logistics Park**

The above mentioned two plans are same in land coverage and surrounding environment, they have similar impacts on acoustic, water and ecological environments, but the big difference lies in the impacts on atmospheric environment and social environment. Refer to Table 4.2-1.

**Table 4.2-1 Comparative analysis of two schemes on environmental impacts**

Indicators	Scheme I	Scheme II	Recommended One
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Indicators		Scheme I	Scheme II	Recommended One
Environmental elements	Atmospheric environment	The trade and logistics area and the transit logistics area are well-located to shorten the travel distance of intermediate machineries and transport vehicles. The exhaust emission is also decreased.	It's too far to transport the goods from container area to storage area for devanning, remanding and consolidation. Also It requires more fuel.	Scheme I
	Social environment	There are three entrances/exits at the Songgang Second Road and the parking lot is near to the exhibition & trade area. This is better for arrangement and optimization of cargo flows, brings less interference to the traffic at the Songgang Second Road, and has better social benefits, e.g. saving resources and energy and improving competitiveness of the firms in this area.	The arrangement of cargo flows is seriously interfered by the traffic at the Songgang Second Road and may hinder the development of the firms in this area.	Scheme I
<b>Recommendation:</b>				<b>Scheme I</b>

In the Scheme I, all functional areas are well-located to shorten the travel distance of intermediate machinery and vehicles in the park. From a long-term perspective, Scheme I will save resources and energy and decrease the environmental impacts during the operation of the logistics park. Therefore, for the purpose of environmental protection, Scheme I is more reasonable.

## (2) Overall layout of Baiyang Port

According to the FSR, there are two schemes to choose from, namely Scheme I and Scheme II in the water area of the project, of which berth #12 ~ 13 are completely the same and only # 7 ~ 11 Berths are different. Scheme I is shown in Figure 4.2-3 and Figure 4.2-4, and Scheme II is shown in Figure 4.2-5.

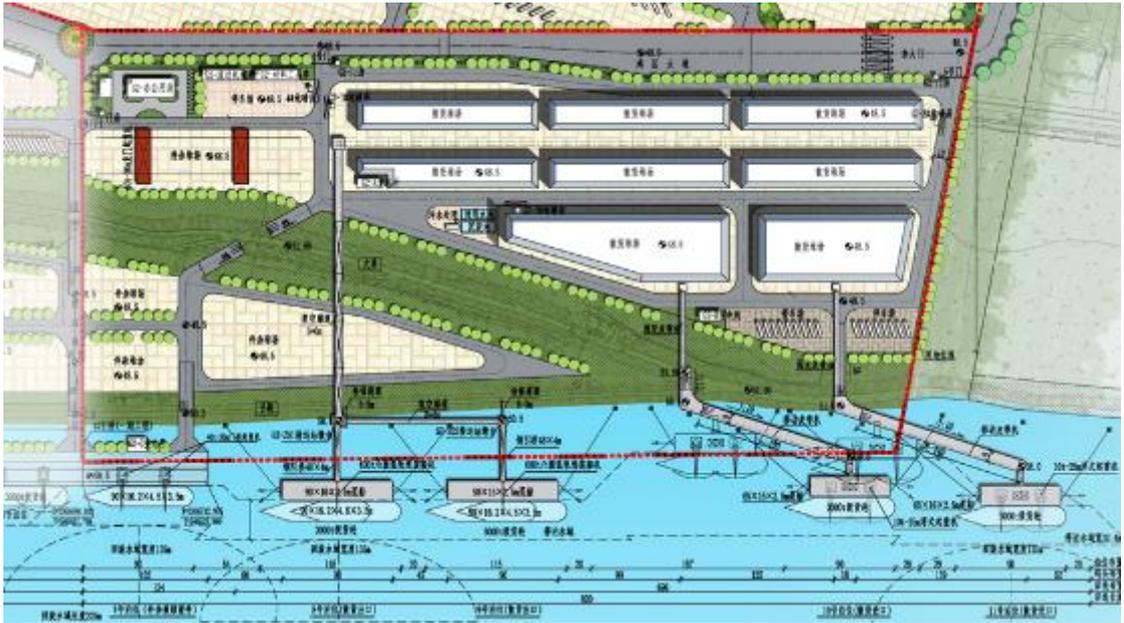
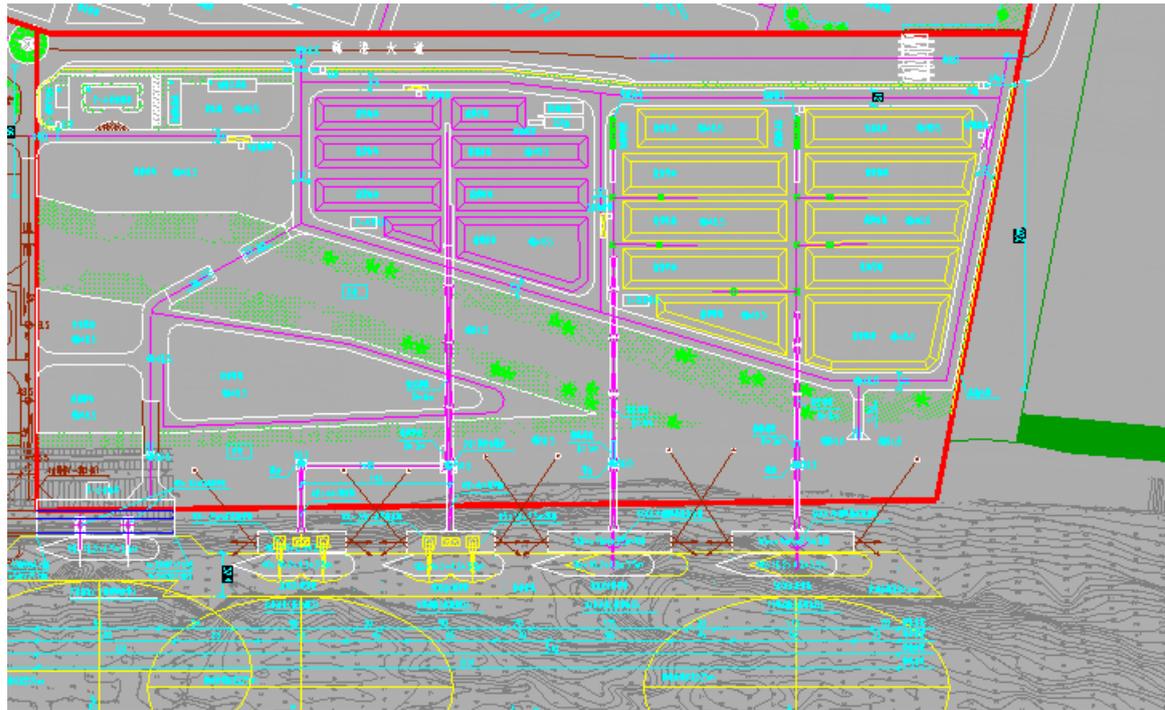


Figure 4.2-3 Layout plan of # 7 ~ # 11 Berths (Scheme I)



Figure 4.2-4 Layout plan of #12 & #13 Berths



**Figure 4.2-5 Layout plan of #7 ~ #11 Berths (Scheme II)**

**Results of environment impacts comparison:**

**Impacts on atmospheric environment:** Compared with Scheme II, Scheme I will enable the mobile machinery and vehicles to move more smoothly in storage yard, and Scheme I brings convenience to work scheduling and horizontal transportation with less fuel consumption and exhaust emission.

**Impacts on water environment:** in Scheme II, the hydraulic structure of the # 10 & # 11 berths adopts floating piers and the construction of abutment uses cast-in-situ bored piles. However, the construction process is apt to affect the groundwater and the drilling mud is apt to pollute the surface water.

For the purpose of environmental protection, we agree to Scheme I as proposed in the FSR by considering the features of the arrangement of storage yard and the hydraulic structure of the wharf.

**4.3 Comparison of different technologies for cargo-handling**

According to common practices in China, two methods are used for horizontal transportation of bulk cargo, **one is dump truck and flatbed trailer with hopper whilst the other is fixed belt conveyor**. The comparison of these two methods is as shown in **Table 4.4-1**.

**Table 4.4-1 Comparison of Main advantages and Disadvantages of Two Cargo-Handling Methods**

Advantages & disadvantages Handling methods	Contents	Advantages	Disadvantages
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Advantages & disadvantages Handling methods	Contents		Advantages	Disadvantages
Scheme I	Loading & unloading ship	Arc track ship loader (outlet); Floating crane + grab bucket (inlet)	1. Bulk cargos are handled by using specified high-tech machineries and transported with belt conveyor. The work efficiency is higher and the usage rate of storage yard is better.  2. Belt conveyor allows airtight transportation to avoid dust and scattered materials and keep the site clean.	1. Substantial investment is needed for equipment. 2. Mobile machineries are used to load bulk cargo and transport them out from storage yard. 3. The fixed belt conveyor and fixed funnel may bother the operation of loading for the bulk cargo.
	Bulk yard	Single bucket loader (outlet); Stacker (inlet)		
	Horizontal transportation	Fixed funnel + fixed belt conveyor (outlet); fixed belt conveyor system + mobile belt conveyor system (inlet)		
Scheme II	Loading & unloading ship	Floating crane + grab bucket	1. The technology used has been practically proven and is appropriate to the operations of bulk cargo carriers. 2. Investment in equipment is reduced.	1. More mobile machineries are used and they need more repairing and maintenance. 2. Handling efficiency of bulk cargo is low. 3. Materials may be scattered from dump trucks and serious dust pollution will be an issue. 4. That dump trucks burn fuel and emit exhaust will cause atmospheric pollution.
	Bulk yard	Dump truck + single bucket loader		
	Horizontal transportation	Dump truck and flatbed trailer with hopper		

In Scheme I, most of bulk cargo ships are electricity-driven with merits of energy saving and environmental protection. With this method, the utilization of storage yard is improved, the dust is decreased to the greatest extent, but the investment in equipment is much increased. In Scheme II, the bulk cargo handling technology has been practically proven and most of the equipment used is mobile machinery that is more adaptive to the working environment, but this method will lead to dust pollution and exhaust emission. By considering the requirements of investment and wharf structure, this assessment is approval of Scheme I as recommended by the FSR.

#### 4.4 Comparison of different rainwater treatment schemes

Usually, rain sewage diversion is adopted to prevent the increase of workload for waste water treatment facilities. Rainwater shall be classified into first flush

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rainwater and later rainwater. The first flush rainwater is similar to the flushing ground water in the port and contains large quantity of SS pollutants (since the goods stored in the wharf are mostly sand and stone, steel and grain. As the first flush rainwater doesn't contain oil, this treatment system does not incorporate oil-removal measures), while the later rainwater on the ground is similar to the natural rainwater, and will flow to the rainwater system, and form surface runoff flowing to surface water body.

(1) Common practice in most port areas

In most port areas in China, rainwater is flowing into the surface water bodies without any classifications of first flush rainwater or later rainwater. In this case, some pollutants on the ground are carried into surface waters by rainwater and will cause water pollution.

(2) Rainwater treatment method used in this project

The initial water is collected into the sedimentation basin through open drain. After sedimentation, the initial water can be used for watering the ground and remove dust. Later rainwater flows into rainwater system and then will be discharged to the open trench in the east of the port through the pumps.

In conclusion, the rainwater treatment method used in this project is more favorable for protection of surface water.

## **4.5 Comparison of different solid waste collection methods**

### **(1). Methods for this project**

The project has two methods of solid waste collection: one is establishing solid waste transfer stations; the other is collecting solid waste together with the neighboring Baiyang Town and transferring the solid waste to the landfill.

The *Standard for Environmental Sanitation Facilities* stipulates that one waste collection station should be established when the maximum daily quantity of wastes produced by the population in the service area is larger than 4 tons/day. Given that 1kg/day wastes are generated per person and the total fixed population is about 1,200, the daily solid waste production is far below 4 tons/day, so the solid waste transfer station is not recommended in the project. Except for the project, one solid waste transfer station is already planned along Ziyun Railway and National Highway 318 at Baiyang Town. Therefore, we propose to transfer solid waste from the port and logistics park to this solid waste transfer station, which is the most efficient and environmental scheme for our project.

### **(2). Alternative schemes for managing ship solid waste**

According to current practice of various cargo wharves in Yichang, the ship solid waste is usually disposed by the ships themselves. Generally, there are no special treatment facilities on the riverbank.

The international best practices of EHS guidelines: the solid waste and liquid waste related to port areas may be quite different in types and quantities owing to the different operating works of the wharves and varying types of ships in service. The

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wastes of the wharves may include packages of goods and the inert solid waste of the administrative office, as well as harmful or hazardous solid waste relevant to ship maintenance (such as waste lubricant and degreasing solvent for engines). Waste from ships may include inert materials such as oily sludge and food package and food wastes, etc.

We propose to learn from the international best practices and it is also strongly recommended by Ministry of Transport (see Section 1.6- Inland Water Environment Management Regulations on Pollution from Ships, PRC). The waste generated by ships shall be brought ashore for disposal as much as possible. See Chapter 11 in EMP for details on prevention, reduction and control measures.

#### **4.6 Comparison of different oily water treatment methods**

In this project, oily wastewater comes from two areas: Land area and water area. The oily wastewater from land area covers machine flushing wastewater, container flushing wastewater, machine maintenance wastewater; the oily wastewater from water area covers cabin bottom oily wastewater. As the land area has been installed with oily wastewater treatment facilities, we only compare the collection and treatment methods of cabin bottom oily wastewater. The common practice of treating cabin bottom oily water is to utilize oil-water separator of its own and the receiving vessels by the Maritime Management Department. Below is the comparison between different disposal methods and international good practice.

##### **(1) Oily water treated on board before being discharged**

According to the *Regulations on Prevention and Control of Inland Water Environment Pollution from Ships in China*, the vessels arrived at the port are not allowed to discharge bilge oil water into the water area. If necessary, the vessels shall first report to the maritime management department in written form and discharge bilge oil water into the designated area after approval.

Earlier in China, mechanical separation technology (separation by gravity and coalescence separation) was widely used by transport ships for the disposal of bilge oil water. This method is quite effective for disposing oil slick but it doesn't work out for emulsified oil. In reality, it cannot meet the requirements of the *Effluent Standard for Pollutants from Ship (GB3552-83)* and the *No. 107(49) International Convention for the Prevention of Pollution from Ships* by Resolution of Maritime Environment Protection Committee (included in the *EHS Guidelines for Ports, Harbors and Terminals*). In addition, the *Effluent Standard for Pollutants from Ship (GB3552-83)* was formulated at very early time and the effluent standards for petroleum pollutants are less constrained, and its discharge limit for bilge oil content is 15mg/L is higher than Class I standard of *Integrated Water Discharge Standard (15mg/L)* and also much higher than Class I B standard of *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (3mg/L)*, so it is not conducive for surface water protection.

##### **(2) Treatment by receiving vessel**

According to the surveys of marine department, the oily wastewater in vessels is

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treated by special receiving vessels. The receiving vessels are capable of collecting oily wastewater which contains high oil content. After that, the oil in the oily wastewater will be collected and recycled ashore for further treatment. The value of the recycled oil is able to offset and even more worthy than the operating expenses of the receiving vessels. Some special vessel can directly process the oil waste with mechanical separation technology. As this treatment method is simple but effective, the receiving vessels always depend on the treatment facilities ashore rather than treat the oily wastewater directly by their own. There are also new kinds of vessels with membrane technology or adsorption systems, which is able to ensure that the discharged water will meet relevant provisions in MEPEC.107 (49).

### (3) International good practices

#### 1) *EHS Guidelines of Shipping Industry* by WB

In accordance with MARPOL and national regulations, port operators shall provide collection, storage and transportation services for the wastewater produced during its stay in the port. The ship operator shall ensure the handling capacity of the wastewater facilities adequate and adapted:

Oily solid waste and wastewater should be collected by a barge, a vehicle or a central collection system with a storage tank. Collect capacity of oily waste should be determined based on the relevant provisions of MARPOL;

In accordance with recommendations of General *EHS Guidelines*, the sewage discharged from the vessels shall be collected to be treated on-site or in other places.

Small service boats in the harbor should be equipped with recycled toilet or chemical toilet which can discharge wastewater onshore for treatment.

#### 2) *EHS Guidelines of Port* by WB

The effluent from ships may contain oil and hazardous substances, which may cause damage to the environment if discharged directly to the ground water. It is recommended to take the following measures to prevent, reduce and control the wastewater pollution:

Unless the ship is equipped with certified oil-water separator (OWS), all oily wastewater and sludge shall be transferred to the receptors in the port for treatment. If certified OWS is installed, then the aforementioned wastewater can be discharged into the sea upon meeting the requirements of MARPOL 73/78 with proper treatment. Other water management measures also include: To install an alarm system which is able to automatically detect and treat the sewage discharged from the OWS when the oil concentration reaches  $15 \times 10^{-6}/106$ .

### (3) Conclusions of the comparison

According to *Regulations of the Prevention and Control Measures of Water Pollution from Ships in Inland Waters of PRC*, two ways are adopted to treat the oily wastewater in the project: treated by receiving vessel or treated by receptors ashore. Since the logistics park plans to install a rainwater storage tank, it is recommended

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to install treatment facilities for bilge oil water within the area of the logistics park. It can be used both for treating the oil wastewater within the park (such as flushing water from washing machines and containers, and oily wastewater from maintenance workshop), and also used for treating bilge oily water from ships, therefore it can guarantee that such bilge oil water is not discharged into inland waters.

Based on above analysis, this treatment method is more environmental than the common treatment method which is discharge the wastewater after self-treatment. It is also in line with *Regulations on Prevention and Control Measures of Pollution of Inland Waters from Ships of PRC* and international good practices.

## **5 Assessment of Environmental Impacts during Construction**

The environment impacts of the project during construction have been analyzed based on the characteristics and environment of the project area.

The wharf stands along the deep-water stretch of the Yangtze River bank so there is no need of dredging in river segment. Piling is the main construction activity on hydraulic engineering.

### **5.1 Impacts on water environment**

The wastewater during construction primarily comes from domestic wastewater (produced by construction workers) and construction wastewater.

#### **(1) Wharf construction**

The project involves construction of two high-piled beam-slab wharves, two floating piers, and two sloped wharves in the water area. One of the high-piled beam-slab wharves is 216×28m and the other is 102×28m. A 90×16m steel pontoon is built in front of the floating piers and a 65×16m steel pontoon is built in front of the sloped wharves.

With regard to the high-piled beam-slab wharves, holes are drilled on the spot for steel-pipe piles and cast-in-place pipe piles, which affects surrounding water bodies.

The main environment impact of piling is the increase of concentration of suspended solids in water bodies. The influential range of piling on the water environment is shaped as oval. According to the survey, if the concentration of suspended solids by piling in water bodies exceeds 10mg/L, it will expand an area of a length of about 100 ~ 250m to the water flow direction and a width of about 50 ~ 100m vertical to the river bank. The suspended solids by piling will not cause water pollution in the water conservation areas and the water intake of the river's lower reaches.

Holes will be drilled for the cast-in-place piles of an approach span. A part of the pile foundation is submerged underwater. A cofferdam will be installed around the underwater part of the pile foundation, and the water inside the enclosure will be pumped empty for construction in dry environment. Therefore, the pollution comes primarily from the sewage spilled from mud circulation pits.

When drilling holes for the cast-in-place piles, workers should build a mud pit in the river bank, pump muddy water into drilled holes from the mud pit, and preserve the walls of drilled holes. The muddy water circulates between the mud pit and drilled holes through a mud pump. After all holes are drilled, mud in the mud pit will be dried in the air and piled on the spot. This is the most common practice used in China at present.

If it comes to rainy days during cast-in-place pile construction, the rainwater may cause wastewater to overflow from the mud pit. As the concentration of SS in the wastewater is high, the wastewater may cause pollution in the water body in the Yangtze River.

Therefore, it is suggested that workers build a cofferdam enclosing the mud pit and cover the mud pit so as to prevent surface runoff and rainwater from flowing into the mud pit and thus prevent waste water from spilling out of the pit. An overflow hole should be arranged at the mud pit and geotextile should be laid at the overflow hole, so as to reduce the SS pollution caused by the waste water overflowing from the mud pit due to heavy rain.

## **(2) Analysis of wastewater discharge from construction ship**

Wastewater discharge from construction ships includes bilge oily water and domestic waste water discharged from a ship. If water construction lasts for 120 days, based on similar project experiences, bilge oily water is generally discharged at a rate of 0.56t/d, the amount of bilge oil water discharged during construction will reach 67.2t, with 0.84kg of petroleum being separated from bilge oil water. If the domestic sewage discharged from a construction ship averages 150L per person per day and considering there are 64 persons, the amount of domestic sewage will reach 9.6t/d.

Construction ships are forbidden to discharge wastewater into the Yangtze River. In case that a construction ship has to discharge sewage into the river, it must submit an application of sewage discharge to Yichang Maritime Management Department for approval. After being approved, the receiving vessels will collect and treat pollutants for charged services.

## **(3) Construction wastewater and domestic wastewater in land areas**

A small amount of industrial and domestic wastewater will be generated during construction in land areas. The main pollutant in industrial wastewater is SS. Sedimentation basins should be established on the site so that industrial wastewater can be precipitated and then used to reduce dust, or naturally evaporated or absorbed by soil.

Worker should try their best not to flush machines on the construction site to get rid of the impacts of oily water. If the machines are in badly need of flushing on site, workers should collect wastewater with sewage collection tanks and transport to the receiving vessels for treatment.

Based on the project's construction scale and compared with similar projects, we can conservatively estimate that the peak number of workers on the construction site is about 400. If domestic water is consumed at a rate of 100L/d per person and the coefficient of pollutants produced is 90%, the maximum amount of domestic wastewater produced will be 36m<sup>3</sup>/d. The main pollutants are COD, animal and vegetable oil, and SS, etc. According to the monitoring results of domestic wastewater in similar construction sites, every liter of domestic sewage contains 200~300mg of COD, 50mg of animal and vegetable oil, and 80~100mg of SS. As the amount of domestic wastewater is relatively small, such sewage may not severely pollute the environment after being treated in a septic tank. After construction, the construction workers' domestic wastewater will have no impacts on the environment.

In conclusion, the wastewater during construction has been properly treated and the impacts on the surface water are relatively minor.

## 5.2 Impacts on ambient air

### (1) Lime-soil mix and dust pollution

Lime-soil mixers and standing mix are used during construction. If it is windy, mixing concrete and construction works will lead to TSP pollution on the site. According to completed surveys of physical works of similar projects, the station of lime-soil mixers produces TSP at a rate of 8.90mg/m at a distance of 50m downwind; the station of lime-soil mixers produces TSP at a rate of 1.65mg/m<sup>3</sup> at a distance of 100m downwind. The amount of TSP produced by the station of lime-soil mixers at a distance of 150m downwind meets the requirements of Class II in the *Ambient Air Quality Standard (GB3095-2012)*. TSP generated in other operations can generally be controlled within 50-200m from the construction site. Beyond this range the amount of TSP generated from the construction site shall be controlled within the requirements of Class II in the *Ambient Air Quality Standard (GB3095-2012)*.

### (2) Dust pollution caused by construction vehicles

During construction, the construction materials will lead to TSP pollution in the areas where they are transported, loaded and unloaded. According to the field monitoring results of similar projects, the dust resulting from vehicle transport will lead to 11.625mg/m<sup>3</sup> of dust pollution at a distance of 50m downwind; 9.694mg/m<sup>3</sup> at a distance of 100m downwind; 5.093mg/m<sup>3</sup> at a distance of 150m downwind, exceeding the standards of Class II in *Ambient Air Quality Standard (GB3095-2012)*. Dust produced by vehicles severely pollutes the areas where construction materials are transported.

Yazishan Village will suffer from the largest impacts as it is located nearby the construction area. During the construction, when it is windy, dry and without watering measures on the roads and construction sites, the fugitive dust on villagers is visible to naked eyes. If we reinforce water spraying on the construction operation surface and the roads, the construction impacts on Yazishan Village will be effectively reduced.

### (3) Machinery in operation

Construction machines include heavy duty trucks, excavators, and diesel-powered machines. These machines emit such pollutants as CO, NO<sub>2</sub> and THC. Most of these are large machinery and such emits a large amount of pollutants. However, as construction machines are scattered in distribution and limited in number, the overall pollution caused by these machines is relatively light. According to the monitoring results of construction sites of similar projects, the concentration of NO<sub>2</sub> is averagely 130µg/m<sup>3</sup> per hour within the range of 50m in the site; and the concentration of NO<sub>2</sub> within 24 hours is estimated at 62µg/m<sup>3</sup>, meeting the requirements of Class II in the *Ambient Air Quality Standards (GB3095-2012)*.

## 5.3 Assessment of acoustic environment impacts

### 5.3.1 Estimate methods and predictive formulas of construction noise

This report lists the noise pollution areas based on the stages of construction in accordance with *Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011)* so that contractors can take site-specific

measures to prevent and reduce noise pollution.

Construction noise can be considered as point source pollution. Because noise attenuates as it gets further and further away from its source, we estimate the noise levels at different distances from the source by using the following formula:

$$L_p = L_{p0} - 20\lg(r / r_0)$$

In this formula,  $L_p$  represents the estimated noise level dB (A) at a distance of  $r$  meters from the sound source;  $L_{p0}$  represents the reference value for the noise level dB (A) at a distance of  $r_0$  meters from the sound source.

### 5.3.2 Estimation of influential scope and impacts of noise during construction

By using the above formulas and information of noise as stipulated in the physical analysis, we have estimated the noise levels of individual machines (main sources of noise) at different distances. We also operate a concrete mixer, an excavator, and a bulldozer simultaneously on the same site, figuring out the overlapping of construction noise levels at different distances. See Table 5.3-1 for more details.

**Table 5.3-1 Construction noise levels (Unit: dB(A)) at different distances**

Distance from the noise source(m)	10	50	100	150	200	250	300	400
Types of equipment								
Concrete mixer, concrete vibrator	85.0	71.0	65.0	61.5	59.0	57.0	55.5	53.0
Excavator	82.0	68.0	62.0	58.5	56.0	54.0	52.5	50.0
Bulldozer	76.0	64.0	56.0	52.0	50.0	48.0	46.0	44.0
Superposition of the noise levels of the above three machines	87.1	73.3	67.1	63.6	61.1	59.1	57.6	55.1
Pile driver	90.0	76.0	70.0	66.5	64.0	62.0	60.5	58.0

### (3) Results of estimation and analysis

a) According to *Emission Standard of Environment Noise for Boundary of Construction Site*, the maximum level of ambient noise emitted from the construction sites is 70dB(A) during daytime and 55dB(A) during nighttime. According to Table 6.4-1, the noise produced by a concrete mixer or a concrete vibrator is in compliance with the requirements at a distance beyond 55m during daytime and 330m during nighttime; the noise generated by a excavator or a bulldozer is in compliance with the requirements at a distance beyond 25m during daytime and 230m during nighttime; Piling is forbidden during nighttime. The noise generated by piling at a distance beyond 100m is in compliance with the requirements.

b) The above estimates show that, when multiple construction machines are operating at the same time, the noise produced by these machines shall be in compliance with the requirements at a distance of more than 60m from the construction site during daytime and 405m from the construction site during nighttime.

c) Guixihu Village (to the west of the construction site) and Yazishan Village (to the

north of the construction site) are sensitive to the noise as they are located within 50-60m from the construction site. Therefore, noise by construction machines disturbs the residents of the two villages to different degrees. Noise generated during daytime construction exceeds the maximum level by 3.3-6 dB(A); Noise generated during nighttime construction exceeds the maximum level by 18.3-21dB(A).

## **5.4 Assessment of ecological environment impacts**

### **5.4.1 Analysis of impacts on terrestrial ecology**

#### **(1) Assessment of impacts on terrestrial plants**

This project covers a total area of about 142.27hm<sup>2</sup>, most of which is agricultural land. In addition, the project also covers a small number of shrub land, water areas, and construction land. A large amount of agricultural vegetation and a small amount of secondary vegetation are affected by the project.

Main construction activities affect vegetation in the following aspects:

- 1) Permanent land occupation will destroy the habitats of vegetation. Once individual organisms lose their habitats, the damage will be irreversible.
- 2) Vegetation in the project area will be destroyed. According to a survey of biogeography, vegetation directly affected by the project is primarily orangery, cropland, and shrub land.
- 3) During construction, temporary land occupation for this project is primarily agricultural land to be used temporarily as dump site, so it will destroy the vegetation in this area.
- 4) During construction, vegetation surrounding the construction site will be crushed by machinery or trampled by construction workers.

In short, most of the proposed project area is agricultural land and most of the land acquisition/occupation is agricultural land. The ecological system of the surrounding area is affected by the project to some degree. However, as either common crops or common species of the plants within the assessment scope, the affected plants are widely grown and adaptive to many environmental conditions; they will never disappear or die out due to project construction activities. Vegetation damages in the project area will have certain adverse impacts on the existing ecological system of the area. However, as the affected area is rather small in comparison with the whole project area and efforts have been taken to afforest the affected area, the damages are not that serious and will not affect the general stability and completeness of the ecological system in the larger scope.

#### **(2) Assessment of impacts on terrestrial animals**

During project construction, excavation and infrastructure construction will damage both vegetation and animals' habitats in the affected areas. Most of the affected animals are the amphibians, reptiles, and birds that inhabit cropland and shrub land. Moreover, noise made by construction machines/equipment and by transport of earthworks and construction materials will affect the feeding, living, reproduction, and migration of terrestrial animals which inhabit the affected areas nearby the noise. Construction activities will completely change the land use of the

assessment area and have permanent impacts on some of the terrestrial animals (especially those unable to adapt to human habitats).

As most of the project area is frequented by human activities, terrestrial animals in the area are more adaptable to human impacts on the environment. Animals living in the area are either adaptable to the changes or have resettled to other places. As there are a large number of similar habitats (farmland, shrub land, ponds, etc.) near the construction site and the existing terrestrial animals are mostly common species, the project will not have significant impacts the biodiversity of the area.

### **(3) Assessment of impacts on agro-ecological system**

Changes in soil structure and texture have rendered the soil infertile for agricultural production. The agriculture in the project area will be severely affected.

#### **a. Arable land will largely shrink**

By analyzing the current status of land use, we have learned that the increase of construction land comes from occupation of farmland. A sharp decrease in the farmland of the planned area is inevitable with the large-scaled development and construction. Land occupation for developing industry, public facilities, and transportation are mostly farmland, as a result, the area of farmland is shrinking farmland and the potential productivity is also dwindling. A decrease in farmland area disrupts ecological balance and the dynamic control of the ecological environment.

#### **b. Farmland's potential of productivity will dwindle**

As seen from the positioning of the planned area, logistics will domain. Production and R&D in the area will produce pollution on air, water and soil. The pollution will affect the quality of surrounding farmland and further reduce the farmland's productivity potential.

As the economy is growing, the occupation of farmland will be inevitably increased. We must increase crop yields in an effort to cover farmland loss and ensure food security. However, with the development and introduction of high-yielding, cost-effective new crop varieties as a way to ensure food security, we have to constantly develop and use chemicals. It will not only enable pests to be resistant to pesticides and increase minor pests in a large number, but it will also contaminate water areas, reducing the food that fish, mollusks, and farmland birds feed on, as well as reducing the number of farmland birds. Moreover, the chemicals we constantly develop and use will leave pesticide residues, making the farmland's quality and productivity further drop and finally leave high-yielding farmland deteriorate untimely and could only be used for all other purposes but farming.

#### **c. Crop yields will decrease**

A total of 2,614 mu of land (all is collective land) will be permanently acquired for this project. Namely 1944.50 mu is agricultural land and 184.20 mu is pond, causing an annual loss of 5,321,750 Yuan (calculated at a rate of 2,500 Yuan/mu) to agriculture.

### **(4) Assessment of impacts on ecological integrity**

The area's ecological integrity is affected by the project as it involves a total area of 142.72hm<sup>2</sup>, most of which is agricultural land. Construction will change the use of

various lands in the project area, affecting the fertility of the project area and ecological stability. As a result, the ecological integrity of the project area will be disrupted. However, such changes have limited influences on the ecological integrity in a wider area (e.g. Baiyang Town).

#### 5.4.2 Analysis of impacts on aquatic ecosystem

##### (1) The category and scope of impacts on the aquatic ecosystem

The impacts of the project on the aquatic ecosystem are primarily during construction period, including direct and indirect influences. Riprap works will bury the habitat of benthos, thus directly affecting the aquatic ecosystem. Underwater construction will increase the concentration of suspended solids (SS) in some water areas, thus indirectly affecting the aquatic ecosystem. See Table 5.4-1.

**Table 5.4-1 Determination of direct and indirect impacts during construction**

Categories of impacts	Affected areas	Factors	Possibilities for restoration	Impacts on organisms
Direct impacts	Piling	Covering, disruption	Can be restored	All benthos have vanished, but the affected area is relatively small
Indirect impacts	Spread of increased SS produced during construction	Lower transparency	Can be restored	Some of aquatic organisms are damaged

##### (2) Impacts of construction activities on plankton

Construction, especially underwater construction, will disrupt the riverbed environment, increasing suspended solids in water and lowering rate of water transparency. Underwater construction will disrupt plankton's photosynthesis, lower the aquatic productivity in some of the water areas, and disrupt the daily life of animals which move largely to the changes of lights. Moreover, suspended solids will adhere to the plankton, disrupting their movement and ingestion and even leading them to die, thus the number of plankton in some water areas will decrease.

According to relevant data, an increase of suspended solids in water bodies will jeopardize the survival and reproduction of planktonic copepods. Excessive suspended solids will block the digestive system of planktonic copepods, especially when the concentration of suspended solids reaches 300mg/L and more. Among suspended solids, sticky sludge causes the biggest harm to plankton; soil and fine sediments cause less harm to plankton than sludge.

A decrease in the number of phytoplankton and zooplankton will cause the number of other organisms to drop as well. A decrease of phytoplankton will lead to a decrease of zooplankton that feed on phytoplankton. The decrease of plankton will cause the decrease of fish that feeds on plankton. Likewise, higher-level consumers that feed on fish will find it difficult to survive if the number of organisms at low trophic levels decreases. Obviously, an increase of suspended solids in water bodies will disrupt the food chain in multiple aspects.

According to the testing results of the toxic effects on aquatic organisms which is caused by SS in the dredged waterway of the Yangtze River estuary, when the concentration of suspended sediment reaches 9mg/L, it will cause some of zooplankton to die and disrupt phytoplankton's photosynthesis. However, as the

piling (including pile driving and constructing bored pile cast in situ) for this wharf affects within an area of less than 100 m<sup>2</sup>, and considering this part of the river is 900~1200m wide, the adverse impacts resulting from construction activities of this wharf in Yangtze River are insignificant. Under the effects of water flow, turbid suspended sediments will be diluted shortly. In addition, construction activities of the wharf won't take long time, so the impacts of suspended solids produced during construction on aquatic organisms will be limited and short-lived.

### **(3) Impacts on the eggs and larvae of fish**

Suspended solids produced during construction will expand in form of high intensity within a certain range. Suspended particles will directly harm the eggs and larvae of aquatic organisms in the Yangtze River. Specifically, suspended particles will hinder the embryonic development of fish and even block the gills of fish, thus suffocating them. Moreover, a large number of suspended particles will reduce the available oxygen in water bodies, thus causing aquatic organisms to die. Hazardous substances in suspended solids will produce secondary pollution to the environment and cause organisms to die. The capacities of different aquatic organisms to adapt to the suspended solids are varying. Generally speaking, the eggs and larvae of fish are much less tolerant to the suspended solids than adult fish. An increase of suspended sediments in water body will hinder the growth of the eggs and larvae of fish.

### **(4) Impacts on fish**

Noise of drilling holes will startle fish in the construction area, but it will not harm fish or cause them to die out. However, constant noise will disrupt the routine foraging and migration patterns of some fish species. If the noise source is close to a spawning ground, or if the noise occurs during the spawning season, spawning will be disrupted to some extent.

During construction period of the wharf, suspended solids produced by dredging will increase and thus contaminate water. Suspended solids will be highly concentrated and spread within a certain range. A high concentration of suspended solids will make water more turbid and less transparent, which will hinder the growth of natural fish feed and thus reduce fish feed.

In addition, a high concentration of suspended particles will suffocate fish and cause fish to die. As these suspended particles are sucked by fish with their gills and cling to the gill lamella and gill filament, they will not only damage the gill tissues but also obstruct the gas exchange and even cause fish to suffocate. Moreover, the particles will also hinder the embryonic development of fish.

The capacities of different fish to tolerant the suspended solids are varying. According to experimental data, if the concentration of suspended solids reaches 80,000mg/L, fish can survive for just one day; if the concentration of suspended solids decreases to 6,000mg/l, fish may survive for one week at most; if workers keep stirring the sediment sludge for a short period every day and keep the concentration of suspended solids at 2300mg/L, fish may survive for 3-4 weeks. It is generally believed that fish will not die from the effects of suspended solids if the concentration is lower than 200mg/l and its effects only last for a short period of time, and that adult fish may successfully avoid the effects of suspended solids if the concentration is slightly higher than 10mg/L because adult fish is highly capable

of swimming for a long distance at a relatively fast speed. The impacts of construction on adult fish are expressed as “dispersion effects”.

The construction methods used for the piling of the wharf include drilling, in-pile drilling, in-pile drilling and grouting etc. The area of the construction interface is limited. The affected area can be contained within 100 m distance from the piling. The main affected area is in the downstream direction, with limited affected area on both sides. As the wharf is near the river bank, where the hydraulic flow is slow, the suspended solids will mostly be carried downstream instead of being carried towards the center of the river. According to statics of similar domestic piling construction, in approximately 0.08 km<sup>2</sup>, or an affected radius of 159 m, there will be an incremental 10 mg/L in SS concentration; in approximately 0.04 km<sup>2</sup>, or an affected radius of 112 m, there will be an incremental 20 mg/L in SS concentration; and in approximately 0.01 km<sup>2</sup>, or an affected radius of 50 m, there will be an incremental 50 mg/L in SS concentration. Compare to the river of 1200 m width, the affected area is very limited. In addition, the water flow will also dilute the SS in the vertical direction. Further, as the construction is concentrated in a limited period of time, the impact of SS increase induced by the construction activity on fishes is limited and temporary. The construction activity will be arranged in dry seasons when the construction area are dry or in shallow water. At this period of time, the fishes will move in the deep water area. Thus the construction will not have significant impact on the fishes in the river. The main impact will be the on the temporary spatial distribution instead of on the fishery resource in the area.

As for the Chinese Sturgeon, they usually live at the layer 3.07 m above the river bottom, which is about 12 m below the water surface in this river segment. In addition, the horizontal affected distance of the construction is less than 200 m. the affected area is still 400 m away from the thalweg line where they live. Therefore the impact of piling construction on Chinese Sturgeon will be insignificant.

#### **5.4.3 Assessment of soil erosion impacts**

Article 4 of *Provisions on the Administration of Examination and Approval of Preparation and Reporting of Water and Soil Conservation Plans for Development and Construction Projects* (No. 24 Amendment of the Ministry of Water Resources dated on July 8, 2005) lists the following requirements: 1) If the area of land acquisition exceeds 1 hectare, the land owner should compile a relevant report; where the area is less than 1 hectare, a report should be prepared. 2) If the volume of excavated/refilled earthworks exceeds 10,000m<sup>3</sup>, a report should be prepared; if the volume of excavated/refilled earthworks is less than 10,000m<sup>3</sup>, a report should be prepared.

In November 2015 the construction contractor entrusted Yichang Friendly Ecological Engineering Consulting Co., Ltd. to compile the *Report on Water and Soil Conservation Plan for the WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project*. In January of 2016, Yichang Friendly Ecological Engineering Consulting Co., Ltd. completed the *Report on Water and Soil Conservation Plan for the WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project*. The report consists of 10 chapters, namely integral statement, general rules, project overview, overview of the project area, analysis and assessment of the water and soil conservation regarding the main works, estimation of soil loss, objectives and measures of soil erosion prevention

and treatment, monitoring of water and soil conservation, investment estimates and benefit analysis of water and soil conservation, guarantee measures for schemes, conclusions and suggestions.

The following content is an abstract from the report

### **(1) Analysis of causes for soil erosion**

The stirred surface soil by construction activities tends to become loose and poised for soil erosion when it comes to rainstorms. Soil erosion may come from the following procedures during construction activities: When soil is excavated and refilled for construction of roadbeds, the vegetation of the area will be damaged, the original soil structure will be destroyed and turn into slopes. When it rains, the rainwater will form surface runoff easily form on such slopes to carry away soil particles, thus causing soil erosion. When it comes to storm, debris in the construction area during construction will also cause soil erosion.

Estimation of soil erosion covers the construction area where soil erosion is to be prevented and treated.

### **(2) Area of the affected terrain, land damage and vegetation**

The land affected by the project covers an area of 183.12hm<sup>2</sup>

### **(3) Estimation of soil erosion**

#### **1) Formula for estimation**

The volume of soil erosion refers to the soil loss caused by soil disturbance in association with excavation and the damage to original landforms in this project. Different formulas used for different indicators are as follows:

The volume ( $W_0$ ) of the soil loss based on the original landforms:

$$W_0 = \sum P_i F_i T = PFT$$

The total volume ( $W$ ) of soil loss during production and construction in the project area (the volume of the soil loss based on the total soil erosion area):

$$W = \sum P_i A_i F_i T = PAFT$$

The increased volume ( $W_c$ ) of soil loss due to production and construction in the project area:

$$W_c = W - W_0$$

In the formulars above,  $P$  represents the erosion modulus based on the original landforms,  $t/(km^2 \cdot a)$ ;  $A$  represents accelerated erosion coefficient;  $F$  represents potential soil erosion area,  $km^2$ ;  $T$  represents the estimated time span, year.

#### **2) Estimated results**

Based on the field surveys and according to the *Report on Water and Soil Conservation Plan for the WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project*, we have determined the background values of soil erosion based on the original landforms in the area before it is affected by the project and the modulus of soil erosion in the area affected by the project. See Table 5.4-2 for the estimated volumes of soil erosion in the affected area during construction and natual restoration.

**Table 5.4-2 estimated volume of soil loss in the area affected by construction**

Section	Timing	Background values of soil erosion	Affected area's soil erosion modulus	Area of eroded soil	Time span regarding soil erosion	Original volume of soil loss	Estimated volume of soil loss	Increase of volume of soil loss
		t/(km <sup>2</sup> ·a)	t/(km <sup>2</sup> ·a)	hm <sup>2</sup>	a	t	t	t
Berth 7-11	Construction	1238.81	7000	25.15	3	934.68	5281.5	4346.82
	Natural restoration	1238.81	1500	3.53	1	43.73	52.95	9.22
Berth 12-13	Construction	1185.65	7000	21.33	3	758.70	4479.3	3720.60
	Natural restoration	1185.65	1500	3.1	1	36.76	46.5	9.74
Integrated logistics area	Construction	1262.03	9000	34.53	4	1743.12	12430.8	10687.68
	Natural restoration	1262.03	1500	7.26	1	91.62	108.9	17.28
Commerce & logistics area A	Construction	1343.55	9000	23.81	4	1279.60	8571.6	7292.00
	Natural restoration	1343.55	1500	6.6	1	88.67	99	10.33
Commerce & logistics area B	Construction	1224.04	9000	31.53	4	1543.76	11350.8	9807.04
	Natural restoration	1224.04	1500	6.89	1	84.34	103.35	19.01
Total	Construction			136.35		6259.86	42114.00	35854.14
	Natural restoration			27.38		345.12	410.70	65.58
	Subtotal			163.73		6604.98	42524.70	35919.72

The land affected by this project covers an area of 183.12 hm<sup>2</sup>, of which 180.07hm<sup>2</sup> is the area of land suffering soil erosion after deducting the area of rivers. No permanent debris is produced in this project. During construction, the volume of soil loss is 42524.70t, and the increased volume of soil loss is 35919.72t. In terms of timing for soil erosion, the volume of soil erosion reaches its peak during construction; In terms of estimated area, a large volume of soil is eroded in the integrated logistics area and business & logistics area A and B during construction period.

### 5.5 Assessment of solid waste impacts

Solid waste during construction primarily comes from domestic waste and construction waste. Construction waste comes from excavation of earthworks, houses demolition, and soil residues.

#### (1) Earthworks

According to the *Report of WB Loaned Yichang Three Gorges Logistics Center Infrastructure Project Water and Soil Conservation Scheme*, the main works of this project involves 743,700 m<sup>3</sup> of excavated soil and unformed rocks (of which 67,900 m<sup>3</sup> is the volume of topsoil stripped; 6,400 m<sup>3</sup> is the volume of sand, silt, and mud that are dredged from the river bottom; and 669,400 m<sup>3</sup> is the volume of soil used for leveling the ground), 1.27 million m<sup>3</sup> of total earthworks fill (including 67,900 m<sup>3</sup> of topsoil refilled and 1.2021 million m<sup>3</sup> of the backfill of soil and unformed rock). Therefore, 526,300m<sup>3</sup> of the earthworks are moved to the construction site from elsewhere. No permanent spoil earthworks are dumped for this project.

In accordance with earthworks balance, there will be no earthworks fetching sites or earthworks spoil sites in this scheme. According to the provisions of *Letters of Yichang High-tech Zone Baiyang Park Management Office on Soil-Borrow of WB Loaned Yichang Three Gorges Logistics Center Project* ([2016] No. 2) , 526,300 m<sup>3</sup> of spoil generated by leveling project of Baiyang new town core area will be used for earthworks refill of the project. In this way, the problems of soil erosion and dust and earthworks fetching will be solved. In addition, the project impacts are minor if the earthworks engineering is implemented in accordance with water conservation requirements.

If debris is inappropriately stored temporarily or managed during construction, it may cause soil erosion and pollute water bodies in wet seasons. It will cause dust, pollute air environment and influence the health of residents in the surrounding areas during dry and windy seasons. Therefore, during construction, measures of water and soil conservation shall be strictly implemented for sheltering and prevention purposes.

## **(2) Domestic solid waste from construction**

During the busiest construction time, there are about 400 construction workers in the construction site. These workers produce about 0.4t of daily domestic garbage, including food waste, plastic packages, and obsolete batteries. If the solid waste is thrown about, it will damage the landscape and pollute the environment seriously. Randomly piled solid waste may stink and draw mosquitoes and mice, jeopardizing the health of construction workers. Also the solid waste that is piled about may produce leachate and contaminate water and soil. As obsolete batteries contain a large amount of heavy metal, they will severely contaminate water and soil if not properly disposed of.

Domestic solid waste generated by construction workers will be collected and handed over to the environment hygiene department for disposal.

## **(3) Construction solid waste and dregs**

Construction solid waste generated from house demolition in the urban areas will be promptly cleared away and disposed by the dregs management department under the authority of urban management bureau. The storage location of construction solid waste is determined according to the construction situation of the region. Allocation in an extensive range and backfill are encouraged. At present, the houses in Baiyang Logistics Park will be demolished collectively in about a month after the residents are resettled. The quantity of construction solid waste is 128788.64t, covering about 80486.7m<sup>3</sup>, which will be sorted and recycled by categories. Reinforcements and woods will be collected and sold out. Blocks such

as concrete and bricks will be crushed to be used as construction filling materials. And all the construction solid waste will be recycled.

If relevant construction workers fail to properly pile up or timely dispose solid waste during construction, the solid waste will directly damage the affected area's vegetation by blocking irrigation ditches and ponds and contaminating water. Therefore, relevant parties should strengthen control over construction and promptly transfer and dispose solid waste as a method to reduce and prevent from effects of solid waste.

As seen from Phase 1 project, construction solid waste from house demolition and domestic solid waste have been well disposed. It is anticipated that the solid wastes from the construction area in this project can also be effectively disposed and have little impacts on surrounding environment after the aforementioned measures are taken.

Considering that construction scale of the hi-tech zone is becoming larger and larger and the difficulty of directly recycling the construction solid waste within the site is building up, it is recommended that Baiyang hi-tech zone follow the practice in urban area in order to reduce the possible environmental impact by establishing temporary construction garbage storage yard in Baiyang hi-tech zone (please refer to Chapter 11 ESMP for the management requirement). The urban management department office of Yichang Hi-tech zone will be responsible for the daily management of construction garbage in a centralized way.

To summarize, we believe that the solid waste during the project construction period can be effectively utilized or disposed and will have little impact on the environment of the project area.

## **5.6 Impacts on cultural relics**

No officially protected historical and cultural institutes aboveground or unofficially protected historical and religious architectures (such as ancestral hall, ancient dwellings, and ancient tombs) are involved in this project. However, there may be unknown cultural relics discovered underground during construction. If so, workers should promptly take protective measures including suspending construction, reporting the discovery to the local administration of cultural heritage, unearthing the relics in an effort to better protect the relics, and restarting construction, etc.

Having taken the above steps, relevant parties can minimize the impacts of this project on cultural relics.

## **5.7 Impacts on health**

As people from different regions gather in the construction camp, their health may be affected by poor hygienic conditions, such as shortage of basic hygienic facilities and tableware sterilization equipment in the camp canteen, latrine pits without any feces bio-safety measures in most camps, drinking water without sterilization treatment at construction camp, poor water quality, severely exceeding bacteriologic indicators of water sample or inappropriate prevention.

There are explicit management regulations regarding on domestic construction camps, which include management of camp environment and life of personnel living in the camp. By implementing management regulations, the construction

camp of the project will have little impacts on the surrounding environment and the livelihood, safety and health of the construction workers of the project can also be effectively safeguarded. The regulations of camp management are described with the construction measures in the environment and social management plan.

For prevention of infectious disease, the good hygienic habits of construction workers are the core measures taken to prevent from infectious diseases. Educate the construction workers with necessary schistosomiasis prevention knowledge and hygienic knowledge. Efforts to dietetic hygiene and necessary schistosomiasis prevention measures can help control the development of contagious disease.

Workers in the workshops with high noise and relatively high concentration of dust should pay attention to health care at work. This method will also be raised in noise and atmosphere environment protection measures.

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## 6 Assessment of Environmental Impacts during Operation

This chapter summarizes the analysis on the environmental impacts during project operation stage, which will serve as the basis for proposing relative environmental protection measures in the ESMP in order to mitigate the environmental impacts to an acceptable level.

### 6.1 Assessment of water environment impacts

Wastewater generated during operation consists of bilge oil water from a transport ship, domestic wastewater generated by crews and staff at the logistics parks, machinery wastewater, flushing wastewater and initial rainwater.

#### 6.1.1 Bilge oil wastewater

According to the *Design Code of Environmental Protection for Ports* issued on December 20<sup>th</sup> 2007, the bilge oil water production for a vessel of 3,000 tons is 0.81 tons/day. This project has a designed throughput of 7 million tons/year. Assuming the 3000 tons vessels will be used and 8 ships docking at the project wharves each day, the total bilge production can be estimated at 2138.4 tons/year. Assuming the oil concentration is 5000 mg/L (the design code recommended oil concentration 2,000-20,000 mg/L. The actual monitored results in domestic ports are approximately 5,000 mg/L), the total amount of oil pollutant is 10,692 kg/year.

In actual operation, the ships in actual operation are usually equipped with oil separation devices, which will dispose the oil concentration so that it can comply with the standards as described in *Pollutant Discharge Standards for Ships* (GB3552-83). Some ports also have special waste receiving vessels to collect and handle the waste. In Yichang, most of the bilge wastewater (above 80%) is collected and handled by special waste receiving vessels. After the oil content is recycled during centralized treatment, the wastewater can be discharged in compliance with the Class I of the *Integrated Wastewater Discharge Standards* (GB8978-1996).

#### 6.1.2 Domestic wastewater from ships

Based on the assumptions that about 2,500 ship-times (about 8 ships/day) docking at port, each ship has a staffing capacity of 20 people and each person consume 150 L water per day and the wastewater conversion rate is 0.8, the domestic wastewater production can be calculated to be 6,000 t/a.

The domestic wastewater of ships is usually treated through the following methods: It is not forbidden to discharge domestic wastewater in the port areas; instead, it should be transferred to sewage receiving vessels registered by the maritime management department with charged service. Generally ships made after mid-90s are all equipped with domestic wastewater treatment devices which can treat the domestic wastewater to the standards that in compliance with relevant discharge standards. However, in reality, according to surveys, most of the ships do not operate their treatment devices; instead, they discharge the domestic wastewater directly into water bodies.

To make sure that these wastewaters can be treated effectively, the maritime

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management department should enhance their supervision on the domestic wastewater treatment from ships.

However, according to relevant requirements of WB guidelines, the port areas are generally required to be equipped with wastewater collection facilities so that wastewater can be pumped to wastewater treatment facilities on land for treatment.

Similar to the case of Yichang Navigation Hub, in many developed countries, domestic wastewater from ships are collected and treated with charged services by wastewater receiving vessels approved by the local maritime department, or be collectively treated in the land area. This can guarantee that the domestic wastewater from ships will be properly treated and no pollution to the surface water in the port area.

### **6.1.3 Flushing water and first flush rainwater on the ground**

#### **1) The estimated amount of flushing water in the wharf's surface and roads**

After cargos are loaded / unloaded on a bulk cargo terminal, there may be a handful of dust left on it. After cleaning the terminal, workers should promptly flush its surface and the roads at storage yards. The volume of flushing water for bulk cargo berth a single time is about  $4.2\text{m}^3$ . Watering is conducted twice a day for flushing a bulk cargo berth and there are four bulk cargo terminals, so the amount of water used annually is 11088 tons.

If SS emissions average  $1100\text{mg/L}$ , the amount of SS emitted annually will be 12.2tons.

#### **2) The maximum potential drainage amount for initial rainwater**

When it rains, first flush rainwater carries a small amount of SS.

The maximum potential drainage for first flush rainwater is determined based on the following formula:

The maximum potential drainage for initial rainwater= $15\text{min rainfall (mm)} \times \text{area} \times \text{runoff coefficient}$

If the amount of 15-min rainfall is 8mm (based on the common amount of Yinchang), the runoff coefficient is 0.9, and (based on the feasibility study report) the runoff area is estimated to be  $600,000\text{m}^2$ , the maximum potential drainage a single time for first flush rainwater will be  $4,320\text{m}^3$  each time; if the average concentration of SS in the drainage of first flush rainwater is  $500\text{mg/L}$ , the maximum amount of SS produced a single time by the drainage for first flush rainwater will be 2,160kg.

#### **3) The drainage for run-off rainwater at a storage yard**

The drainage for runoff rainwater at a storage yard= $\text{daily rainfall} \times \text{area of the storage yard} \times \text{runoff coefficient}$

If daily rainfall is at least at 75mm for this project, (according to the *Environmental Impact Assessment Specification for Port Construction Project*) among daily rainfall maximums in recent 10 years, area of the storage yard is  $104,547\text{m}^2$  (of which  $63,247\text{m}^2$  is the wharf area and  $41,300\text{m}^2$  is the Baiyang Logistics Park area), and runoff coefficient is 0.1(ditto), the one-time drainage for runoff rainwater in the project's storage yard will be  $784.1\text{m}^3$ ; if the average concentration of SS in the drainage of first flush rainwater is  $1,000\text{mg/L}$  (empirical value from the similar

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project ), the maximum amount of SS produced a single time by the drainage for first flush rainwater will be 784.1kg.

When it rains, the maximum drainage a single time for rainwater is about 5,200m<sup>3</sup>. The drainage will be collected and transferred to a sedimentation basin. After the wastewater is treated in the settling basin, it will be used to water the storage yard, which will not contaminate the water environment of the Yangtze River.

#### 6.1.4 Oil wastewater

Oil wastewater comes primarily from water used to flush machines, vehicles, and containers.

##### (1) Water for flushing machinery

###### 1) Baiyang Port Operation Area

This project is equipped with about 100 vehicles. In accordance with similar domestic wharves and considering 30% of the vehicles need to be flushed on a daily basis and 0.8 tons of water is used for flushing a vehicle, the amount of water used to flush the vehicles for this project will be 7920 tons a year. According to similar monitoring data, the main pollutants in the wastewater produced when vehicles are being flushed are SS and oil. The concentrations of SS and oil in the wastewater are 50mg/L and 200mg/L respectively, and the amounts of SS and oil produced annually are 396 kg and 1,584kg respectively.

###### 2) Baiyang Logistics Park

This project is equipped with 60 vehicles. In accordance with domestic logistics experiences and considering about 30% of the vehicles need to be flushed on a daily basis and 0.8 ton of water is used for flushing a vehicle, the amount of water used to flush the vehicles for this project will be 5,280 tons a year. According to similar monitoring data, the main pollutants in the wastewater produced when vehicles are being flushed are SS and oil. The concentrations of SS and oil in the wastewater are 50mg/L and 200mg/L respectively, and the amounts of SS and oil produced annually are 264.0kg and 1.06kg respectively.

##### (2) Water for flushing container

Throughput of container of this project is 8×10<sup>4</sup>TEU/a. In accordance with the formula as recommended in the *Specifications of Environmental Design for Port Engineering* (JTS149-1-2007) of the Ministry of Transportation, the daily maximum number of cleaned containers can be calculated according to the following formulas:

$$N_d = D / Na K$$

In the formula,  $N_d$ —Daily maximum number of cleaned containers (TEU/d)

$N_a$ —total number of cleaned containers (TEU) which will be calculated according to 0.05% to 0.1% of the throughput of container; in this project, we take 0.1%.

$D$ —work days of the year (d);

$K$ —uniformity coefficient of daily number of cleaned containers; in this formula,  $K=2$ ;

The daily maximum water quantity for container cleaning can be calculated

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according to the following formula:

$$W_j = Q N_d$$

In which:

W – Daily maximum water quantity for container cleaning ( $m^3/d$ );

Q – Water quantity for container cleaning (L/TEU), which shall be in the range of 100~200 L/TEU, we take 200L/TEU for this project

$N_d$  – Daily maximum number of cleaned containers(TEU/d)

We can know from the above formula that the daily maximum production of container cleaning wastewater is about  $0.1m^3/d$  and the annual maximum production of container cleaning wastewater is about  $33.0m^3/a$ .

According to the data analysis of similar projects, we found that the pollutants in the wastewater from this type of containers mainly include petroleum, SS and COD and their concentrations are respectively 30mg/L, 300mg/L and 150mg/L. On this basis, we can conclude that the daily maximum production of cleaning wastewater from containers contains petroleum, SS and COD respectively 0.003kg/d, 0.03kg/d and 0.015kg/d and the annual maximum production of cleaning wastewater from containers contains petroleum, SS and COD respectively 1.0 kg/a, 10.0kg/a and 5.0 kg/a.

(3) Flushing water in the machine repair workshop

#### 1) Baiyang Port Operation Area

The project is equipped with about 100 vehicles (empirical value from the similar project). If the repair rate of equipment used for this project is 5% and the amount of water used for cleaning one piece of equipment is 0.8 tons, the bilge oil water produced when workshops are being flushed will amount to 1320 tons a year. The concentration of oil in the wastewater is about 2,000mg/L and the oil separated from the wastewater amounts to 2640.0kg a year.

#### 2) Baiyang Logistics Park

The project is equipped with about 60 vehicles. If the repair rate of equipment used for this project is 5% and the amount of water used for cleaning one piece of equipment is 0.8 tons, the oily wastewater for flushing workshops will amount to 792 tons/year. The concentration of oil in the wastewater is about 2,000mg/L and the oil separated from the wastewater amounts to 1,584kg a year.

Yichang Transportation Investment Co., Ltd. will establish oily sewage treatment facilities in the Baiyang Logistics Park to treat the oily wastewater by ways of sedimentation, oil separation and oil-water separator. After oil-water separation, the content of petroleum in water is 10~20mg/L which can reach the Class III standard in the *Integrated Wastewater Discharge Standards* to be discharged in the wastewater pipeline networks.

### **6.1.5 Domestic wastewater produced by the logistics center**

According to the FSR, the domestic water consumption of the Three Gorges Modern Logistics Center is  $156.3m^3/day$ . If the logistics center is active 330 days per year and the coefficient of water discharge is 0.9, the annual water discharge

will be 46421.1m<sup>3</sup>. If the domestic sewage from logistics center meets the requirements of Class III in the *Integrated Wastewater Discharge Standards* after is the treatment in a septic tank, it can be discharged into the urban sewage network in the park area.

The above analysis indicates that the wastewater produced during the project's operation can be effectively treated and it generally will not contaminate the water environment of the Yangtze River.

## 6.2 Impacts on ambient air

### 6.2.1 Analysis of cargos dust pollution

Dust at storage yards and the exhaust gas emitted by cargo loading/unloading machines and by docking vessels are fugitive emissions and tend to pollute their surrounding areas. Exhaust gas will pollute ambient air in the Baiyang Port Operation Area. Air pollution is caused by particles produced when cargos are being loaded, unloaded, or stockpiled on the wharf. Predictive analytics is used to assess the TSP impacts on ambient air.

#### I. Estimated Content

Dust emission probability and the amount of dust generated when sand and gravel is being loaded, unloaded, or stockpiled on the wharf are affected by weather and the moisture content of bulk cargos. The TSP's pollution on the wharf's surroundings and sensitive spots is estimated when No.8-No.11 berths are being used at the same time. See Table 6.2-1 for relevant details.

**Table 6.2-1 Estimated Scenarios**

No.	Emission scheme	Types of pollution sources	Predictors	Items to be calculated
1	Bulk cargos are being loaded/unloaded on the four berths at the same time	Moisture content 8%	TSP	Ambient air protection targets Maximum measured ground-level TSP concentration

#### II. Estimation methods

The concentration of pollutants in the air is calculated based on the formula SCREEN3 proposed in the *Technical Guidelines for Environmental Impact Assessment-Atmospheric Environment*.

#### III. Intensities of pollution sources

A wet-type degusting system is activated whenever bulk cargos are loaded or unloaded from a vessel, a vehicle, or a storage yard in the port area. Windbreaks are set up around the storage yard of bulk cargos. See Table 6.2-2 for basic information of the intensities of pollution sources with regards to this project.

**Table 6.2-2 Intensities of dust emitted when bulk cargos are being loaded/unloaded on the wharf and stockpiled on the storage yard**

Category	Area sources (name)	Area sources (length)	Area sources (width)	Angle between due north and an area source	Height of initial emissions from area sources	Emission intensities	
						TSP	PM <sub>10</sub>
Unit	—	m	m	°	m	mg/s	mg/s
Types of pollution sources	Ores loaded/unloaded on the wharf	90	32	11.5	10	79.6	16.7
	Dust produced by wind erosion at storage yards	180	60	11.5	8	103.22	21.68

#### IV. Estimated results

##### (1) Estimation of impacts on the atmospheric environment

**Table 6.2-3 Estimations of impacts on the atmospheric environment**

At a distance of D(m) downwind from the pollution sources	TSP produced when cargos are being loaded/unloaded on the wharf		PM <sub>10</sub> produced when cargos are being loaded/unloaded on the wharf		TSP produced when cargos are being stockpiled		PM <sub>10</sub> produced when cargos are being stockpiled	
	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)
10	0.03535	3.93	0.00742	1.65	0.02957	3.29	0.00621	1.38
100	0.08040	8.93	0.01687	3.75	0.05192	5.77	0.01091	2.42
200	0.06116	6.8	0.01283	2.85	0.06358	7.06	0.01335	2.97
300	0.03485	3.87	0.00731	1.62	0.04172	4.64	0.00876	1.95
400	0.02228	2.48	0.00468	1.04	0.02770	3.08	0.00582	1.29
500	0.01561	1.73	0.00328	0.73	0.01971	2.19	0.00414	0.92
600	0.01167	1.3	0.00245	0.54	0.01485	1.65	0.00312	0.69
700	0.00915	1.02	0.00192	0.43	0.01169	1.3	0.00246	0.55
800	0.00743	0.82	0.00156	0.35	0.00951	1.06	0.00200	0.44
900	0.00619	0.69	0.00130	0.29	0.00794	0.88	0.00167	0.37
1000	0.00526	0.58	0.00110	0.25	0.00676	0.75	0.00142	0.32
1500	0.00288	0.32	0.00060	0.13	0.00371	0.41	0.00078	0.17
2000	0.00191	0.21	0.00040	0.09	0.00247	0.38	0.00052	0.12
2500	0.00141	0.16	0.00030	0.07	0.00182	0.35	0.00038	0.09
3000	0.00111	0.12	0.00023	0.05	0.00143	0.32	0.00030	0.07

At a distance of D(m) downwind from the pollution sources	TSP produced when cargos are being loaded/unloaded on the wharf		PM <sub>10</sub> produced when cargos are being loaded/unloaded on the wharf		TSP produced when cargos are being stockpiled		PM <sub>10</sub> produced when cargos are being stockpiled	
	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)	Estimated concentration C <sub>i1</sub> (mg/m <sup>3</sup> )	The proportion of estimated concentration to standard concentration P <sub>i1</sub> (%)
3500	0.00090	0.1	0.00019	0.04	0.00117	0.3	0.00025	0.05
4000	0.00076	0.08	0.00016	0.04	0.00099	0.27	0.00021	0.05
4500	0.00066	0.07	0.00014	0.03	0.00085	0.2	0.00018	0.04
5000	0.00058	0.06	0.00012	0.03	0.00075	0.16	0.00016	0.04
Maximum measured ground-level TSP/PM <sub>10</sub> concentration	0.08679	9.64	0.01821	4.05	0.06797	7.55	0.01428	3.17
D <sub>10%</sub> (m)	/		/		/		/	

Table 6.2-3 shows that  $P_{i_{max}} = 9.64\%$ , which is less than 10%. So the air pollution caused by this project is rated as Class III. The pollution caused by sand-gravel dust on the atmospheric environment is relatively insignificant.

### (2) Estimation regarding the sensitive spots

According to estimation, the shortest distances from the Guixihu Village and the Yazishan Village (the two sensitive spots covered by the assessment for this project) to the storage yard of bulk cargos are 1,700m and 180m respectively; the shortest distances from the Guixihu Village and the Yazishan Village to the operation area of wharf are 2,000m and 600m respectively.

The contributed values of TSP and PM<sub>10</sub> to the concentrations are relatively low when bulk cargos are being loaded, unloaded, or stockpiled for this project). The proportion of maximum measured ground level TSP concentration to the standard concentration is 9.64%, while the proportion of maximum measured ground level PM<sub>10</sub> concentration to the standard concentration is 4.05%. TSP and PM<sub>10</sub> primarily affect the berth and storage yard areas. The Guixihu Village and the Yazishan Village, the two sensitive spots closest to the project area, are located in the areas downwind from the project area. According to relevant estimation, loading, unloading, and stockpiling bulk cargos have rather limited impacts on ambient air in the project area.

### (3) Determining the distance of atmospheric environmental protection zones

The formula proposed in HJ/T2.2-2008 for determining the atmospheric environmental protection zones will be used to calculate the distance of the atmospheric environmental protection zones from the fugitive emission sources.

Calculation based on the proposed formula indicates that air pollutants have not exceeded the standard, so there is no need to set up the distance of atmospheric environmental protection zone.

### 6.2.2 Analysis on the impacts of vehicle exhaust

The main pollutants of vehicle exhaust emitted during the project's operation are SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm. Analogy analysis will be used to analyze the impacts on the atmospheric environment throughout the project's operation.

The source of air pollution throughout the project's operation is vehicle exhaust. Vehicle exhaust comes primarily from the gas leaked from the crankcase, fuel volatilization, and emissions from the exhaust funnel. Based on the motor vehicles' pollutant emission factors (Table 6.2-4) proposed in the *Standards of Environmental Impact Assessment for Port Construction Projects*, we calculate that the SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm emitted by a motor vehicle average 97.82g/100km, 815.13g/100km, 1340.44g/100km, and 134.04g/100km respectively.

**Table 6.2-4 Motor vehicles' pollutant emission factors**

Pollutants	Petrol fuel (g/L)	Diesel fuel (g/L)
SO <sub>2</sub>	0.295	3.24
CO	169	27
NO <sub>x</sub>	21.1	44.4
CnHm	33.3	4.44

The traffic flow for this project is estimated to be about 500 vehicles per day. Based on the traffic flow in the port area and the average distance that a vehicle travels in the port area, if vehicles use diesel fuel and the distance a vehicle travels in the port area averages 1.0 km, the SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted daily by the vehicles traveling in the port area are estimated to be 0.49 kg, 4.08kg, 6.70 kg, and 0.67kg respectively. The SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted annually by the transport vehicles traveling in the port area are estimated to be 0.16 ton, 1.35 tons, 2.21 tons, and 0.22 ton respectively.

According to the analysis of similar projects, the average CO emissions within 24 hours range are between 1.80 mg/m<sup>3</sup> and 2.7mg/m<sup>3</sup>, and the average NO<sub>2</sub> emissions within 24 hours range between 1μg/m<sup>3</sup> and 60μg/m<sup>3</sup>. Therefore, exhaust emissions is in accordance with Class II of the *Ambient Air Quality Standards*. Moreover, as the project area is located in the rural areas, the CO and NO<sub>2</sub> emitted by transport vehicles in the port area tend to have no pollutions to the surrounding areas throughout the project's operation.

### 6.2.3 Cargo loading and unloading machines

(1) Exhaust emitted by cargo loading and unloading machines in the Baiyang Port area

Diesel consumption in the Baiyang Port area is 1,000 tons per year. Based on this, the SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted daily by the machines operating in the port area are estimated to be 12.3 kg, 102.2kg, 67.3kg, and 6.70kg respectively. The SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted annually by the machines operating in the port area are estimated to be 4.10 tons, 33.7 tons, 22.2 tons, and 2.22 tons respectively.

(2) Exhaust emitted by cargo loading and unloading machines in the Baiyang

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## Logistics Park area

Energy consumed by the Logistics Park project includes electricity, diesel, and water. Diesel consumption is 500 tons a year. Based on this, the SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted daily by the machines operating in the port area are estimated to be 6.1 kg, 51.1kg, 33.65kg, and 3.35kg respectively. The SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted annually by the machines operating in the port area are estimated to be 2.05tons, 16.9 tons, 11.1 tons, and 1.11 tons respectively.

Emissions from cargo loading and unloading machines and from fugitive emission sources tend to pollute their surrounding areas. Exhaust emission will pollute the atmospheric environment within 50 meters from the emission point. The pollution will only be found within the port and operations area and the logistics park area, so generally exhaust emission will not pollute the atmospheric environment throughout the project's operation.

### **6.2.4 Exhaust emissions from vessels**

During a vessel's stay at the port, the vessel relies on its auxiliary engine to supply power for electric lighting. The auxiliary engine emits SO<sub>2</sub> and NO<sub>2</sub> when it is operating.

The tailpipe emission from a vessel is calculated based on the method recommended by the Lloyd's Register of Shipping, namely, fuel consumption for every 1KW·h averages 231g. Given one auxiliary engine on board a vessel operates at 250KW·h, 7 berths with the capacity of 3000 tons and 8 vessels docking every day in this project and based on the emission coefficient of SO<sub>2</sub>, NO<sub>x</sub>, and other pollutants, it is estimated that the SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted daily from the vessel are 20.9kg, 173.7 kg, 286.0kg, and 28.6kg respectively. Berths of the ports are active for 330 days a year. Therefore, SO<sub>2</sub>, CO, NO<sub>x</sub>, and CnHm that are emitted annually from the vessel are 6.9 tons, 57.4 tons, 94.4 tons, and 9.4 tons respectively.

Exhaust from the docking vessels is fugitive emissions and it tends to pollute its surrounding areas. Exhaust emission will pollute the atmospheric environment within the range of 50m from the emission point. The pollution will only be found within the port and operating area, so the exhaust will generally not pollute the atmospheric environment during operation period. It is proved by the data monitored at the yard from acceptance report of environment protection of Yichang Navigation Hub Yidu Port Area Shigu Operation Zone Integrated Terminal (the actual monitoring data account for 10~20% of the emission standards).

Currently China requires using shore power to reduce air pollution and CO<sub>2</sub> emission caused by power generation of diesel engines. According to *Regulations on Prevention and Control of Air Pollution of Yichang*, Yichang Navigation Hub requires the vessels which docking the port to use the ashore power. Considering the above factors, the exhaust from ships will have less impact on air environment.

### **6.2.5 Exhaust emissions from processing and exhaust gas of storage**

As processing involved in this project is only the physical deform of steels, the dust produced is in small amount. As warehouses are used solely for storing cargos, only a small amount of dust is produced in warehouses when cargos are being carried in and out of warehouses. The dust is produced in a small amount and

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within 10m away from the operations area, so it will not pollute the sensitive objectives in the ambient air.

### **6.3 Assessment of acoustic environment impacts**

Noise during the project's operation comes primarily from the loading and unloading equipment, stockpiling machines, warehouse/logistics machines, and vehicles. The supporting facilities for the logistics park will generally not cause noise pollution to the environment outside the park.

A number of villagers in the Yazishan Village and Guixihu Village will be resettled as they are living within the red line of land acquisition and resettlement of the project. As the villagers will be resettled during the project's operation, two villages will suffer from noise pollution. Therefore, efforts should be paid to protect the two villages from noise pollution. The Yazishan Village is located along China National Highway 318 (G318) which is under construction and to the north of the project's construction site. This assessment has conducted to assess the overlapped impacts of both the construction of China National Highway 318 and the noise sources on the acoustic environment of Yazishan Village.

#### **6.3.1 Assessment of Estimation Methods**

This environmental impact assessment uses the formulas listed in the *Technical Guidelines for Environmental Impact Assessment-Acoustic Environment* (HJ2.4-2009) to measure the ambient noise levels, assessing the effects of the traffic noise and noise produced by machinery and equipment.

#### **6.3.2 Assessment of Estimation Formulas**

(1) Formula for noise at point sources

Based on the characteristics of the noise source, the following formula is used to measure noise levels.

$$L_i = L_0 - 20 \lg \frac{r_i}{r_0} - \Delta L$$

In this formula,

$L_i$  represents the level of noise at a distance of  $r_i$  from the sound source [dB(A)]

$L_0$  represents the level of noise at a distance of  $r_0$  from the sound source [dB(A)]

$\Delta L$  represents the noise levels reduced by other factors; in this case conservatively  $\Delta L=0$

High level noise throughout the project's operation is generated primarily by cargo loading and unloading machines operating on the wharf. Such machines include multi-purpose portal cranes, forklifts, wheel cranes, rail mounted gantry cranes, belt conveyors, and single-scoop loading machines. Based on the field data of similar projects, the noise source intensity of cargo loading/unloading machines used for this project is estimated to vary between 67dB and 99 dB.

(2) Formula for traffic noise levels

$$L_{Aeq_i} = L_{oi} + 10 \lg \frac{N_i}{TV_i} + 10 \lg(7.5/r) + 10 \lg((\Psi_1 + \Psi_2)/\pi) + \Delta L - 16$$

$$L_{Aeq_{\text{交}}} = 10 \lg \left[ 10^{0.1 L_{Aeq_{\text{大}}}} + 10^{0.1 L_{Aeq_{\text{中}}}} + 10^{0.1 L_{Aeq_{\text{小}}}} \right]$$

In this formula,  $L_{Aeq_i}$  represents the equivalent continuous sound level of model  $i$  vehicles (in large-, medium-, and small sizes), dB;

$L_{Aeq_{\text{交}}}$  represents the equivalent continuous sound level of traffic noise, dB;

$L_{oi}$  represents the average radiated noise levels of model  $i$  vehicles at a distance of 7.5 meters, dB;

$N_i$  represents the traffic flow of model  $i$  vehicles per hour, number of vehicles/h;

$T$  represents time during which the equivalent continuous sound level is measured; in this case  $T=1$ h;

$V_i$  represents the average driving speed of model  $i$  vehicles, km/h;

$r$  represents the distance between the center line of the lane and the spot where noise levels will be measured, m;

$\Psi_1$  and  $\Psi_2$  respectively represents the field angle and radian between the measuring spot to the measured road section;

$\Delta L$  represents the correction caused by other factors, dB(A); it can be measured based on the following formula:

$$\Delta L = \Delta L_1 - \Delta L_2 + \Delta L_3$$

$$\Delta L_1 = \Delta L_{\text{坡度}} + \Delta L_{\text{路面}}$$

$$\Delta L_2 = A_{\text{atm}} + A_{\text{gr}} + A_{\text{bar}} + A_{\text{misc}}$$

$\Delta L_1$  represents the correction caused by routes, dB(A) ;

$\Delta L_{\text{GradeGrade}}$  represents the correction caused by highway longitudinal grades, dB(A) ;

$\Delta L_{\text{Pavement}}$  represents the correction caused by highway pavement materials, dB(A) ;

$\Delta L_2$  represents the noise level reduced due to the propagation of acoustic waves, dB(A) ;

$\Delta L_3$  represents the correction caused by emission, dB(A) ;

$A_{\text{atm}}$  represents the correction caused by atmospheric absorption, dB(A) ;

$A_{gr}$  represents the correction caused by ground effect, dB(A) ;

$A_{bar}$  represents the noise level reduced due to obstacles, dB(A) ;

$A_{misc}$  represents the correction caused by other effects, dB(A) .

(3) Overlapped impacts of noise

Aggregate noise from various sources will be measured at sensitive spots by using the following formula:

$$L_{TP} = 10 \lg \left[ \sum_{i=1}^n 10^{0.1L_{pi}} \right]$$

**6.3.3 Estimation of technical specifications**

**(1) Sensitive spots**

The southern part of the project area is close to the Yangtze River waterway and there are two sensitive spots (Guixihu Village and Yazishan Village) of the acoustic environment on which noise effects will be assessed. Noise levels will be estimated at the northern, western, and eastern parts of the project area as well as the Guixihu Village and Yazishan Village.

**(2) Estimation of machinery noise value**

As terminal operations are intermittent and the vehicles are commuting in the wharf, it is difficult to estimate the noise levels in the area. In order to fully reflect the noise effects by machinery in the port area and considering both the general layout of the port area and the use of berths and cargo loading/unloading machinery, we choose to estimate noise at the berths in front of the wharf, the storage yards at the back of the wharf, as well as noise produced when the machines in warehouses operate simultaneously.

**(3) Estimation of noise at sensitive spots**

Yazishan Village suffers from both the traffic noise of China National Highway G318 and the noise by the machines involved in this project. For China National Highway G318, it has a roadbed of 21.5m; the driving speed is designed to be 80km/h; it is two-way, four-lane; and it has asphalt concrete pavement. See Table 2.6-1 for the traffic flow of China National Highway G318.

**6.3.4 Estimation and assessment of ambient noise**

**1. Estimation of noise at boundary**

See Table 6.3-1 and Figure 6.3-1 for estimates of noise at boundaries of industrial enterprises throughout the project's operation.

**Table 6.3-1 Estimates of noise at boundary**

Spots	The shortest distance(m) from the sound source	Noise made by multiple machines [dB(A)]	Background noise level [dB(A)]		Estimated noise level [dB(A)]		Assessment standard	Noise level [dB(A)]	
			Daytime	Nighttime	Daytime	Nighttime		Daytime	Nighttime

Spots	The shortest distance(m) from the sound source	Noise made by multiple machines [dB(A)]	Background noise level [dB(A)]		Estimated noise level [dB(A)]		Assessment standard	Noise level [dB(A)]	
			Daytime	Nighttime	Daytime	Nighttime		Daytime	Nighttime
Boundary in the north	35	43.5	—	—	43.5	43.5	4	Reasonable	Reasonable
Boundary in the west	30	41.0	—	—	41.0	41.0	3	Reasonable	Reasonable
Boundary in the east	40	49.5	—	—	49.5	49.5	3	Reasonable	Reasonable

## 2. Results of noise estimation at sensitive spots

Yazishan Village, the sensitive spot on which noise effects will be assessed, suffers from both the traffic noise of China National Highway 318 and the noise produced by the machines involved in this project. Guixihu Village suffers the noise primarily by the machines involved in this project. According to the *G318 Wancheng Bridge to Yunchi Segment Renovation Project EIA Report*, Yazishan Village of Baiyang Town is located on the newly constructed road section from K50+680 to the terminal and the shortest distance between the Yazishan Village and China National Highway 318 is 60m, so the village is estimated to be suffering from the traffic noise of China National Highway 318. The medium-term construction of China National Highway 318 makes noise at a level of 59.3dB (A) during daytime and 56.7dB (A) during nighttime; the noise produced by the construction during nighttime exceeds the relevant standard by 6.8dB (A). The project proposes to install soundproof windows for residents in the Yazishan village. Relevant estimation indicates that noise at the Guixihu village is below the standard level. See Table 6.3-2 for details.

**Table 6.3-2 Estimations of noise at sensitive spots (unit: dB(A))**

Estimated Spots	Noise produced by multiple machines	Noise from China National Highway 318		Background noise level		Estimated noise level		Assessment standard	Noise level vs standard	
		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime		Daytime	Nighttime
Guixihu Village	35	/	/	46.2	44	46.2	44.0	2	-	-

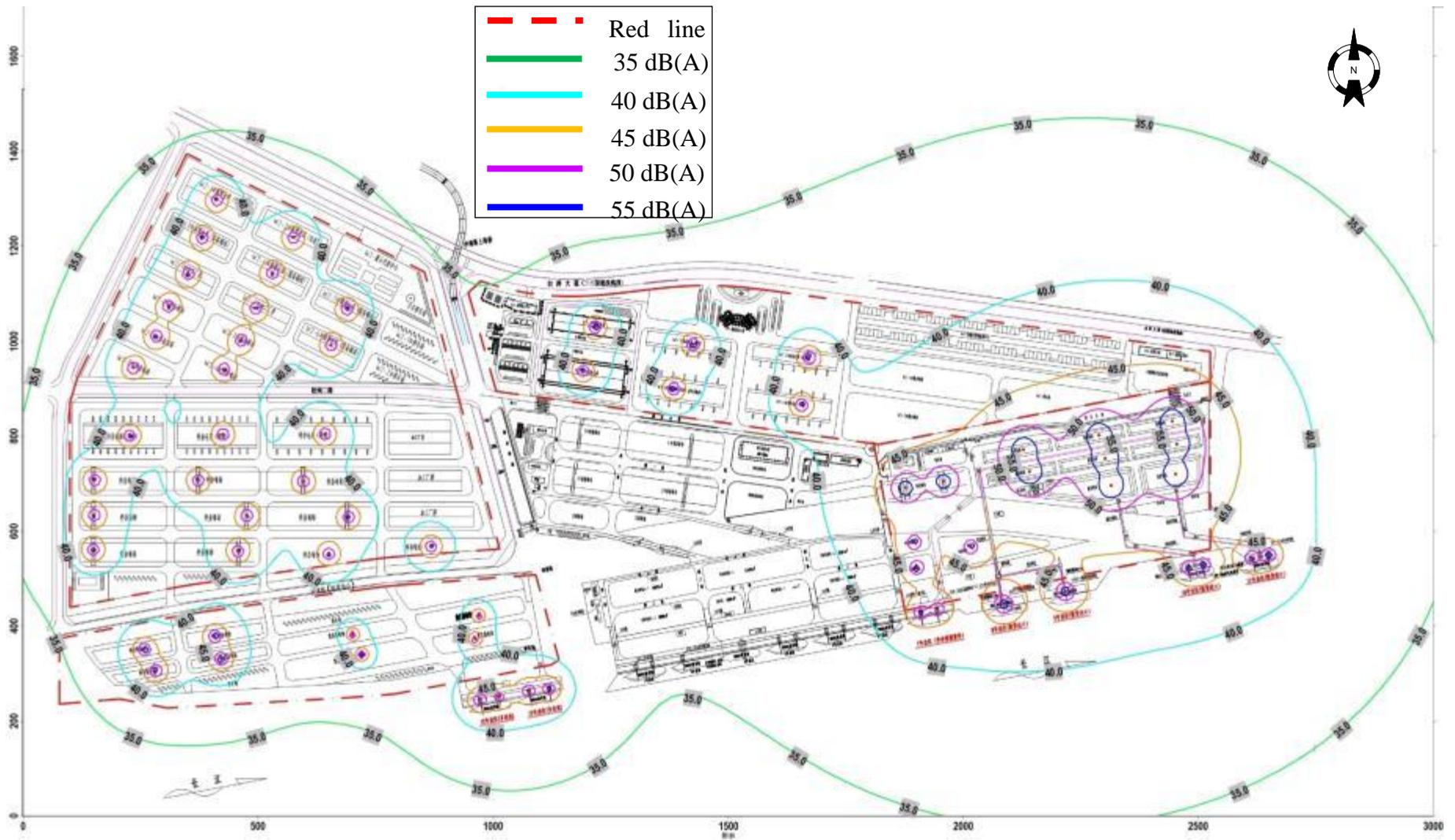


Figure 6.3-1 Noise contours

## **6.4 Assessment of impacts on ecological environment**

### **6.4.1 Impacts on terrestrial ecosystems**

#### **(1) Assessment of impacts on terrestrial plants**

After the construction is completed, the vegetation and shrubs on the permanently occupied farmland will be fully destroyed. Structures, road pavement and the supporting facilities will be constructed on such farmland, turning it into construction land. However, the land used for the project's construction is relatively small compared with the total land area of Yichang municipality, the changes on species composition in the project area is minor and plants will be replenished in the project area. Therefore, we can say that despite there are partial impacts on the ecosystem in the project area, the impacts on the ecosystem and vegetation in a wider range are insignificant.

#### **(2) Assessment of impacts on terrestrial animals**

When the project is completed and put into operation, the habitats of animals in the project area will be completely destroyed by the changes such as noise pollution, vehicle exhaust, and dust produced at storage yards. A majority of animals will leave their habitats in the project area for new habitats elsewhere.

As the terrestrial animals inhabiting the project area are generally adaptable to human impacts, construction will neither cause them to die out nor change their habits. However, a large number of these animals will leave their original habitats in the project area as a result of construction activities in the project.

### **6.4.2 Analysis of impacts on aquatic ecosystems**

Impacts on the Yangtze River's aquatic ecosystem during the project's operation are due to the following factors: impacts on the aquatic animals and their migration routes, domestic wastewater of workers on land around the port, machinery flushing water for vehicles and workshops, and wastewater discharged from docking vessels influencing the water quality and aquatic ecological environment.

#### **(1) Impacts on aquatic organisms**

Industrial wastewater and domestic wastewater will be treated before being discharged into a WWTP in the logistics park area; the domestic wastewater from the docking vessels and their bilge oil water are forbidden to be discharged into the wharf area, instead, such wastewater will be collected and treated for charged service by the vessels approved by the local maritime management department. Therefore, the wastewater generated has been effectively treated, which neither contaminates water in the section of the Yangtze River involved in this project nor harms the aquatic ecosystem of this section of the Yangtze River.

#### **(2) Impacts on fish**

The implementation of the project affects both water quality and activity space of fishes.

Firstly, as the water quality of the section of the Yangtze River involved in this project remains unchanged, the fish food sources remain generally unchanged.

Secondly, as some of the wharves are beam-slab structures with high piles, fish can still swim under the approach spans and wharves after the construction is

completed. The width of this section of the Yangtze River is about 1200m and the depth varies from 5.75m to 17.5m, and the maintenance water depth is 3.5m. Horizontally, the wharves have 10 piles at most (with the diameter of each pile 1000mm). The water area occupied by the wharf piles is 10m at most. Therefore, the blockage area only accounts for about 1% of the flow area of Yangtze River. Therefore, the impacts on fish caused by the decrease of the flow area are insignificant.

Thirdly, as the wharves is completed and put into operation, the number and density of ships will increase significantly. As the depth of this river section is generally more than 10m, the waterline of ships won't be less than 3.5m. Therefore, fish can distribute in the spatial area of about 6m. The impacts of ships on the distribution of fish in the section of the Yangtze River are minor. As for the Chinese sturgeon, they mainly live the area about 3.07m to the river bottom, e.g., about 12m under water, thus the unfavorable living space for Chinese sturgeon is only about 7m under normal hydrological conditions.

Additionally, the waves and noise of operating ships will cause fish to migrate from original habitats of important waterways; propellers may injure or even kill fishes if they fail to promptly dodge the propeller, but such cases are relatively rare. In addition, some fish may become accustomed to the impacts on their habitats after some time.

Therefore, it can be concluded that the impacts on fish caused by implementation of the project are acceptable.

### (3) Impacts on four Asian carps

Affected by the Gezhouba Dam, the spawn scale of Asian carps has been increased in the Yichang section of the Yangtze River. The spawn sites are concentrated in the segment (from Gezhouba Dam to Huyatan) that is about 23km downstream from the dam and 28km upstream of the project. As the project area is relatively far away from the spawn sites, it will not severely disrupt the reproduction of Asian carps.

#### **6.4.3 Impacts on Yichang Chinese Sturgeon Natural Reserve**

As the wharves that the project plans to build up are located about 3.0km from the outlying area of Yichang Chinese Sturgeon Natural Reserve (see Appendix 1), the impacts of wharf construction on the habitats of Chinese sturgeons will be insignificant.

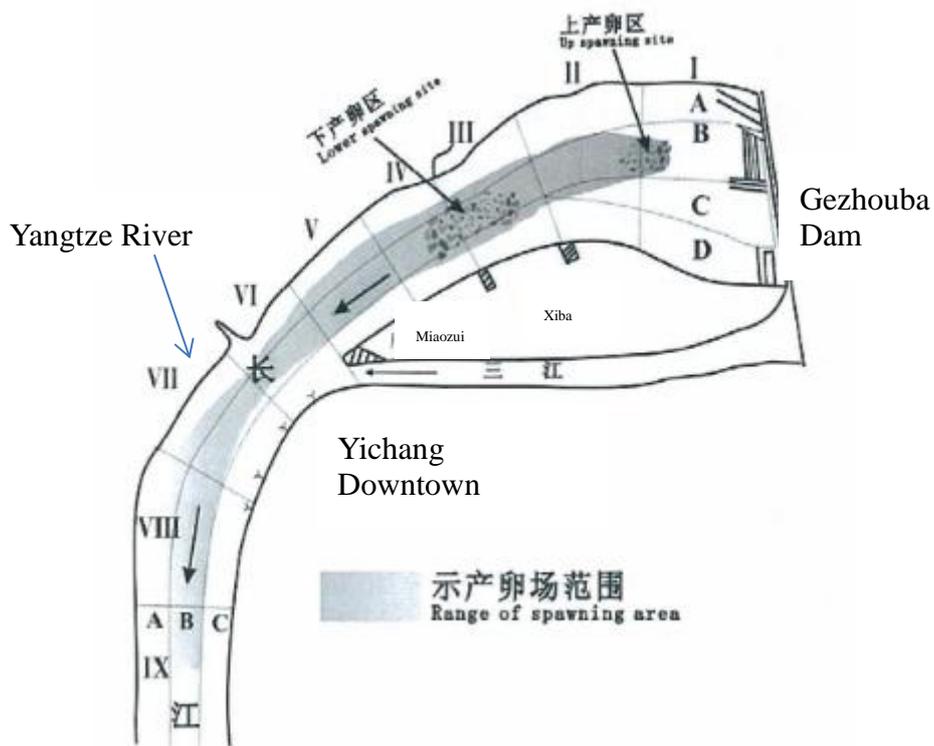
##### (1) Analysis of impacts on the spawning of Chinese sturgeons

Since the Gezhouba Dam was put into operation in 1981, a new spawning site for the Chinese sturgeons isolated downstream from the dam has taken shape and is located 4km in Yangtze segment downstream from the dam. By 2008, the spawning activities of Chinese sturgeons had been found every year on this site and we can say this site is the stable spawning site.

Moreover, in October 1986 and November 1987, minor spawning activities were found in Huyatan segment which is about 25km downstream from Gezhouba Dam, as the historical occasional spawning site. Since Impoundment of the Three Gorges Project in 2003 (second phase), clean water has been flowing downward after years of operation, resulting in the increase of gravel riverbeds downstream from

Gezhouba Dam. Also, the existing stable spawning site of Chinese sturgeons may expand and move downstream, turning the current “occasional spawning site” into a stable one. However, as of 2008, there was no evidence indicating that Chinese sturgeons had spawned in this segment of the Yangtze River.

The surveys since 1996 show that the spawning downstream the Gezhouba dam occurs mostly in two narrow areas in the main channel between Gezhouba Power Plant and Miaozi segment (approximately 4 km) as illustrated in Figure 6.4-1, mainly in the I3-B to II1-B area (upper spawning area) near the outlet of the power plant and the III1-B to IV2-B area (lower spawning area). Each year there was Chinese Sturgeon spotted spawning in the lower spawning area. And the number of Chinese Sturgeon spawning in the lower area is significantly higher than that in the upper area.



**Figure 6.4-1 Schematic diagram of the spawning site for Chinese Sturgeon**

The spawning times and locations of Chinese Sturgeons from 1996 to 2012 is shown in Table 7.3-4 and Figure 6.4-1.

**Table 6.4-1 Location of Chinese Sturgeon spawning (1996-2012)**

Year	Times of spawning	Location of spawning			
		I	II	III	IV
1996	2				
1997	1				
1998	1				

Year	Times of spawning	Location of spawning			
		I	II	III	IV
1999	2				
2000	1				
2001	2				
2002	2				
2003	1				
2004	1				
2005	1				
2006	1				
2007	1				
2008	1				
2009	1				
2010	1				
2011	2				
2012	2				

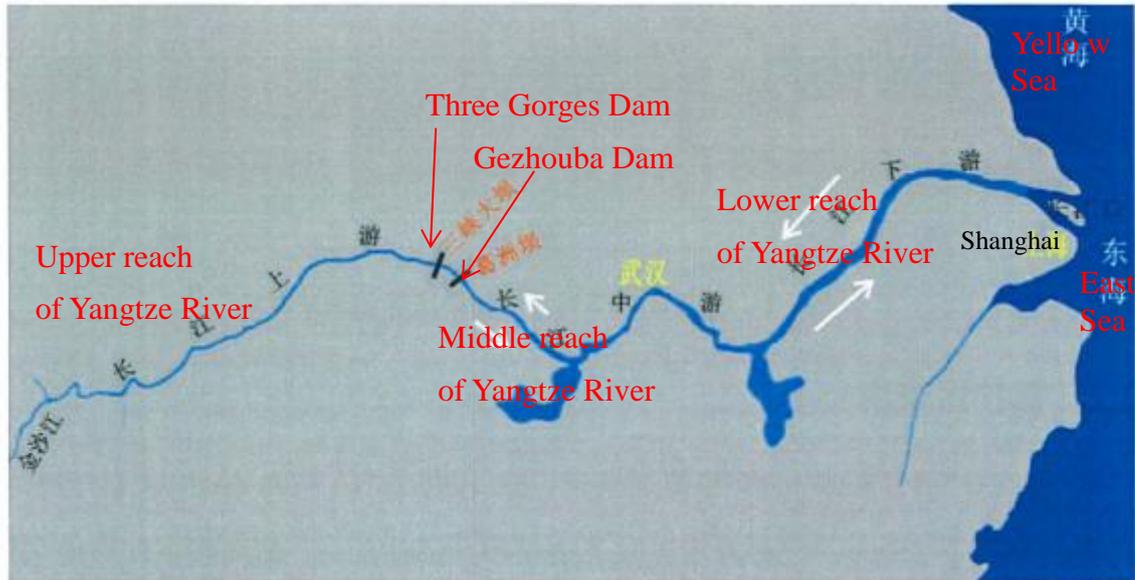
The river segment involved in this project is located downstream from the aforementioned spawning site of Chinese sturgeons, about 47km from their stable spawning site and 30km from their historical occasional spawning site. It is estimated that this project will not have any impacts on the spawning activities of Chinese sturgeons.

(2) Analysis and estimation of impacts on the migration of Chinese sturgeons

The Chinese Sturgeon Natural Reserve covers approximately 50 km of Yangtze River main channel. It is a typical river ecological system. Due to variance of geotechnical conditions, topographic conditions, climate conditions and ecological habitats, the river ecological system has formed many diversified habitats, which are important to the survival and reproduction of many aquatic organisms including the Chinese Sturgeon.

Yangtze sturgeon is a typical migratory sturgeon species. Chinese sturgeon spawns mainly in the Yangtze River. The spawning season is from October to November each year. Multi-year survey results show that the lower reach of Yangtze River including the Yichang Segment have habitats for Chinese Sturgeon.

Before the Gezhouba Dam was built, the soon-to-be mature sturgeon in the sea migrates up along the Yangtze River during July and August, until October and November of the next year when they reach the Jinsha River segment. After the Gezhouba Dam was built, their migration route was interrupted. The Chinese sturgeons formed new spawning sites downstream from the dam. However the area was limited. The migration routes are illustrated in Figure 6.4-2.



**Figure 6.4-2 Migrate routes for Chinese Sturgeon in Yangtze River**

The project is located on the passage of Chinese sturgeons' migration from the mid-and lower reaches of the Yangtze River to the stable spawning site downstream from Gezhouba Dam, and the fries' migration passage into sea.

According to the ultrasonic tracking survey conducted by the Yangtze River Fisheries Research Institute in recent years, Chinese sturgeons in the Yangtze River inhabit the area along the river channel and migrate along it, which matches the record made in the 1970s. Based on the direction of this segment's channel and adult sturgeons' habits, it is estimated that adult sturgeons are used to passing through the left bank of the segment (where the project is located). Therefore, the construction noise of the project is estimated to have some impacts on the adult sturgeons' migration.

The fries and juveniles of Chinese sturgeons may either migrate with the mainstream of the river channel or swim along the two sides of the channel due to the impacts of current. There may be only a few fries migrating along the segment where this project is located, or passing through the space between the foundations of wharves. The project is estimated to have little impacts on the migration of the fries and juveniles.

In addition, Chinese sturgeons tend to migrate against the current in the mid-and lower reaches of the Yangtze River to the spawning site downstream from Gezhouba Dam 1-3 days before spawning. Before and after spawning, only a few parent sturgeons stay at the spawning site while most inhabit the segment between Yanzhiba and Gulaobei.

As the proposed wharf of this project is located downstream from this segment, construction of the wharf is estimated to have little impacts on the temporary habitat of parent sturgeons.

(3) Analysis of impacts on the spawning of other major fish species

i. Chinese high-fin banded sharks (*Myxocyprinus asiaticus*)

The spawning sites of Chinese high-fin banded sharks are generally concentrated in the upper reaches of the Yangtze River. Before Gezhouba Dam was built, no spawning sites had been found in the mid-and lower reaches of the Yangtze River. Since construction of Gezhouba Dam began, the Chinese high-fin banded sharks living downstream from the dam have developed their own spawning sites in some segments of the river. According to the survey conducted between 1985 and 1992, the spawning sites of Chinese high-fin banded sharks living downstream from Gezhouba Dam are generally concentrated in the segments between the Yangtze River hub and Xiaozhayan, Yanzhiba and Huyatan, and Honghuatao and Houjiangtuo. The largest spawning site that is also the closest to the project is located about 8 km upstream from the project. Parent *myxocyprinus asiaticus* migrate to the segment downstream from Gezhouba Dam during late autumn and early winter. They generally inhabit the deep water of the river. When spring arrives, they grow mature and begin spawning in the river bottom's segment where the flow regime is disrupted by gravels or reefs.

No spawning sites of Chinese high-fin banded sharks have been found in the Yangtze River's segment where the project is located. The spawning site closest to the project segment is located about 8km upstream from the project. Therefore, the project is estimated to have some impacts on one or two spawning sites.

ii. Impacts on Chinese paddlefish (*Psephurus gladius*) and Dabry's sturgeon (*Acipenser dabryanus*)

At present, there is a very small number of Chinese paddlefish and Dabry's sturgeons in the Yangtze River. Chinese paddlefish generally inhabit the mainstream of the Yangtze River. Dabry's sturgeons generally inhabit the upper reaches of the Yangtze River and Jinsha River, which fall within Yichang Chinese Sturgeon Natural Reserve. Since 1995, no case of catching adult/juvenile Chinese paddlefish or Dabry's sturgeons has been recorded or reported. Only one adult Chinese paddlefish was found in Nanjing's Yangtze River segment in 2002. As adult Chinese paddlefish and Dabry's sturgeons generally inhabit big rivers and they are good swimmers, they tend to be more adaptable to changes of water quality and more capable of dodging vessels. There are a small number of adult Chinese paddlefish and Dabry's sturgeons inhabiting the natural reserve. Therefore, the area affected by the project is relatively limited and thus the negative impacts on the fish's habitat and living are insignificant. There has been no direct evidence proving if Chinese paddlefish and Dabry's sturgeons can spawn in the segment downstream from Gezhouba Dam. There are spawning sites of Chinese paddlefish and Dabry's sturgeons in the upper reaches of the Yangtze River, where the fish spawn in March and April. Thereafter, their fries and juveniles flow with water and the chance is not high for them to pass through two great dams and reach Yichang.

Therefore, this project has no obvious impacts on Chinese paddlefish and Dabry's sturgeons in the natural reserve.

### iii. Impact on finless porpoise (*Neophocaena phocaenoides*)

Yangtze finless porpoise generally inhabits the area where saline water meets fresh water and the lower reaches of rivers. In the Yangtze River, they generally inhabit the lower reaches, concentrating in Tongting Lake, Poyang Lake, and the mainstream of the Yangtze River.

The challenge facing Yangtze finless porpoise comes primarily from the impacts of human activities. The noise and propellers of vessels traveling back and forth frequently pose the worst challenge to finless porpoise. The widely use of unlawful fishing gears and the construction of water conservancy facilities will disrupt their habitats. As some of the wharves in this project are built with high piles, their water area is limited. Moreover, only a few vessels berth at the wharves and the wastewater produced by this project has been properly treated, so the project's impacts on Yangtze finless porpoise are insignificant.

The project has minor impacts on the natural reserve and its aquatic organisms. However, construction of wharves in this project covers some water area in the natural reserve, which will increase the number of vessels passing through the natural reserve and relevant human activities. As a result, emergencies may occur. Therefore, the project's long-term impacts on the natural reserve and its aquatic organisms should not be ignored(See chapter 8 for details).

## **6.5 Solid waste pollution**

### **6.5.1 Analysis of solid waste pollution from vessels**

Domestic solid waste from the docking vessels in the port is about 75tons per year. Solid waste from vessels includes seafarers' domestic garbage and maintenance waste. Domestic solid waste comes primarily from food residue, chemicals used for cleaning, and used packing bags, bottles and jars. Maintenance waste comes primarily from garbage on deck, used gauze, paint slag, and used tools. Vessels are forbidden to discharge solid waste into inland waters. Solid waste from the vessels arriving in port must be sealed or packed in buckets, collected and then transported to land for treatment. Waste from the vessels coming from epidemic areas or overseas must be quarantined; in case of any epidemic disease, the vessels must be disinfected. By taking the above measures, we can minimize the negative impacts of vessels' solid waste to the port area, ecological environment, and society.

### **6.5.2 Analysis of impacts from solid waste on land**

There are 506 full-time workers and about 1,500 other staff working in the port area. They produce 662 tons of domestic solid waste per year and 200 tons of production waste a year. The waste includes staff's domestic solid waste and production waste. Domestic garbage comes primarily from food residue, chemicals for cleaning, and used package bags, bottles, and jars. If solid waste on land fails to be cleared up in a timely manner, it will decay and stink, largely increasing bacteria, mosquitoes, and flies, and causing infectious diseases to spread locally. The stink caused by domestic garbage will disrupt the lives of local residents. By ways of timely collection and transfer, the impacts of solid waste will be effectively controlled. The package bag, residual materials generated during operation shall be collected and recycled.

Therefore, the domestic waste and production waste during operation can be disposed timely and effectively. The impacts of solid waste in the project are minor.

### **6.5.3 Analysis of hazardous waste impacts**

Hazardous wastes, such as cutting oil and the cotton yarn and rag used for cleaning up the machines and equipment that have oil leakage, is produced 4tons a year during the project's operation period. These wastes should be collected and then treated by the local hazardous waste treatment plant in Yichang.

WB has specified measures on the management of hazardous wastes, such as:

Separate the hazardous waste, materials and non-hazardous materials; If not in use, shut off the valves and control the removal of materials and wastes; Put proper labels on the containers of wastes to specify the materials and record the stored spots in the tracking system; Transfer or pour only one kind of material each time;

As long as WB guidelines and domestic management requirements are followed and the treatment measures are in effectiveness, the solid wastes will have no adverse impacts on the surrounding environment of the wharf area.

## **6.6 Analysis of induced impacts**

Induced impact refers to indirect impact generated from the project implementation; this section carries out analysis on induced impact as follows:

### **6.6.1 Impacts on regional port integration**

At present, the Yichang Yangtze River section is already overdeveloped. Besides, the Chinese sturgeon protection area is exactly where Yichang downtown is located. The existence of a lot of ports is unfavorable to the protection of Chinese sturgeon. In order to change the aforesaid situation and based on the master plan of Yichang Navigation Hub of the Yichang Municipal Government, it is required that the wharves in urban area are consolidated and high-standard wharves are built outside the urban area, one of which is the Baiyang Port. There is no explicit schedule regarding the shutdown of the urban area wharves, so it is difficult to assess its impacts. However, for controlling the sand wharves and illegal sand excavation, the Yichang Municipal Government developed *Yichang Work Plan for Governing Illegal Sand Excavation and Sand Wharf along Yangtze River's Main Stream and Branch*. In some areas, the implementation of this plan has already commenced, as illustrated in Figure 6.6-1. The abovementioned plan is not completely induced by Baiyang Port, but the port will replace some functions of sand transportation wharf in part and may have indirect impacts, both negatively and positively.

#### **(1) Positive impacts**

Excessive sand excavation is usually accompanied with the following hazards: riverbed is excavated, which is easy to cause river bank collapse and impair bridge safety; cause river way blockage and affect safety for flood drainage; severely damage ecological environment in the river and cause devastating blow on the organisms in the river; change the original hydrological environment of the river, damage navigation channel and pose severe threats to the shipping safety; severely affect water quality and pose severe threats to the drinking water safety

for neighboring residents; directly cause water and soil loss leading to arable land erosion and severe damage of land resources.

By fixing the excessive and disorderly sand excavation and integrating resources at wharf to avoid and reduce the above mentioned negative impacts, the rate of resources utilization can be increased to avoid excessive development and protect the ecological shore. Fixing regional wharves is also favorable to flood prevention, shipping, reduction of water and soil loss, protection of ecological system of water and land area. The shores of these small wharves will be restored to original condition, trees and grass will be planted and the concrete revetment will be restored to ecological revetment. These measures are favorable to ecological restoration and of great significance to protecting water quality of Yangtze River, the ecological system of Yangtze River and the main fishes under protection.

## (2) Negative impacts

The main negative impacts generated from banning the sand wharf is social impacts, namely, the impact on the livelihood of the workers associated with sand excavation. Meanwhile, impacts may also be caused to the production of the enterprises relying on small wharves in short period. Therefore, Yichang Municipal Government must develop policies for the re-employment and diversion of corresponding personnel in time before shutting down the enterprises, to reduce the social impacts and potential hazards of social instability.

### **6.6.2 Change of land use and urbanization**

The project will change the existing condition of the land use by transforming the original agricultural land into urban construction land, which is helpful for regional urbanization and promotion of urbanization process. Urbanization is favorable for transferring spare labor force and for farmers to get rid of poverty and become better-off. The essence of urbanization is to transform farmers into citizens. As more and more farmers migrate into the city, stable employment in non-agricultural sectors will be realized.

### **6.6.3 Improve living environment**

The implementation of the project will enable further development of local infrastructures. The public service facility system will be further improved. The domestic wastewater and solid waste from local residents will be collected and disposed in a centralized way. It will become more convenient for travel. All of these will be helpful to improving their living environment and increase the living quality.



Existing excessive and disorder wharves



Figure 6.6-1: Demolition of excessive and disorder sand wharves by Dianjun District in 2016



## 7 Environmental Risks Analysis

In accordance with *Notice concerning Risk Evaluation over Hidden Dangers of Major Environmental Pollution Accidents* ((90) H.G.Zi No. 057) of National Environmental Protection Administration, *Notice concerning Strengthening Management over Environmental Impact Evaluation and Preventing Environmental Risks* (H.F.[2005] No. 152), *Technical Guidelines for Environmental Impact Assessment of Construction Projects* (HJ/T169-2004), and *Identification of Major Hazards Installations* (GB18218-2000), as well as the WB requirements concerned and health & safety guides, we evaluate the environmental and safety risks, understand the acceptability of environmental risks, put forward the emergency measures and contingency plans and provide information and basis for project design and environment management, so as to reduce hazards and pollutions.

### 7.1 Identification of main risks

In accordance with relevant national policies, the construction unit has prepared a *Report on Safety Pre-evaluation for WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project* (“Safety Evaluation” for short) in September of 2015. The report was completed in February of 2016. According to the report, risks can be divided into risks of construction period and risks of operation period.

#### 7.1.1 Risks during construction period

Construction period risks mainly include risks in the prefabrication and installation of components, cast-in-place of concrete, foundation treatment, surface construction, the installation of balustrade, railway ancillary facilities, power equipment, and other equipment, as well as water terminal operation.

**Table 7.1-1 Analysis of risks during construction period**

No.	Operation activities	Main potential hazards
1	Marine piling	Crane accidents, injuries caused by mechanical equipment, drowning, falling from a height, object strikes
2	Erecting and dismantling scaffolds	Collapse, falling, object strikes
3	Template engineering	Collapse, falling, object strikes
4	Temporary electricity use on the construction site	Electric shock, fire
5	Water terminal operation	Drowning, falling
6	Construction of superstructure of pile foundation	Falling, object strikes, crane accidents
7	Cast-in-place of concrete	Injuries caused by mechanical equipment
8	Transport of equipment and materials	Injuries caused by vehicles

No.	Operation activities	Main potential hazards
9	Gas cutting and gas welding	Electric shock, fire, and explosion
10	Operation of other machines and equipment	Injuries caused by mechanical equipment

### 7.1.2 Operation period risks

According to the information obtained from Yichang Maritime Management Bureau and other relevant departments, accidents in the port area are primarily associated with vessels or wharves.

Most commonly vessel-related accidents are oil leakage caused by stranding or shipwreck. Water level of the Yangtze River has long been maintained at 3m deep. However, as vessels become increasingly larger and larger in recent years, they absorb deeper and deeper water. Although maritime authorities forbid full load for a vessel, stranding still occur now and then. Fire accidents are also common. They are generally caused by circuit aging aboard a vessel, by absence of fire retardant materials, or by the use of substandard engine oil.

Accidents associated with wharf operation include capsizing, sinking, injuries, falling overboard, fire, and explosion. Fire and explosion are generally caused by the use of unqualified oil products.

## 7.2 Analysis of construction period risks

Construction may cause injuries to construction workers, which is the main risk involved during construction.

### (1) Erecting and dismantling scaffolds

Erecting and dismantling scaffolds may lead to such accidents as collapse, falling, or object strikes for the following reasons:

- 1) There is absence of a specialized construction plan or proper protection measures; when erecting and dismantling scaffolds, workers work under improper directions or fail to strictly follow the relevant plan.
- 2) Operators have no relevant certificates when doing the job.
- 3) When erecting and dismantling scaffolds, workers fail to fasten their safety belts or fail to use protection supplies as required.
- 4) Relevant workers have a poor awareness of safety. They fail to follow the relevant rules when erecting and dismantling scaffolds.
- 5) Workers throw away structural segments when erecting and dismantling scaffolds.
- 6) The rigidity and stability of scaffold components fail to meet the design requirements, or load-bearing components are defective.
- 7) No guardrail, toe board, or safety net is set up on the construction site.
- 8) Irrelevant people enter the construction site.

### (2) Operation of floating cranes and mobile cranes

Operation of floating cranes and mobile cranes tend to beget crane accidents for the following reasons:

- 1) The tower crane installation team has no qualifications for the installation. The team members do not receive any safety and technical training. After installation, the tower crane is not inspected by competent authorities.
- 2) The mobile crane base fails to meet the requirement, or sling load fails to meet the requirements.
- 3) River flow changes (e.g. rate of flow changes abruptly) when floating cranes are in operation; level-luffing cranes or compensation pulley blocks fail; lifting/hoisting is unstable; slings or booms are defective; the sling base is unstable or the sling loses balance when heavy cargoes are hoisted or loaded.
- 4) A crane is not dismantled in accordance with standard operation procedures
- 5) A crane's hooks, brakes, stroke limiters, limit switch, and interlock protection device are defective; hoisting is improperly inspected; and electrical equipment is defective. All these may cause extrusion, falling (of slings), object strikes, electric shock, and other accidents.

### **(3) Temporary electricity use on the construction site**

Electric shock is a common accident on the construction site. Various electrical equipment are used during construction, yet electric wires on the construction site are installed for temporary use, thus electric cables and wires tend to be tangled up. Some distribution boxes, switch gears, and wires are exposed to inclement weather and vandalism. In this case, electric shock tends to occur easily. "TN-S system" and "protection of one switch of one machine" must be implemented for electricity utilization on the construction site. Messy wires must be avoided; wires in distribution boxes must be marked for different circuits. The causes of electric shock are the same as those in operation period.

### **(4) Gas cutting/gas welding**

Fire may be caused by a short circuit and an electrical circuit overload during welding; if there are inflammables and explosives nearby during welding, the flying sparks and spatter may beget fire and explosion. Fire, explosion, and the flying sparks may also injure or kill people in the vicinity. Moreover, the arc light and toxic smog that are produced during welding may beget radiation, pneumoconiosis, intoxication, and other occupational hazards. Materials tend to be piled up high on the construction site, so any match or cigarette butt randomly thrown away by construction workers who have poor awareness of fire prevention may cause fire.

### **(5) Other operations and considerations**

Substandard support materials, improperly installed or disassembled support materials that cause form boards to keel over, or unreliable operating platforms constitute main hazards of formwork. Main hazards involved in construction of the pile's superstructure may arise in the following cases: workers do not use protection supplies, guardrails or safety nets are not set up on the construction site,

construction workers work in inclement weather, systems of work involve workers crossing, or materials or tools falling. Main hazards in water terminal operation may arise in the following cases: workers do not wear life jackets, the construction site is insufficiently illuminated during night work, or workers do not wear protection suits.

Workers may fall and get injured or even die in the following cases: working at height (openings, scaffolds, etc) is entailed in construction, no safety net is installed, or workers do not fasten their safety belts.

During over-water construction, workers may accidentally fall in the water, which may cause drowning, especially during flood season. Construction of bored piles cast in situ may form holes. If the pile fails to be promptly cast in situ or safety precautions are not taken to prevent the exposure of the wellhead, construction workers may accidentally fall into the well and drown.

Project construction entails diesel oil, engine oil, lubricating oil, and other combustible materials. If the construction site is not properly managed, naked flame may cause fire or even intoxication or suffocation in some extreme cases. The gasholders, oxygen cylinders, and acetylene cylinders entailed in construction may cause explosion, if they are not placed in safe distance from each other or if their use is not properly managed.

Large supports, tower cranes, and other structures need to be erected for construction. These temporary structures may take a long time to be erect, heavily loaded and high, so they tend to be unsafe. Special attention should be paid to them. Substandard construction materials, improper construction technology, and shoddy construction may pose dangers to construction and cause huge losses.

If the temporary accommodation for construction workers is built in a low-lying area, it may be submerged or destroyed by heavy rainfall.

Safety signs play an important role in reminding people of being mindful of potential risks and in preventing accidents. The proposed project's construction process entails multiple steps. If there are no safety signs, or are not accurate or standard, casualties may occur as a result. In addition, it should be noted that during construction, a lot of dust may be produced when powdery material is loaded, unloaded, and transported or when asphalt is being stirred and used for paving a road. Drill rigs, concrete mixers, rollers, and other construction machinery may produce noise; rock drills and boring machines tend to cause vibration.

Risks in project construction and operation primarily come from oil leakage. When construction vessels operate in the project area, oil may be spilled or leaked due to incorrect operation, operation against the rules, or negligence in managing the operation. The impact of these oil leakage accidents can be small, but they may still contaminate water.

### **7.3 Analysis of operation period risks**

The wharf operation for this project does not involve the storage and transport of dangerous goods. Currently, the way in which break bulk cargo are loaded and unloaded can ensure that cargo will be less likely to fall in the water. In addition, the area between the wharf and the river bank is equipped with safety nets in proper size so as to prevent cargo and workers from falling into the water. Therefore, risks in wharf operation generally come from the oil leakage caused by collision, fire and explosion caused by oil products, exposure of bulk cargo when they are being loaded and unloaded, and shipping.

This coincides with the survey results on Yichang Navigation Hubs discussed in previous sections that the most common accidents are the oil leakages caused by ships grounding (stranding) and ships collisions, followed by fire accidents caused by aged electric circuits, lack of flame resistance material in ships decoration and usage of subgrade oil product, etc. The common accidents in port operation include ship overturn, personal injury and drowning, fire and explosion, etc.

These accidents all could lead to oil leakage and spill as a result. The concentration threshold of toxicity caused by oil to aquatic organisms is low in general, so any oil leakage during operation period may cause fish in the contaminated water to suffer acute toxicity and mutagenicity. It may also cause phytoplankton and zooplankton to suffer toxicity, or even cause some fish, aquatic plants and animals to die of toxicity. Therefore, oil leakage is the worst water pollution, thus it is the focus of the analysis of operation period risks.

#### **7.3.1 Analysis of oil leakage accident**

According to relevant statistics of serious oil leakage accidents abroad, there is a certain probability of abrupt occurrence of oil leakage accidents. Affected by objective conditions and uncertainties, no methods of calculation are effective for analyzing the probability of risks involved in a project. Instead, relevant statistics are used in general to analyze the probability of risks.

According to the statistics over vessel accidents in Hubei and Chongqing section of the Yangtze River, the accident probability of incoming and outgoing ships was  $3.6 \times 10^{-4}$ . The number of times for ships entering and leaving the port for this project is 2,500 a year, then the accident probability of this project is 0.9 accidents/year. Of the accident probability, the oil leakage accidents account for 25%, which means the probability of oil leakage accidents is 0.23 accidents/year.

In accordance with the survey data of the Ministry of Transport of the People's Republic of China on total tonnage and oil fuel tank of cargo ships, the total fuel volume of 2910-ton Haizhou oil fuel tank is  $210 \text{ m}^3$ , the number of oil fuel tanks is 3 and the fuel volume of the biggest oil fuel tank is  $106 \text{ m}^3$ . Assuming that ships collide with each other when approaching to and berthing at this wharf or loading and unloading at the wharf and an oil fuel tank is broken, causing leakage of diesel into the Yangtze River, then the maximum quantity of diesel which flow into the Yangtze River is about 90t per accident. This analysis on the intensity of oil leakage risks is based on the aforesaid data.

### 7.3.1.1 Prediction of oil leakage at the wharf

#### (1) Prediction methods

This assessment uses Fay oil-bound film extension equation to predict the risks of pollution caused by oil leakage accidents.

Fay oil-bound film extension equation is widely used at present and it includes three stages:

- ① At the stage of inertial extension, the diameter of oil-bound film is

$$D = K_1(\beta g V)^{1/4} t^{1/2}$$

- ② At the stage of viscous extension

$$D = K_2 \left( \frac{\beta g V^2}{\gamma_w^{1/2}} \right)^{1/6} t^{1/4}$$

- ③ At the stage of extension of surface tension

$$D = K_3 \left( \frac{\delta}{\rho_w \gamma_w^{1/2}} \right)^{1/2} t^{3/4}$$

- ④ After extension, the diameter of oil-bound film remains unchanged

$$D = 356.8V^{3/8}$$

In the formula:

$D$  --diameter of oil-bound film(m)

$g$  --acceleration of gravity( $m/s^2$ )

$V$  -- total volume of overflow

$t$  --time (calculating from the beginning of overflow)

$\gamma_w$ —coefficient of kinematic viscosity of water( $m^2/s$ ) ; Table 7.4-1 shows the relationship between water's viscosity coefficient and temperature

**Table 7.3-1 Relationship between viscosity coefficient of water and temperature**

Temperature °C	0	5	10	15	20	30	40	60	80
Viscosity $10^{-6}m^2/s$	1.79 2	1.52 0	1.307	1.139	1.1004	0.801	0.658	0.475	0.365

$$\beta = 1 - \frac{\rho_o}{\rho_w}; \quad \rho_o, \rho_w \text{ are oil density and water density respectively}$$

$\delta = \delta_{aw} - \delta_{oa} - \delta_{ow}$ ,  $\delta_{aw}$ ,  $\delta_{oa}$ ,  $\delta_{ow}$  are coefficient of surface tension between air and water, coefficient of surface tension between oil (liquid) and air, and coefficient of surface tension between oil (liquid) and water (N/m) respectively

$\delta_{aw}$  is the coefficient of surface tension between air and water (below 20°C,  $72.75 \times 10^{-3} \text{N/m}$ )

$\delta_{oa}$  is the coefficient of surface tension between oil (liquid) and air (below 20°C,  $25.0 \times 10^{-3} \text{N/m}$ ),

$\delta_{ow}$  is the coefficient of surface tension between oil (liquid) and water (below 20°C,  $1.8 \times 10^{-2} \text{N/m}$ );

$K_1$ ,  $K_2$ ,  $K_3$  --empirical coefficients at different extension stages; in general,  $K_1 = 2.28$ ,  $K_2 = 2.90$ ,  $K_3 = 3.2$ .

The dividing point of time of the above stages can be determined based on the condition that the extension diameter of two adjacent stages is equal.

In reality, oil-bound film extension increases the area of oil film and reduces its thickness. When the film thickness is thicker than the critical thickness (namely the thickness when the film diameter remains unchanged after ending of extension), the film remains as a whole; when the film thickness equals to or is thinner than the critical thickness, the film begins to split into pieces and continues to diffuse.

### (3) Method of calculating drift of spilled oil

Diesel rapidly extends and forms into film after entering water and drifts under influences of current and wind generated current. Meanwhile, equivalent round film generated from diffusion of spilled oil is also continuing to extend. Hence, the pollution range of spilled oil is the continuously extending and drifting equivalent round film. If initial position of film center is set as  $S_0$ , its position  $S$  after  $\Delta t$  (time) is calculated through the following formula:

$$S = S_0 + \int_{t_0}^{t_0 + \Delta t} V_0 dt$$

In the formula, drifting speed of film center is  $V_0$  which can be obtained through the following formula:

$$\vec{V}_0 = \vec{V}_{\text{风}} + \vec{V}_{\text{流}}$$

$$\vec{V}_{\text{风}} = U_{10} \bullet K$$

$U_{10}$  --wind speed at the height of 10m

$K$  --3.5% wind factor which is 3.5%

In case of a leakage accident, wind direction has a big influence over the movement of water-immiscible contaminants floating on the surface of water. In case of onshore wind, the leakage accident has influence on the creatures living on the shore; in case of offshore wind, then the impact on onshore sensitive targets is smaller.

#### (4) Prerequisites for prediction

Oil leakage form is taken into consideration by viewing it as a sudden instantaneous point source. In accordance with distribution of water intakes of the sections to be assessed and actual average annual wind speed, this assessment only provides the calculation of oil-bound film drift in high flow period (current speed is about 2.0m/s) and under the circumstance of most unfavorable wind direction (wind speed is 1.9m/s). Specifically, including: the quantity of oil that enters the Yangtze River is 90t, the average wind speed is 1.9m/s, current speed takes the inshore current speed in high flow period which is 2.0m/s and the drifting speed of oil-bound film is 2.067m/s (parallel to the current direction).

#### 7.3.1.2 Prediction results and analysis

##### (1) Prediction results

Table 7.3-2 shows the drift and diffusion of oil-bound film at the time of oil leakage accidents and Table 7.3-3 shows the extension characteristic value of contaminants.

**Table 7.3-2 Prediction Results of 90t Spilled Diesel Extension to the Current Flowing Direction**

No.	Time (S)	Diameter	Area (m <sup>2</sup> )	Thickness (mm)	Distance (m)
1	60	63.593	3176.2	33.7	124.0
2	120	89.935	6352.5	16.87	248.0
3	180	110.147	9528.7	11.24	372.0
4	240	127.187	12704.9	8.43	496.0
5	300	142.199	15881.2	6.75	620.0
6	360	155.771	19057.4	5.62	743.9
7	420	168.252	22233.7	4.82	867.9
8	480	179.869	25409.9	4.22	991.9
9	600	201.100	31762.4	3.37	1239.9
10	720	220.294	38114.8	2.81	1487.9
11	840	237.944	44467.3	2.41	1735.9
12	900	246.296	47643.5	2.25	1859.9
13	1036	264.250	54843.0	1.95	2140.9
14	1200	274.152	59030.1	1.82	2479.8

No.	Time (S)	Diameter	Area (m <sup>2</sup> )	Thickness (mm)	Distance (m)
15	1800	303.399	72296.9	1.48	3719.7
16	1840	305.071	73095.7	1.47	3802.4
17	3000	344.728	93334.8	1.15	6199.5
18	3600	360.805	102243.2	1.05	7439.4
19	4200	374.981	110435.3	0.97	8679.3
20	4800	387.710	118060.3	0.91	9919.2
21	5400	399.296	125221.8	0.86	11159.1
22	6000	409.953	131995.4	0.81	12399.0
23	6600	419.839	138437.9	0.77	13638.9
24	7200	429.072	144593.7	0.74	14878.8
25	7534	433.963	147909.5	0.72	15569.0
26	8400	470.8503	174122.7	0.62	17358.6
27	18000	833.9264	546192.0	0.20	37197.0
28	24000	1034.741	840917.6	0.13	49596.0
29	30000	1223.247	1175218.0	0.09	61995.0
30	33000	1313.889	1355837.0	0.08	68194.5
31	36000	1402.491	1544864.2	0.07	74394.0
32	39000	1489.264	1741941.1	0.06	80593.5
33	42000	1574.383	1946751.4	0.06	86793.0

Note: \*The drift distance of front edge of oil-bound film

**Table7.3-3Extension Characteristic Value of 90t Spilled diesel**

Characteristic value	Contaminants	Crude oil
Inertial extension stage(s)		0~1036
Viscous extension stage(s)		1036~7534
Stage of extension of surface tension(s)		7534~60061
Radius of 10-minute equivalent circle(m)		100.6
10-minute thickness(mm)		3.4
Critical thickness(mm)		1.95
Critical thickness(mm)		0.72

## (2) Analysis of prediction results

When oil leakage accident takes place under the conditions that the wind speed is 1.9m/s and the current speed is 2.0m/s, the oil-bound film will drift to the water area of intake of Lucheng No. 2 Water Plant which is located in downstream of the wharf and is about 1.8km away from the wharf in about 15 minutes upon occurrence of accident. At this time, the diameter of oil-bound film is 246.3m and the area is 47643.5m<sup>2</sup>.

The oil-bound film will drift to the water area of intake of Tianjiahe Water Plant which is located in downstream of the wharf and is about 3.8km away from the wharf in about 31 minutes upon occurrence of accident. At this time, the diameter of

oil-bound film is 305.1m and the area is 73095.7m<sup>2</sup>.

Since the intakes of water plants which are located in downstream of the wharf are established 1.5m under the water, oil-bound film drifting to the water area of these intakes will not be directly sucked when those water plants take water but water quality of these water areas will be affected.

In order to protect the water quality of the Yangtze River, strict environmental management must be implemented to avoid occurrence of this type of accidents. Meanwhile, we must set up relevant rules and regulations, improve the equipment, enhance the quality of personnel, formulate contingency plans and take appropriate oil leakage control measures to control the pollution caused by oil leakage accidents. Once accidents take place at the wharf, contingency plan must be immediately implemented and emergency measures must be taken to reduce impacts of oil leakage accidents on the environment.

The main risk associated with this project is leakage from ships. Hence, risk assessment of this project is different from that of production, use, storage and transportation of poisonous and harmful substances and explosive and inflammable substances. Combining with the prediction on freight amount of this project, the risk source is the oil leakage due to collision of ships which has small occurrence probability and basically no fatal accident will be caused thereby. When oil leakage accident happens, the time for oil-bound film to arrive at the nearest intake is about 15 minutes and the time for it to arrive at the planned nearest intake is about 30 minutes. Given that this project is equipped with sufficient emergency equipment, contingency plan can be launched in a shorter period upon occurrence of accidents to effectively intercept the drifting oil-bound film before it arrive at the intakes and effectively control the pollution to the Yangtze River. Therefore, maximum credible value at risk of disasters and accidents of this project,  $R_{max}$ , is smaller than the risk acceptability,  $R_I$ . Hence, the risk of construction of this project is acceptable.

### **7.3.2 Loading and unloading risk analysis**

The following accidents may take place based on the project Safety Assessment and investigation and interview with relevant departments. And corresponding risks are also analyzed.

#### **(1) Crane accidents**

The hoisting machinery used in the warehouse area, processing zone, and storage yard in the logistics park includes bridge cranes, wheel cranes, and electric single-girder cranes. Causes of crane accidents are as follows:

- 1) Hooks crack or break; wire ropes break or deform by extrusion; plugs' wire ropes loosen; out-of-service slings are used; routine inspection is conducted carelessly; the load is not tightly packaged or it is imbalanced during the hoisting; the load and slings tend to fall, which may damage the equipment and cause casualties.
- 2) Brakes are unreliable, worn-out parts are excessively used, braking torque falls short of relevant standard; space between brake pads is not inconsistent with the space between brake wheels; the pins of brakes do not move smoothly; there are defects such as backsliding, seizing up, and rusting.

- 3) Stroke limiters, limit switch, and interlock protection device have defects; emergency switch, buffer, and end stop, as well as overload limiter and anti-collision device do not work.
- 4) Shields, covers, guardrails, and fenders are substandard.
- 5) Crane maintenance personnel accidentally fall from it or are hit by the running crane and fall.
- 6) The electrical equipment with which a crane is equipped has defects; electrical circuits lack power-system protection; a crane is operated improperly. All these may cause electric shock and fire.
- 7) Workers who operate hoisting machinery have no qualification certificate for operating special equipment; hoisting machinery operators do not properly wear helmets.
- 8) Hoisting machinery lacks proper management, for example, hoisting machinery has not been checked or tested on a regular basis; or prompt rectification fails when a hidden danger is identified.

## **(2) Injuries caused by vehicles**

Forklifts are used in the logistics park to load, unload, and stockpile cargo. Automobiles can enter the warehouse area to load and unload cargo, thus vehicles tend to cause injuries.

- 1) When the speed of a vehicle exceeds the speed limit, especially when a vehicle fails to slow down or its brake fails at a turn of a road, the vehicle may injure the pedestrians at the turn or a crossroad.
- 2) If operators are absent-minded or are not mindful of the surroundings when transporting cargo from one place to another in the warehouse area, or if they do not pay attention to the abnormality behind their vehicles when they backing vehicles, injuries may occur.
- 3) Roads in workshops or public roads that are stained by oil may be slippery, causing vehicles to hit pedestrians or other machines/equipment.
- 4) Forklifts are special equipment. If a forklift lacks a complete set of safety devices that work (such as steering gear, brake, signal, horn, illumination, etc.), if a forklift has not been regularly inspected and tested, or if a forklift is not repaired right after a failure is identified, the forklift may injure people.
- 5) Forklift operators are special equipment operators and are supervised by quality watchdogs. If an operator overloads the forklift or use the forklift to carry people, the forklift may injure people.
- 6) For the forklift that is powered by diesel oil, its oil leakage may cause fire or explosion because diesel oil is combustible
- 7) When an electric forklift is being charged with electricity, hydrogen (combustible gas) may be produced. If hydrogen meets naked flame or spark, it will cause explosion.

## **(3) Fire**

The stockpiled cargo in the logistics park area excludes inflammables and explosives, but include liquor (wine, its flash point is over 70°C; low concentration liquor, the volume of alcohol accounts for less than 24% of the liquor's total volume), and rice bran oil (its flash point is over 300°C). The fire risks of the stored cargo fall under Category C, which means the cargo is combustible when they meet naked

flame or high temperature.

Attention should also be paid to electrical fire. Electrical fire can be caused by aging electrical facilities/equipment in structures, poor installation of equipment, short circuit, or other failures. If structures are not equipped with fire extinguishers and if fire is not put out promptly right after it occurs, it may cause huge economic losses.

#### **(4) Object strikes**

Cargo may hit people when they are transported, loaded, and unloaded. If the cargo in the storage yard or warehouses is improperly placed, they may move due to the effects of gravity or other external forces. As a result, they may hit people and cause injuries. If cargo are piled up so high that the height exceeds the standards, or if cargo are improperly placed, for example, fenders are not used when disc-shaped goods (e.g. rebar discs or coiled steel plates) are stored, the disc-shaped goods may slide or roll under the effects of gravity, thus they may hit people and cause injuries.

#### **(5) Injuries caused by mechanical equipment**

If pumps, rotatable parts of electromotor, and other mechanical equipment have defects (e.g. equipment do not have protection system, support is improper, or distance for protection is too short), and if equipment operators accidentally contact the running parts of the equipment, they may be injured. Moreover, if the “no switch on” sign is not set up as required when maintenance personnel is examining and repairing equipment, and if irrelevant people unintentionally switch on the equipment, maintenance personnel may be injured.

### **7.3.3 Navigation risk analysis**

According to *Safety Evaluation* and relevant surveys as well as interviews with relevant departments, information of the following accidents is collected and the risks involved are analyzed.

#### **(1) Collision**

After the wharf is put into operation, collision tends to occur with the effects of wind and water flow in the following cases: vessels are improperly dispatched; communication, vessel traffic monitoring and management, and navigational aids are defective; marine navigators are absent-minded or steer vessels against the rules; vessels are arriving in or leaving port against the required speed, direction, and waterway. After the proposed wharf is put into operation, a busy operations area in port will be formed, which will increase vessel traffic flow in the port area. In addition, some sub-components have yet to be completed. Within a certain period of time, construction vessels may disturb each other, so management of ship dispatch should be strengthened.

#### **(2) Analysis of risks regarding vessels docking and leaving port**

When a ship is arriving at the port, accidents such as collision, sinking, stranding, oil

leakage, damage to wharf, or even fire or explosion may occur due to the direct impacts of wind, water flow, wave, tide, and fog, as well as the direct impacts of operating a ship. The causes of those accidents are as follows:

- 1) Water area marked for berthing in port is not wide enough, and turning basin in front of the wharf is not wide enough.
- 2) Neither the berth area nor turning basin is timely dredged; water in front of the wharf is not deep enough
- 3) When a vessel is arriving in port at a fast speed, it may beget collision, or even cause spark or fire.
- 4) When wind speed exceeds Beaufort scale 6, a vessel arriving in and leaving port may beget collision, causing the wharf to collapse.
- 5) If the fender of the wharf is not timely examined and maintained, it may break down, thus a vessel arriving in or leaving port may press against the wharf and damage it.
- 6) Berthing/unearthing numbers have not been timely set, causing vessels to be mistakenly operated.
- 7) Before terminal operation begins, safety nets and gangplanks have not been set up as required, which causes people to fall in the water.
- 8) Damaged mooring ropes are not timely replaced, causing the ropes to break and ships to run out of control, or sink or hit against the wharf.

### **(3) Slope failure**

Pilling may impair slope stability from two aspects: on one hand, in pilling period, core water pressure of surrounding soil rises sharply and the effective stress of soil decreases, and on the other hand, the vibration acceleration produces an inertial force, which may cause slope instability. For example, at Xinshengwei wharf in Nanjing and Zhanghuabang wharf in Shanghai, slopes were heavily deformed in pilling process; at Digang Port in Anhui, the slope collapsed at the time of pilling and several hundreds of driven piles fell down, causing a loss of RMB 5 million; at the 200,000t oil wharf built on soft soil in Zhoushan, when constructing cleat, 13 piles were driven in one day, which was too fast that the piles had an displacement (1m), the slope slid down and the cleat fell down into water, causing a heavy loss. Lots of cases of heavily deformed or failed slopes in China show that for high-piled wharves, the construction of pile foundation may be a threat to slope stability and slope failures caused by pilling are not rare. Therefore, pilling must be considered in analysis of slope stability for high-piled wharves.

#7 berth is built on high piles with beam and slab structure. According to the geological survey report, subsurface erosion may occur and may cause slope collapse. But after carrying out protection measures such as scaling and revetment on the basis of calculations, partial factors of minimum resistance meet with related requirements to ensure slope stability.

10# and 11# berths are built with solid slope structure. During construction process, low water level, high water flow rate or incorrect construction procedures may cause local collapse and fail the slope.

## **7.4 Risk management and emergency response**

All construction projects have the risks of accidents. Thus the construction unit shall follow the management requirements for major risk sources to strengthen risk management, implement risk mitigation measures carefully, and adopt appropriate technical methods to minimize their probabilities. The principle to be followed in risk management is "*prevention first and integrated prevention & control*". Once an accident occurs, the emergency plan shall be initiated immediately to effectively control the trends of the accident. All kinds of risk prevention measures and emergency plans are described in Chapter 11. Project construction can be performed from the perspective of environmental risk on the condition of having implemented prevention measures and emergency plan for risk of accidents.

# 8 Cumulative Impact Assessment

## 8.1 Background and methodology

### 8.1.1 Introduction

In a statement issued by the US Council on Environmental Quality (USCEQ) titled as considering cumulative effects under the *National Environmental Policy Act* (NEPA) in 1978, the cumulative impact is defined as follows: “*the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.*”

*Technical Guidelines for Plan Environmental Impact Assessment* (HJ 130-2014) defines cumulative impact as follows: cumulative impact refers to superposition, combined and synergic effect of the assessed planning and the planning related development activities on resources and environment in the planned period and certain range.

The WB/IFC Handbook also provided definition of cumulative impacts and recommended that cumulative impact assessment should better be conducted during planning stage. This project is part of Yichang navigation hub which has a master plan. The *Strategic Environment Assessment* (SEA) was conducted for this hub master plan in 2008. This chapter will set out from the original SEA and carry out *Cumulative Impact Analysis* (CIA) by updating the actual conditions and for this specific project.

### 8.1.2 Methodology

Currently, the technical guidelines for environment assessment in China require that cumulative impacts should be considered. However no detailed guidance on assessment method and assessment procedures’ has been provided. Therefore international practices (WB/IFC Handbook on CIA) have been used which has the CIA methodology of 6 steps:

- 1) Identify key VECs (valuable ecological components) and scoping;
- 2) Identify threshold of VECs taking into consideration of relevant laws and regulations, standards, and experts and public consultation;
- 3) Establish baseline of the VECs;
- 4) Qualitatively and quantitatively predict the incremental impacts from the project;
- 5) Predict accumulative impacts with past, current and future activities and compare against the thresholds of step 2 to see the differences of taking measures or not; and
- 6) Propose mitigation and management measures as appropriate.

The approach under the *Technical Guidelines for Environmental Impact Assessment of Plans* is actually similar to the 6-step method. Firstly, identify the main impact in the planned range, determine the assessment focus (namely ecological components (VEC)), determine the time range and spatial extent of assessment, collect the laws, regulations, standards and basic database related to the planning and carry out on-the-spot investigation. Secondly, analyze, predict and assess the impact of implementation of different planning scheme on resources,

environment and ecology, put forward the suggestions on optimized adjustment and offer them to the planning scheme formulation authority for them to compare, consider, select and use different planning scheme. The Guidelines brings up some assessment methods, such as, expert consultation method, matrix method and network analysis method and so on which are also similar to that in IFC handbook.

## **8.2 Assessment scope**

According to the *Master Plan of Yichang Port* and its approval document (J.G.H.F.[2009] No. 320), the scope of Yichang Navigation Port master plan is illustrated in Figure 8.2-1. The scope covers six port districts including main urban port district, Zigui port district, Xingshan port district, Zhijiang port district, Yidu port district and Changyang port district. The proposed project belongs to the main urban ports district.

*The Strategic Environmental Assessment (SEA)* for the master plan had been developed and received the clearance from the Hubei Provincial EPB on Dec. 31, 2008. This SEA provides the good basis for cumulative impacts assessment of this project. The scope of assessment includes all the land area and the water area in the master plan and the surrounding areas and sensitive areas that might be affected by the ports. The Mast Plans' duration is from 2005 to 2020 (with reference to the data of 2006 and 2007). The projection years are 2010 and 2020. The year 2020 is also the planned ending year of this project. Therefore, the scopes of assessment and timeline for the SEA of the master plan are in line with the construction plan the proposed project and the scope of this CIA. .

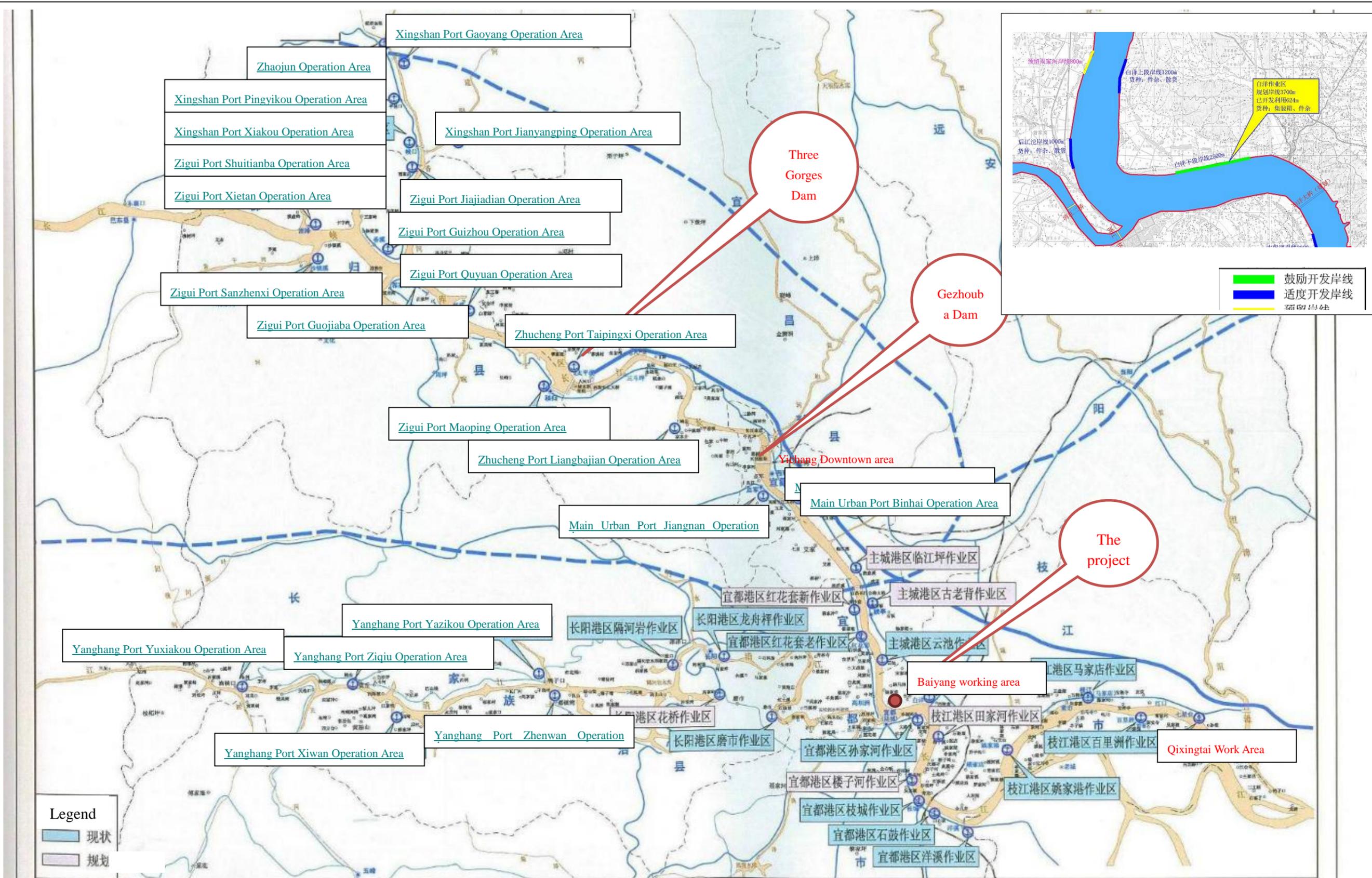


Figure 8.2-1 Scope of Yichang Navigation Hub (all blue markers along rivers indicate existing ports, all pink markers for planned ports)

### 8.3 Identification of Valued Ecological Components(VECs)

The identification of main environmental impacts and VECs within the planned scope was conducted in accordance with the WB practices and public consultation.

#### 8.3.1 Screening and identification of main environmental impact

Based on the master plan scheme, the environment of the ports, nature of goods transported and the layout of Yichang hub, the key areas of Yichang hub and main impacts are screened and shown in Table 8.3-1.

**Table 8.3-1 Screening and Identification of Main Environmental Impact**

Type	Objects to be affected	Main impacts	Key contents or areas
Resources	Shoreline resources	Implementation of port planning occupies some shoreline resources; development of portside industry and services will also indirectly stimulate the highly-intensified utilization and development of shoreline resources	The differences between the planned function of shoreline in main urban port district, Changyang port district and Zigui port district and the living, travelling and other relevant functions of city; connection of functions
	Land resources	Construction of the planned working area and development and construction of portside industry and service occupy some farmland and wet land and other land resources	Land occupation of Linjiangping, Gulaobei, New Honghuatao, Louzihe and Tianjiehe working areas included in main urban port district, Zhijiang port district and Yidu port district and portside industry
	Water resources	Implementation of the planning will directly or indirectly increase the use of water resources, which may exert greater stress over water resources supply of Yichang Municipality	Focus on the relationship between the increased water consumption and water supply in main urban port district, Maoping working area of Zigui port district, Zhijiang port district and Yidu port district
Natural environment	Ecological environment	Construction of port project has certain impact over aquatic ecosystem and changes original vegetation characteristics and landscape pattern within the land area; development of port industries indirectly influences the aquatic ecological environment through affecting water, air and sound environment; accidents happening in the port directly and indirectly affect the ecological environment	Impact of construction in Linjiangping, Gulaobei and Yunchi working areas of main urban port district as well as New Honghuatao working area of Yidu port district on Chinese sturgeon; impact of oil leakage and chemical products leakage accidents on aquatic ecological environment and human body
	Water environment	Drainage of production waste, domestic sewage and vessel sewage of the port district exert impact on water quality of the	Impact of pollutants in the port on water quality of the river; environmental risks in Maoping, Linjiangping, Shigu

Type	Objects to be affected	Main impacts	Key contents or areas
		river and could further influence the surface water and other water body; impact of accidents happening in the port on water environment	and Yunchi working areas and other areas with big throughput and high frequency of accidents on water environment; possible impact brought by passenger transportation in main urban port district and Zigui port district
	Ambient air	Impact of dust from loading and unloading, fugitive dust of storage yard and oil gas generated in daily operation of port on ambient air	Focus on environmental impact of dusts of storage yards and dusts generated in loading and unloading in areas with large quantity of works on coal and ores (Linjiangping, Shigu and Zhicheng working areas and so on)
	Sound environment	Impact of machinery noise and traffic noise on surround environment; boost of port industries to portside industry; planning of port district	Noise impact of highway for port in working areas; impact of loading and unloading noise in working areas with larger throughput and container transportation
Social and economic environment		Impact of development of port industries and relevant industries on hinterland economy, industrial structure, life of residents and development direction of cities	Boost of port industries to portside industry; promotion of implementation of port district planning to urbanization of Xingshan, Zizhui and Changyang and so on, improvement of the implementation on local transportation conditions and changes in spatial layout of Yichang

### 8.3.2 Public consultation

#### (1) Public consultation during SEA stage

During the period of the Master Plan of Yichang Port, public consultation was conducted mainly in the following three aspects: (1) consulting with management personnel of departments under YMG and other relevant governmental departments; (2) carrying out on-the-spot investigations on the public within the areas of planning and conducting investigation on the public on the website of YMG; (3) Disclosure at the YMG official website to seek public opinions.

The results suggested that among the identified impacts, water pollution is the most concerned for the public, followed by noise. Among the impacts on resources utilization, it is widely acknowledged that the impacts on shoreline resources and land resource are most significant while the impacts on tourism resources and fishery resources are less significant. Among the social impacts, the impacts on urban development and economic development are significant while the impacts on fishery and land development are less significant. Among the impacts on daily life, the impacts on living environment, traffic conditions and residential area are likely to

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be more significant.

Generally, the results of online survey were similar to that of field survey. However, the two survey results differed in the most impact local resource. Most field survey participants (47.2%) considered shoreline is the most affected resource while most online survey participants (31.0%) considered fishery the most affected resource. Only 13.9% online survey participants considered shoreline the most affected resource. 72.6% field survey participants favored the master plan while 82.1% of online survey participants favored the master plan.

#### **(1) Public consultation during CIA for this project**

To update, the EA Consultant for this project held a public workshop with Yichang Urban Construction Investment Company in December 2015. The staff from the relevant authorities including the environmental protection authority, agriculture department, planning department and water conservancy department discussed the Project accumulative effects, identified the VECs and their threshold. They do not have different opinions against the identified VECs and their thresholds of this project.

Discussions were also held via phone calls or inter-personal interview with specialists from Hubei Academy of Environmental Sciences and Yichang Institute of Environmental Sciences.

Based on the public consultations and discussions with experts, the shoreline and water quality of Yangtze River are the most concerned environmental issues. As the project area is near the Chinese Sturgeon Natural Reserve, the Chinese Sturgeon is also included. Thus the VECs identified include Chinese Sturgeon, water quality and the shoreline resource of Yangtze River.

### **8.4 Identification of VECs threshold**

The threshold of VECs refers to their ecological environment capacity, which means that the impacts of human activities should not exceed the maximum limit of the self-recovery capacity of VECs.

#### **8.4.1 Threshold for shoreline**

According to the SEA and the characteristics of the regional environment, based on the experience of the planning environment impact assessment of other ports, the safe ecological threshold of shoreline utilization is determined to be less than 10% of the overall shoreline. However, it only considers port development, ignoring all non-port but also developed shoreline. . All shorelines artificially developed into other use are not taken into account. In addition, the SEA for The master plan considered the entire surface water shoreline (including branches). But the WB project is on main stream of Yangtze River, and has little to do with other branches. The ecological upper limit of the developed shoreline resources on the main stream of Yangtze River is yet to be determined. Currently, it is generally considered that the Yichang section of Yangtze River is already overdeveloped.

#### **8.4.2 Threshold of Water quality**

The surface water functions are based on the natural quality and social attribute of

the basin or region and water area is divided by application functions or uses it has. The surface water of Yangtze River in Yichang section is defined as “centralized drinking water source level 2 protection zones and common fish protection zone”. Therefore, its water quality is required to reach surface water Grade III. The corresponding water quality indexes include COD and NH<sub>3</sub>-N; their threshold values are COD<sub>Mn</sub> ≤ 6mg/L, and NH<sub>3</sub>-N ≤ 0.5mg/L, respectively. Please refer to Table 8.4-1 in detail.

### 8.4.3 Threshold for Chinese sturgeon

According to the results of literature review and expert investigation, under an ideal state, the appropriate features for prenatal habitat of Chinese sturgeon is <sup>2</sup>: curved or forked river way, with sandbank or shoal, river section length 21.39km, deep water (water depth deeper than 19m, river way length 13.88km, with 172 river section length 21.river way and deep water area 874m and 279m, respectively; the average and the maximum water depth of thalweg 28.01m and 40.55m, respectively; and river way tortuosity ratio 2.56.

Horizontally, the ratio of the distance between the distribution points of Chinese sturgeon and the thalweg and the distance between the distribution point and the bank is 1:4.2, indicating that the Chinese sturgeon prefers to inhabit in deep water.

Meanwhile, the migration distance of the Chinese sturgeon is about 3.1m away from the river bottom.

There is no clear conclusion as to how much influence water pollution has on Chinese sturgeon; however, if the current water quality Class III can be maintained or improved, the impacts on survival of Chinese sturgeon will be reduced. The water quality of Yangtze River is also one of the important ecological elements from public participation.

To summarize, based on the analysis in Chapter 6, as long as the water quality and the hydrological condition of the migration route of Chinese sturgeon in Yangtze River are well maintained (water quality not lower than Grade III, average water depth 38m, flow rate 1.0m/s) or even improved, there will not be negative impacts on Chinese sturgeon.

Therefore, the safety threshold of Chinese sturgeon is determined as shown in Table 8.4-1.

**Table 8.4-1 Environmental Goals and Threshold Values**

<b>Elements</b>	<b>Target</b>	<b>Indicators</b>	<b>Threshold values or recommended limit</b>
Shoreline	Protection of shoreline	Planned shoreline occupation for ports	No clear understanding on the ecological threshold

<sup>2</sup>*Migrations for Reproduction of Chinese Sturgeon (Acipenser sinensis) and its Habitat Selections in the Yangtze River*, PhD thesis of Wang Chengyou, Huazhong Agricultural University

Elements	Target	Indicators	Threshold values or recommended limit
	ecological function	development in total shoreline resource (km, %)	value yet. More study is needed.
Yangtze River water quality	Protection of water quality	Class III surface water	COD <sub>Mn</sub> ≤ 6mg/L; NH <sub>3</sub> -N ≤ 0.5mg/L
Chinese sturgeon	Protection of the safety of Chinese Sturgeon during migration in this region.	Migrate passage, depth, flow rate, mid-stream width; navigation speed and construction schedule.	Maintain current state: water quality no worse than Class III, average depth 38.32 m, average flow rate 1.14 m/s; 1/5 of river width reserved, navigation speed limit 15 km/h.

## 8.5 Incremental impact of this activity

### 8.5.1 Incremental impact on shore line resources

The length of shoreline occupied by the proposed project is 1036 m. It is within the planned port occupation according to the Master Plan of Yichang Hub. It is a part of the planned shoreline, accounting for about 1% of the planned port shoreline of the main stream of Yangtze River (94.68km), and about 0.2% of the planned shoreline (468.3 km) of the main stream of Yangtze River. Therefore, the increment impact of the project on the Yichang Hub shoreline is very small.

### 8.5.2 Incremental impact on water quality

Pollutants, which are treated in Shawan wastewater treatment plant (WWTP) from waste water pollutants generated upon the operation of the project, will be 13.93 tons/year of COD and 1.62 tons/year of NH<sub>3</sub>-N. According to the SEA, the remaining water environment carrying capacity is 27,834 tons/year of COD and 1058.3 tons/year of NH<sub>3</sub>-N. The discharge amount of COD and NH<sub>3</sub>-N of this project account for 0.05% and 0.15% of the remaining water environment capacity, respectively, indicating that the incremental pollutant discharge will have little impact on the water quality and basically will not pollute the Yangtze River.

### 8.5.3 Impact on Chinese sturgeon

It is known from above that the main factors affecting Chinese sturgeon are water quality and hydrological conditions. It has been demonstrated that the increment impact on the water quality is small. The increment impact of this project on the hydrological conditions will be described as follows:

#### (1) Impact on flow rate

According to the symposium *Flood Control Evaluation Report of WB Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project* occupancy rate of wetted cross section area is 0.49%, which is not significant. After the project is completed, the water flow rate is changed by only 0.5cm/s-2.0cm/s, which is insignificant compared with the average flow velocity between 0.68m/s and

2.0m/s.

## (2) Impact on thalweg

The construction is mainly conducted along the bank, so the impact on thalweg is relatively small.

After the project is put into operation, about 2400 ships will be added per year, which is quite small compared with the annual flow of 100,000 ships in Yangtze River Yichang section. However, the navigation line is usually located on both sides of thalweg and the project is only about 3.0km away from the Chinese sturgeon protection zone, downstream from the spawning site, thus the impacts on the thalweg should not be neglected despite its small increment.

As the narrowest river section is about 1000m and the direction of thalweg in Yizhi segment is consistent with the direction of main flow, thus the flow is steadily to the direction, with little deviations varying from 100m to 150m. Both sides of the middle line of the river channel (totally 200m, about 1/5 of the width of river) will be served as the migration channel of the Chinese sturgeon, to mitigate the project impacts on thalweg and the Chinese sturgeon. The width of the river section will reserve 200m along the thalweg, as shown in Figure 8.5-1.

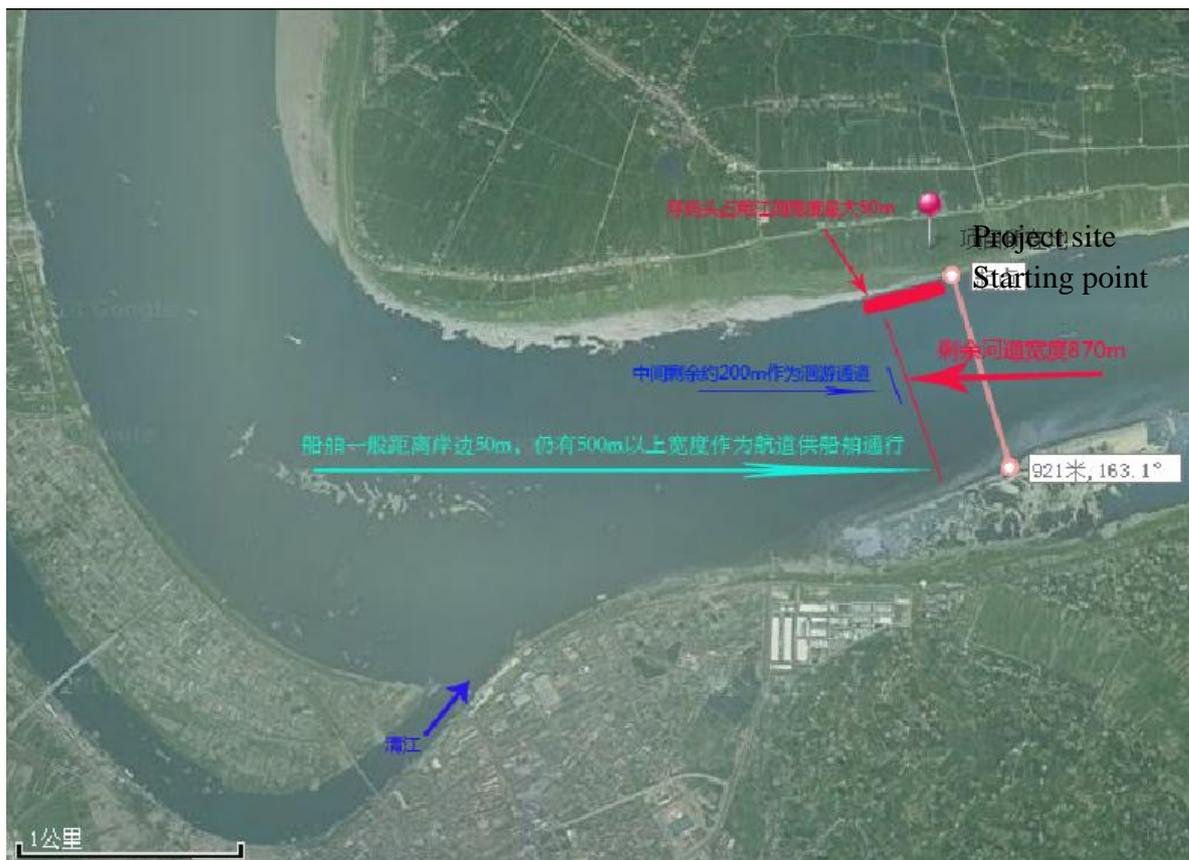


Figure 8.5-1: Reserve of 200m on both sides of thalweg in the river section

## (3) Other impacts

The atadromous migration of Chinese sturgeon propagation group takes place in

the middle of October every year in the project area. The catadromous migration of Chinese sturgeon adults happens from February to middle of April every year in the project area, and that of juvenile fish from the mid-December to the end of December. If work is carried out in the water in the abovementioned periods, relatively large impact will be exerted on the migration of Chinese sturgeon.

## 8.6 Cumulative impact

### 8.6.1 Cumulative impact on shoreline resource

In accordance with the *Master Plan for Yichang Port*, totally 69 sections of port shoreline are planned, with a total length of 94.68km (an increment of 62.32 km new port shoreline, accounting for 63.9% of the total length of planned shoreline), mainly in main stream of Yangtze River and the channels of Xiangxi River, Qing River and Huangbo River, taking up about 9.6% of total length of corresponding shorelines. The newly planned port shoreline is 62.32km, taking up 63.9% of total planned port shoreline. So the proportion of port shoreline is within 10%. Port banks along different rivers are shown in Figure 8.6-1.

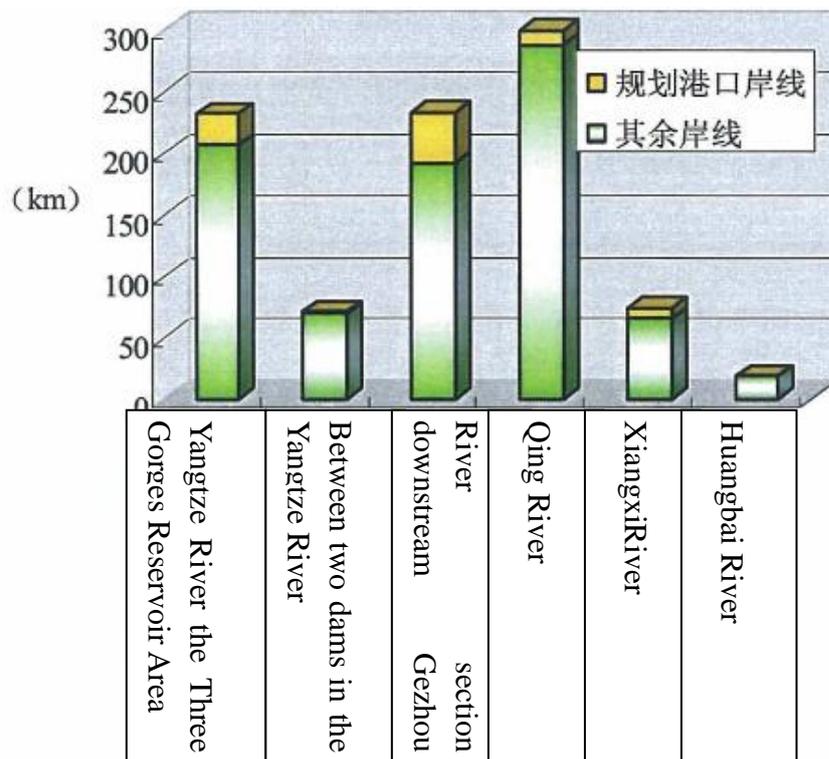


Figure 8.6-1 Distribution and utilization of shorelines (from left to right, each bar is Yangtze River Three Gorges Reservoir Area; Yangtze River Segment between two major dams; Yangtze River Gezhouba Dam Downstream area; branched named Qingjiang River; Xiangxi River, and Huangbo River)

For mainstream of the Yangtze River, the available shorelines are on both sides. The left side starts from the Niutougou in Badong County, down to Yazikou of Qixingtai in Zhijiang City, with total length 253.7 km. The right side starts from

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Laohuangyan in Badong County, down to Yangxihe in Yidu City, with total length 180.4 km. There is also shoreline on alluvia islands, mainly the shoreline on Bailizhou with total length 34.2 km. Thus the total shorelines length in Yichang is 468.3 km. Currently 146.7 km of them have been developed, accounting for 31.3 % of total shorelines, among them 64.12 km are developed into ports and 82.53 km are developed into other artificial use, including industrial shorelines (mainly for ships manufacturing), livelihood shorelines (mainly for hydraulic facilities and water resource protection ), river cross shorelines, urban pollution discharge shorelines, and other special use shorelines (mainly for landscaping). The unused shorelines have a length of 321.65 km (up to 2016), accounting for 69% of total available shoreline resource.

However the VEC is the natural shoreline or shoreline with original ecological function and free of artificial development. The unused shorelines include agricultural uses and are not exactly the natural shorelines. Therefore the natural shoreline length can be even less.

It is widely accepted that the Yangtze River segment in Yichang has been over-developed. Especially in the urban area, there is nearly no natural shoreline left. In addition, the Chinese Sturgeon Natural Reserve is located in Yangtze River section of the urban area. Due to the above two reasons, the city's strategy is to gradually phase out the wharves in the urban areas and to develop high-standard wharves in suburban or rural areas. The proposed Baiyang Port is among them. Currently there haven't been plans for the phasing out of the wharves in the urban areas yet, and it is difficult to assess the impacts. But there have been plans for phasing out the excessive and scattered sand mining wharves along the river. The details can be referred to Section 6.6 on induced impacts.

### **8.6.2 Cumulative impacts on water quality**

According to the monthly water environment quality report from February to May 2016 by Yichang Environmental Protection Bureau, the water quality of Yunchi Cut-down section, which is the nearest to this project, can meet the Class III standard. So, the man-made development activities along the river in the past and present have not deteriorated the water quality of Yangtze River. The water quality has been maintained at Class III. See Table 8.6-1.

**Table 8.6-1 Monthly Water Environment Quality, Yangtze River in Yichang from February to April**

**Water quality data (February 2016)**

River name	Cross-section name	Monitoring point	Cross-Section nature	Water quality status	Limit-exceeding item	Corresponding concentration of limit-exceeding item mg/L	Times of limit-exceeding
Yangtze River	Nanjinguan	Left	Control section	Good	None	None	None
		Middle		Good	None	None	None
		Right		Good	None	None	None
	Nanjinguan section			Good	None	None	None
	Yunchi	Left	Cut-down section	Good	None	None	None
		Middle		Good	None	None	None
		Right		Good	None	None	None
	Yunchi section			Good	None	None	None

**Water quality data (March 2016)**

River name	Cross-Section name	Monitoring point	Cross-Section nature	Water quality status	Limit-exceeding item	Corresponding concentration of limit-exceeding item mg/L	Times of limit-exceeding
Yangtze River	Nanjinguan	Left	Control section	Good	None	None	None
		Middle		Good	None	None	None
		Right		Good	None	None	None
	Nanjinguan section			Good	None	None	None
	Yunchi	Left	Cut-down section	Mild contamination*	None	0.26	0.30
		Middle		Good	None	None	None
		Right		Excellent	None	None	None
	Yunchi section			Good	None	None	None

**\* Note: despite that the total phosphorus exceeds limit in the left section of Yunchi, the water quality of Yunchi section still reaches the standard (whether the section reaches the standard is based on analysis of the average value of the left, middle and right sections).**

### Water quality data (April 2016)

River name	Cross-Section name	Monitoring point	Cross-Section nature	Water quality status	Limit-exceeding item	Corresponding concentration of limit-exceeding item mg/L	Times of limit-exceeding
Yangtze River	Nanjinguan	Left	Control section	Good	None	None	None
		Middle		Good	None	None	None
		Right		Good	None	None	None
	Nanjinguan section			Good	None	None	None
	Yunchi	Left	Cut-down section	Good	None	None	None
		Middle		Good	None	None	None
		Right		Good	None	None	None
	Yunchi section			Good	None	None	None

### Water quality data (May 2016)

River name	Cross-Section name	Monitoring point	Cross-Section nature	Water quality status	Limit-exceeding item	Corresponding concentration of limit-exceeding item mg/L	Times of limit-exceeding
Yangtze River	Nanjinguan	Left	Control section	Good	None	None	None
		Middle		Good	None	None	None
		Right		Good	None	None	None
	Nanjinguan section			Good	None	None	None
	Yunchi	Left	Cut-down section	Good	None	None	None
		Middle		Good	None	None	None
		Right		Good	None	None	None
	Yunchi section			Good	None	None	None

The prediction of impact of construction activities in future on water quality is mainly based on the total pollutant discharge amount of the urban master plan of Yichang and the analysis of port pollutant discharge amount relevant to this project.

#### (1) Yichang Urban Master Plan

According to *Yichang Urban Master Plan (2011-2030)*, the total urban area in planning is about 4331 square meters, being the entire administrative territory of Yichang. It is estimated that sewage production in urban area will be 808,000 t/d by 2020, and 1,083,000 t/d by 2030. It will be treated to Class I B standard according to sewage treatment standard (COD60mg/L, NH<sub>3</sub>-N8mg/L), the sewage pollutant discharge amount COD will be 17520t/a, and NH<sub>3</sub>-N 2336t/a. Currently, Yichang COD environment capacity is 124578.4 t/a, NH<sub>3</sub>-N environment capacity 5218.5 t/a. So, the ratio of COD in environment capacity by 2020 will be 14.1%, and that of NH<sub>3</sub>-N will be 44.8%/ Because pollutant discharge amount is within the scope of water environment capacity and the water body can effectively self-clean, if the plan can be strictly followed in future and sewage can be collected and treated as per requirement, the current water quality of the water body can be guaranteed.

## (2) Yichang Port

Seen from the water environment capacity of Yichang, since the implementation of the master plan up to now, the total discharge amount of COD and NH<sub>3</sub>-N accounts for very small ratio in the water environment capacity of the main basin (not including the water environment capacity of Xingshan County and Zigui County) (Table 8.6-2). Among them, except the main stream section of Gezhou Dam~Yunchi (left) of Yangtze River, the ratio of COD and NH<sub>3</sub>-N of other ports usually accounts for less than 1% of the environment capacity, and very often 0.01%~0.29%. However, at the section of Gezhou Dam~Yunchi (left), as the scale of every operation zone grows after the planning is implemented, it is estimated that the water environment capacity of this section will reach about 3.32% by 2020. It indicates that the port pollutant discharge is only a very small part in the sewage discharge amount of the whole city, far less than the water environment capacity, and the water body can be effectively self-cleaned, so the existing water body functions will not be affected.

**Table 8.6-2 Comparison between Main Pollutant Discharge Amount of Yichang Hub and Environment Capacity**

Pollutant	2020	
	COD	NH3-N
Predicted discharge amount of port pollutant (t/a)	63	10.4
Ratio in water environment capacity (%)	0.04	0.1
Ratio in maximum allowable pollutant discharge amount (%)	0.05	0.2

## (3) Other factors contributing to pollutant generation

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Considering that cities in future will gradually implement more strict sewage treatment and discharge standards, the treatment and discharge standards of all the WWTPs will have to reach WWTP Class 1A discharge standard. So, pollutants entering the surface water body will significantly decrease. Meanwhile, with the advance of the times and the progress of technology, reuse of recycled water will be greatly increased, which is helpful to reducing pollutant discharge in surface water.

To summarize, the cumulative impact on surface water quality is not significant, and the Yangtze River can maintain the current Class III water quality class.

### **8.6.3 Cumulative impact on Chinese sturgeons**

As the Three Gorges Dam and Gezhou Dam and others have been constructed, the Chinese sturgeons have to migrate to the downstream of the dam to breed. As a result, the downstream of Gezhou dam becomes the only spawning site. The current status of Chinese Sturgeon is summarized in Section 3.6. Conclusion has been drawn in Section 8.4.3 that: the safety limit for Chinese Sturgeon is that the water quality (class-III standard or better), depth (38.32m averagely) and flow velocity (1.14m/s) in the migration route remain unchanged or be improved. The cumulative impacts on water quality have been discussed in Section 8.6.2. This section will focus on the impacts on hydrological conditions.

#### **(1) Impact on hydrological conditions**

The average depth is currently 40.21m. The current flow rate is between 0.68m/s and 2.0m/s.

Since the Yangtze River has deep-water shoreline in Yichang, there will be no dredging involved, thus there is no impact from dredging on the river channel, water depth and mid-stream line.

The biggest impacts on hydrology are from wharf development. The wharves in the water will occupy some wetted river cross section area, and affect the free flow and flow rate. It will not affect the water depth. According to the master plan, the upstream ports and wharves will be relocated and integrated while some new ports and wharves will be developed downstream. Though they are not entirely equal, the dismantling of old facilities will offset some impacts of the new wharves. It is difficult to predict the impact of large scale development. However the developed will be phased thus the impacts will gradually take effect and the changes in hydrology will occur slowly. Therefore we consider the wharves development will not cause significant impacts on the living environment of Chinese Sturgeon.

#### **(2) Other impacts**

As the economic develops further, the number of ships and the tonnage in the Yangtze River in Yichang section (the natural reserve) will further increase. The ships noise can cause certain impacts on the Chinese Sturgeon and other fishes. The ships propellers can also cause higher possibility of physical damage or

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casualty on Chinese Sturgeon and other fishes.

The ships, wharves and paved shorelines can also affect the material and energy exchange between the river ecological system and other places, and occupy the spaces and migrate routes of Chinese Sturgeon and other fishes.

Overfishing in the river leads to decreasing fish populations, many of which are food for Chinese Sturgeons. The impact of diminishing fish stocks in the food chain on the Chinese Sturgeon is apparent.

Based on above analysis, the water quality and the hydrological condition can be well maintained. With additional measures taken, such as the ports integration, fishery management enhancement, the impacts on Chinese Sturgeon can be control within acceptable level.

#### **8.6.4 Accumulative Impacts on the nine logistics parks**

In accordance with the *Three Gorges Modern Logistics Plan (2010-2020)* issued by NDRC comprehensive transport institute, there are totally nine logistics parks including Huayan, Taipingxi, Maoping, Yunchi, Honghuatao, Xiaoxita, Dongshan, Zhicheng and the Three Gorges airport within the scope of accumulative impacts assessment. Considering the accumulative impacts of the project are mainly related to the water body and coastline of the Yangtze River, the land area logistics parks including Huayan, Xiaoxita, Dongshan and the Three Gorges Logistics Parks are not analyzed. We will assess the accumulative impacts with the analysis of the remaining five coastline parks, including: Taipingxi, Maoping, Yunchi(part of Yunchi logistics parks), Honghuatao and Zhicheng.

The selected five parks will generate water pollution to the Yangtze River and affect the survival of the Chinese sturgeon and the coastline resources. As *Yinchang Port Master Plan* has covered all the ports that serve for these logistics parks, thus the water pollution and coastline will not be further analyzed here.

### **8.7 Measures and suggestions**

Based on the accumulative impacts analysis of the Chinese sturgeon, the water quality and coastline of the Yangtze River, we put forward the following suggestions to solve the problems and mitigate risks:

#### **8.7.1 Protection on natural shoreline**

##### **(1) Studies ecological threshold value or carrying capacity for main shorelines.**

As indicated in section 8.4.1, currently there is no conclusive opinion on the ecological threshold value in the main channel shoreline. In order to strengthen the protection of the ecological shoreline, it is suggested to conduct studies on the ecological threshold value or carrying capacity for main channel shorelines.

As the study on ecological threshold value will be carried out by the Yangtze River

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Committee, the study of local ecological coastline threshold will be handed over to local EPB and transport bureaus.

## **(2) Implementation of access system for projects related to riverbank resources**

For projects related to shoreline resources, access system should be implemented and project resources utilization assessment system should be set up. Shoreline occupied by and depending land of projects related to Shoreline resources should be selected and reasonably arranged according to the investment intensity and construction scale of projects and status of the project association. Meanwhile, we should carry out comprehensive assessment on the impact of project development on shoreline resources and environment and comprehensively analyze the social benefits, economic benefits and ecological benefits of the developed project. We should specify that the proportion of length of the shoreline occupied by projects related to shoreline resources to deep length of the supporting land should not be smaller than 1:3, guide the project to be arranged deep into the land and reduce the occupation on shoreline. Meantime, we should set up sound comprehensive shoreline management system and formulate effective assurance measures.

Currently, shoreline of Yichang Municipal is not intensively utilized. Planning of port should reflect the idea of intensive utilization of shoreline. We can reserve the shoreline resources for development at appropriate time. We suggest that the utilization of shoreline can be implemented periodically and should be determined according to the throughput and the shoreline should be gradually developed. We should deeply dig the potential of shoreline utilization, improve the utilization rate of shoreline and strictly control the examination and approval on shoreline utilization.

The approval of Yangtze River coastline falls under the jurisdiction of Ministry of Transport in China. At present, the approval of coastline is quite strict.

## **(3) Restore shoreline in the port shoreline integration initiative**

Taking advantage of the opportunity that Yichang Municipality is relocating the excessive and borderless wharves and urban wharves, promote the ecological shoreline development. While ensuring structural safety, adopt soft material (soil) as much as possible to make the shoreline permeable to water, water and energy exchanges, so that they can be habituated by biological organisms to achieve real ecological restoration.

The resources of the port area are led by the governmental departments. The port navigation bureau is responsible for implementation. The coastline restoration and construction will be applied to the local DRC first. The port navigation bureau will be responsible for the implementation in accordance with the allocation of project fund.

### **8.7.2 Water quality of the Yangtze River**

According to the latest orientation of Yangtze River by the central government in 2016, great efforts will be put to protect instead of to develop the Yangtze River. All the departments are actively developing relevant policies, plans and measures to enhance the protection of Yangtze River. Meanwhile, in April 2016, Hubei has already begun to develop the *Ecological Protection and Green Development Planning of Hubei Yangtze River Economic Belt* to guide the construction of

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ecological Yangtze River. The main responsible department of water quality protection is Yichang EPB. The local governmental department(usually local DRC) will take a lead in industrial optimization. The EPB will be responsible for pollution control and take different measures to the implementation progress of the regional project. With regard to domestic wastewater and non-point pollution source, we mainly follow the *Environment Protection Plan of the 13<sup>th</sup> FYP* and take other measures on water quality improvement as specified in Hubei's action plan of "clear water, blue sky and sanitary earth" .

Specific advice regarding water quality protection is as follows:

### **(1) Further promote industrial pollution prevention and control**

Accelerate adjustment and optimization of industrial structure, give priority to developing hi-tech industries and other pollution-free industries and strictly forbid to add new projects that cause all kinds of pollution. Speed up shutdown and relocation of polluting enterprise in sensitive area and promote structural optimization and upgrading. Strictly execute the environment impact assessment and the regulations of designing, constructing and putting in use pollution control facilities together with the main production facilities. The principle of "rejecting ten types of projects" for environmental protection approval of construction project shall be implemented to improve the standard of environmental access. Fully implement regulations of total sewage discharge amount control and forbid new erection of direct pollution discharge into the rivers. Strictly execute pollution discharge permit system and strictly forbid pollution discharge without permit, exceeding limit or excessive discharge.

### **(2) Enhance domestic sewage and rural surface source control**

Firstly, speed up promoting urban sewage treatment facility construction and implement sewage intercept where possible. All the towns in catchment area must build and complete sewage treatment facilities or put the sewage into neighboring WWTP. WWTPs that are newly built or under construction shall be provided with nitrogen and phosphorus removal facilities to ensure that the outlet water quality reaches Class A discharge standard of the *Urban WWTP Pollutant Discharge Standards*. Where the effluent of the existing urban WWTP fails to reach standard or the plant is not provided with nitrogen and phosphorus removal facilities, the process must be renovated in order to discharge to the standards. Secondly, speed up rural domestic sewage treatment. Accelerate the construction of rural domestic sewage water treatment facilities by means of centralization or scattering based on the local conditions.

### **(3) Strengthen ecological protection and restoration**

Firstly, give priority to wetland protection and restoration in riparian zones. Actively carry out wetland protection demonstration project. Actively promote construction of ecological wetland system, planting floating plant, emerging plant and submerged plant, and speed up creating aquatic plant zones at main stream, estuary and riparian zones. Carry out Lake Reservoir embankment renovation, plant

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configuration project and improve land and water exchange capacity. Configure and renovate farmland forest network and enhance village greening according to local conditions. Secondly, enhance prevention and control of soil erosion. Promote the construction of small valley that is ecologically clean; establish water conservation forest and ecological forest for public interest. Forbid such activities as ore mining, quarrying, soil taking and sand excavation along the river section.

#### **(4) Enhance construction of monitoring alert system**

Firstly, enhance water environment monitoring and control. Governments at all levels must prepare overall plans and coordinate, integrate monitoring resources, optimize monitoring network and establish water environment information sharing platform covering water quality, water condition and weather. Carry out whole-process monitoring for lake reservoirs, especially lake reservoirs that provide drinking water, regarding water quality from water taking, water producing and water supply in water plant. Secondly, speed up building-up water environment alert system. Complete automatic monitoring system of surface water quality, promote construction of water quality security online bio-alert system, and speed up the construction of around-the-clock real-time water environment quality monitoring system. Meanwhile, speed up water environment alert index system and uniform alert information release system to guarantee water environment safety precaution. Thirdly, establish and complete water environment protection emergency system. Governments and departments at all levels should further establish and complete emergency plan for preventing and controlling water pollution emergencies and implement various emergency measures.

#### **8.7.3 Suggestions on Chinese sturgeons**

Due to the rapid growth of throughput capacity and frequent various production activities, waste water discharged from accidental discharge, oil pollutants, oil leakage from ship and operation noise can hardly be avoided. Therefore, pollutant discharge in the port area and from ships must be strictly controlled.

Yichang port navigation bureau will carry out unified planning and layout for the wharves in the Chinese sturgeon natural reserve for unified management; improve the scattered and messy conditions of the wharf operation area inside the natural reserve to reduce the impacts of small and medium-sized wharves on the natural reserve.

The master plan specifically requires gradual demolition of existing operation areas in the Chinese sturgeon spawning site and relocation far away to downstream of the reproduction zone, which is favorable to Chinese sturgeon propagation and protection.

The SEA shall be implemented strictly by Yichang port navigation bureau. 33 wharf berths in Binjiang, Jiangnan, Wangjiahe and Gulaobei operation areas inside the Chinese sturgeon protection zone shall be demolished. 20 new berths will be built in Linjiangping and Gulaobei operation areas. The total number of berths inside the core area of the protection zone will be greatly reduced, favorable to protecting the Chinese sturgeon and the ecological environment in the core area.

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Overfishing is strictly controlled. Awareness campaigns shall be the focused on. The hazards of overfishing must be explained to the fishermen. Chinese sturgeons migrate in this river section usually takes place in the middle of October. The migration of adult Chinese sturgeon takes place in mid-October , and that of juvenile and larvae from mid-December to the end of December. It is suggested that Yichang fishery management department should fully consider the abovementioned migration period when fixing the fishing-off season. Fishing is strictly forbidden during fishing-off season. Meanwhile, law enforcement should be enhanced. Overfishing must not be tolerated.

## 9 Social Impact Assessment

### 9.1 Baseline of the project impact area

#### 9.1.1 Baseline of the Baiyang Town

The proposed project is located in Baiyang Industrial Park of the Hi-Tech Zone. It was established in 2007 upon approval of the Hubei Provincial People's Government. Currently it has jurisdiction over 18 rural administrative villages with 86 natural villages or groups and one urban community. Baiyang Industrial Park has a total area of 156 km<sup>2</sup> and a population of 40,676.

According to the data provided by the Baiyang Industrial Park Administration Office, the socio-economic development of Baiyang Industrial Park in 2014 is listed in Table 9.1-1.

Table 9.1-1 Socio-economic development of Baiyang Industrial Park

Index	Unit	Year 2014
<b>I. Basic information</b>		
Area of administrative divisions	Ha.	15,600
Number of resident's committee		1
Number of villages		18
of which: Number of villages that have access to public transport		18
Number of villages that have internet access		18
Number of villages that have access to cable TV		15
Number of villages that have access to tap water		12
Number of villages that have concentrated disposal of garbage		18
Number of villages that have concentrated disposal of sewage		0
<b>II. Population &amp; Employment</b>		
	-	
Number of permanent residential households		14,556
Population of permanent residents		40,818
Registered population		40,818
of which: Registered agricultural population		36,050
Population employed in primary industry		6,304
Population employed in secondary industry		13,365
Population employed in tertiary industry		5,688
Population of out-of-town employees		1,765
<b>III. Financial revenues &amp; expenditures</b>		
	-	
Public financial revenues	10,000 Yuan	1711
Public financial expenditures	10,000 Yuan	5,983.81
<b>IV. Agriculture</b>		
	-	
Cultivated land area	Ha.	3,850
Effective irrigation area	Ha.	2,825
Number of agricultural technology agencies		3
<b>V. Industries &amp; Construction</b>		
	-	

<b>Index</b>	<b>Unit</b>	<b>Year 2014</b>
Number of industrial enterprises		35
Gross industrial output value	10,000 Yuan	195,958
of which: gross industrial output value of industries above the specified scale	10,000 Yuan	174,049
Number of employees in industrial enterprises		3,205
Number of construction enterprises		1
Total output value of construction industry	10,000 Yuan	3,509
Number of employees in construction enterprises		223
Number of enterprises in the accommodation and catering industry		17
<b>VI. Education, culture &amp; health</b>	-	
Number of primary schools		4
Number of full-time teachers at primary schools		97
Number of students at primary schools		1,140
Number of medical and health organizations		1
Number of beds at medical and health organizations		50
<b>VII. Social security</b>	-	
Number of insured people under the New Rural Cooperative Medical System		31,000
Number of insured people of the New Rural Social Pension Insurance		11,637
Number of rural residents with minimum living allowances		1,551
<b>VIII. Information of urban areas</b>	-	
Planned urban area	Ha.	2,500
Developed area	Ha.	200
Number of households in the developed area		1,650
Total population in the developed area		4,932

### 9.1.2 Baseline of the direct-affected villages

This project is located on the northern bank of the Yangtze River, in Baiyang Industrial Park. All the affected residents come from Yazishan Village and Guixihu Village.

The two villages share multiple similarities: the family size is about 3.2-3.4 persons; agricultural income mainly comes from citrus plantation; the area of citrus orchard per person is 1.6-1.8 mu; the income is about 11,000-12,000 Yuan per person per year, roughly equal to the average income of 11,837 Yuan of rural residents of Yichang in 2014. Both are typical rural areas of Yichang. Currently neither of the two villages has any collective business entities. All the residents are insured under the New Rural Cooperative Medical Insurance Program around year 2005, and all of them are insured with basic pension insurance since 2013.

Table 9.1-2 Basic conditions of the affected villages (2014)

<b>Item</b>	<b>Yazishan Village</b>	<b>Guixihu Village</b>
Number of households	489	601
Population	1,584	2,065
Income per person (Yuan)	12,166	11,600

Item	Yazishan Village	Guixihu Village
Quantity of workforce	927	1,317
Area of paddy fields (mu)	210	50
Area of dry land (mu)	614	810
Area of vegetable fields (mu)	500	120
Area of ponds (mu)	59	350
Area of orchards (mu)	2,600	3,750
Other land area (mu)	500	500

According to interviews with the villagers, currently most of the workforce of both villages is engaged in non-agricultural businesses and operations outside of their village. The rest of the workforce, mostly women, stays at home to do housework and manage the simple production of citrus orchards. However, due to degradation of local citrus varieties in recent years, the citrus becomes less competitive on the market, and its contribution to family income has been dropped significantly. As a matter of fact, the proportion of income from citrus production in the total family income is below 20% for most households. From information provided by the village cadres, only 25% of the workforce spends certain time on agricultural production; more than 50% of the workforce works in the construction industry and other industries throughout the whole year, while about 20% works in the service industry throughout the whole year.

### 9.1.3 Affected rural households

In order to gain a deeper insight into the social and financial situation of the affected households, the PMO conducted a sampling survey among households affected by land acquisition and house demolition. PMO gathered detailed information about the social and financial situation of 62 households, accounting for 13.80% of the households affected by land acquisition and 25.40% of the households affected by house demolition.

Table 9.1-3 Basic conditions of the surveyed households

Item	Quantity	Proportion (%)
Number of households	62	11.05
Population	232	
Male population	116	50%
Female population	116	50%
Education (over 15 years old):		
Illiterate/ semiliterate	5	2.48
Primary school	45	22.28
Junior high school	83	41.09
Senior high school/ secondary technical school	48	23.76
Junior college and above	21	10.40
Age:		
0-15	20	8.62
15-40	70	30.17
40-60	82	35.34
60+	60	25.86

Item	Quantity	Proportion (%)
Field of employment <sup>3</sup> :		
Agriculture	25	23.15
Construction industry & other industries	54	50.00
Service	29	26.85
Workplace		
Baiyang Town	40	37.04
Yichang City	39	36.11
Inside Hubei Province yet outside Yichang City	16	14.81
Outside Hubei Province	13	12.04

See Table 9.1-4 for information about the economic activities, income, and housing conditions of these households.

Table 9.1-4 financial conditions of the surveyed households

Item	Average	Max.	Min.
Monthly income per person (Yuan)	1087.56	5000	600
Housing area (m <sup>2</sup> )	410.50	800	72
Age of the housing (Year)	18.8	41	3
Area of citrus orchards (mu)	4.70	14	0
Proportion of agricultural income in total family income (%)	24.30	50	0

According to the survey, the project's impact on the living standard of the land-acquired households is not significant. The reasons are as follows:

First of all, the agricultural income of the affected population comes almost entirely from citrus plantation. Due to the characteristics of soil and climate, only one citrus variety, i.e. the so-called "Shawan Sour Citrus" can survive and have scaled production in the two villages. However, this citrus variety has poor market performance, and is generally sold at 1.6 - 2 Yuan per kg. Under normal conditions, the gross income of citrus production is about 3,500 - 4,000 Yuan per mu. After deducting farming cost of 1,000 Yuan on fertilizers, irrigation, machinery, etc., the income of citrus is 2,500 - 3,000 Yuan per mu, while the net income is about 1,500-1,800 Yuan per mu deducting the cost of labor input. Since the average area of citrus orchard of Yazishan Village and Guixihu Village is 5 mu per household, it means that citrus orchard can bring a net income of 7,500-9,000 Yuan for a household each year, which is roughly equivalent to three months' salary of a migrant worker who works outside of village.

Second, most of the workforce of Yazishan Village and Guixihua Village have being working outside of the two villages. The High-tech Zone and the Baiyang Industrial Park have increasing demand of workers recently, offering a monthly salary of about 3,000 Yuan and even 5,000 Yuan for some higher-demanding jobs. As a result, the proportion of income made outside of the two villages in total family income has been increasing year by year. It is found that some families have largely given up citrus plantation and solely make a living by working outside village or start up their own business, or simply leave the citrus orchards to the care of the elderly

<sup>3</sup> Since the respondent may be engaged in more than one industry, this item refers to the main industry which the respondent has engaged in for longest time in the previous year.

people or the women who stay at home. Statistically, the proportion of agricultural income in total family income of about 79% households is below 20%, indicating that land acquisition has minor impact on their family income. Only 3.23% households mainly rely on agricultural income to make a living, and they should be the focus of the livelihood rehabilitation work after land acquisition.

**Table 9.1-5 Proportion of agricultural income in total family income of surveyed households**

Proportion of agricultural income in family income	Number of household	Proportion (%)
50-100%	2	3.23
20-50%	11	17.74
10-20%	29	46.77
0-10%	20	32.26
Total	62	100.00

Third, we observed that during the citrus harvest season in October and November, 2015, numerous ripe citrus fruits remained unharvested in some unacquired orchards. It turned out that the owners of these orchards are working outside of the villages because selling citrus fruits makes little profit. According to the socio-economic survey, all the owners of orchards within the project area agree that the compensation by current land acquisition standard is more financially appealing than citrus plantation.

## 9.2 Stakeholders and their relationship with project risks

### 9.2.1 Identification of project stakeholders

According to the results of survey and analysis, the stakeholders of this Project are distributed at different levels and varying in different scopes. The major stakeholders of the project are identified as the follows:

- 1) The WB
- 2) PMO
- 3) Yichang Transportation Investment Co., Ltd
- 4) Resettlement Office of High-tech Development Zone Management Committee
- 5) Baiyang Industrial Park Resettlement Office
- 6) Construction contractor of Baiyang Port and Logistics Park
- 7) Residents, enterprises and units impacted by land acquisition
- 8) Residents, enterprises and institutes in the neighborhood of projects of Baiyang Industrial Park
- 9) Existing ports and logistics enterprises of Yichang City
- 10) Service objects of Baiyang Port and Logistics Park
- 11) Public media that publicizes information related to the project (newspaper, TV, internet, etc.)

The stakeholders are shown in Table 9.2-1.

Table 9.2-1 Project stakeholders

Stakeholder	Stakes	Role	Attitude towards the project	Impact on the project
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Stakeholder	Stakes	Role	Attitude towards the project	Impact on the project
WB	Loan provider	Provide a part of financial support	Supportive	Significant
PMO	Direct project initiator	Major decision-making in project construction	Supportive	Significant
Yichang Transportation Investment Co., Ltd	PIU	Arranging for specific project construction	Supportive	Significant
Resettlement Office of High- and New-tech Development Zone Management Committee	Indirect stakeholder	Carrying out land acquisition and house demolition work	Supportive	Significant
Baiyang Industrial Park Resettlement Office	Indirect stakeholder	Coordinating the land acquisition and house demolition work	Supportive	Large
Construction contractor of Baiyang Port and Logistics Park	Can gain economic benefits from the project	Undertaking construction of the contracted bid section	Supportive	Significant
Residents, enterprises and units impacted by land acquisition	Can either be the direct beneficiary or victim of the project	Propel or hinder project construction	Can either be supportive or against	Significant
Other ports and logistics enterprises in Yichang City	Can either be competitor or partner of the project	Propel or hinder project construction	Can either be supportive or against	Relatively small
Customers of this port and logistics park	Direct beneficiary	Propel project construction	Supportive	Relatively small
Residents, enterprises and institutes indirectly impacted by the project	Can either be the direct beneficiary or direct victim of the project	Propel or hinder project construction	Can either be supportive or against	Relatively small
Public media	Can enhance popularity and influence by reporting the project	Publication and spreading negative or positive news about the project	The attitude of public media depends on the project progress and its social impact	Relatively large

### 9.2.2 Requirements of Stakeholders and risk analysis

The above identified stakeholders assume different responsibilities, have different attitude towards this project and plays different roles in the preparation and implementation of this project. Their stakes and behaviors in the preparation and implementation of this project are closely associated with risks of this project may

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occur.

### **Word Bank**

As the loan provider of this project, WB provides certain financial support to construction of this project. Its main demands towards this project are as follows:

Strict regulation and supervision are followed during the preparation and implementation period of this project, to ensure its compliance with WB's development philosophy, bring comprehensive social and economic benefits and achieve the project development objectives. Financial support from WB will urge relevant governmental departments of China to pay more attention to the preparation and implementation of this project and is conducive to the prevention of relevant risks. Meanwhile, the risks of WB loans are: there are strict procedures and technical specifications for preparation and implementation of WB funded projects; whether the preparation procedures and management in implementation of domestic projects can meet the relevant requirements is an important factor which influences whether the projects can be prepared and implemented according to the given plan.

### **PMO**

PMO, the leading agency responsible for major decision-makings, has been established by Yichang People's Government. The main demands are as follows:

- 1) Promoting development of transportation and logistics of Yichang and improving the efficiency of freight and logistics along Yangtze River within Yichang through construction of this project;
- 2) Promoting multimodal transport in ports of Yangtze River and reducing carbon emission in logistics and transportation process;
- 3) Facilitating the WB funded project to be approved and implemented as soon as possible and expanding the function of foreign capital.

As the major decision maker, organizer and coordinator of this project, the relationship with social stability is dependent on whether PMO can ensure scientific and democratic decision-making in the planning and preparation process of this project, ensure the smooth planning and approval process of this project and lead the relevant functional department to ensure the legality and effective implementation of the policies regarding this project.

### **Yichang Transport Investment Co., Ltd**

As PIU of this project, main demands of Yichang Transportation Investment Co., Ltd. are as follows: constructing Baiyang Port and Logistics Park to establish the growth point and platform for sustainable development of enterprises. The smooth completion of the project will be the achievement of leaders and staff and they also want to seize this opportunity to obtain multi-channel fund support to realize leapfrog development. Therefore, as specific organizer in the preparation phase of this project, Yichang Transportation Investment Co., Ltd. wishes to get vigorous support from relevant departments of Hubei Province and Yichang Municipality, so that the project will be approved by relevant departments as soon as possible, evaluated and recognized by the WB to enter the implementation period soon. Their association with the project risks lies in whether the project preparation is in

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accordance with the national and local policies and procedural specifications, scientifically organize the construction and not affect the interests of other relevant groups with its own interests in the construction process and set up scientific modern enterprise management system, safely and effectively realize the project's operation and realize the harmony between economic benefits and social benefits during operation period.

### **Hi-Tech Zone Resettlement Office Management Committee**

As the PIU of land acquisition and house demolition, the resettlement office of Hi-Tech Development Zone will also be funded for the completion of the task. They hope that PIU can carry out land acquisition, house demolition and compensation in accordance with the relevant policies of the state and Hi-Tech Development Zone on one hand and hope that the affected households, enterprises and companies to actively cooperate so that they can complete their tasks within jurisdiction on the other hand. They are indirectly related to this project in terms of economic benefits. However, since land acquisition and house demolition shall be borne by the government, the performance of the specific executor, will be supervised and examined by the Yichang People's Government and Management Committee of Hi-Tech Development Zone, thus they basically hold positive attitude towards this project. Their association with the project risks lies in whether they can smoothly implement policies regarding land acquisition and house demolition with professional knowledge and policies, guarantee that the affected persons can be reasonably compensated and arranged and provide safe social environment for smooth progress of project construction.

### **Baiyang Industrial Park Resettlement Office**

Baiyang Industrial Park Resettlement Office is the organizer and implementation unit of land acquisition and house demolition as assigned by the Hi-Tech Zone Resettlement Office in Baiyang Industrial Park. With directly interaction with the affected people and enterprises, Baiyang Industrial Park Resettlement Office's policy knowledge and professional skill will the directly influence smooth advancement of resettlement. They will also get fund support for their specific implementation of the resettlement. They not only organize land acquisition and house demolition in accordance with policies as specified by the Hi-Tech Zone Resettlement Office but also responsible for publicizing the information pertinent to resettlement to the affected people and enterprises and organizing the construction and distribution of resettlement housing. They have positive attitude towards the project. Their risks of the project lies in whether they can solidly and meticulously implement resettlement policies as specified by the Hi-Tech Zone Resettlement Office, carry out activities to let the public participate, collect and solve the complaints which may occur in the process of land acquisition and house demolition and ensure the smooth implementation of land acquisition and house demolition.

### **Contractors of Baiyang Port and Logistics Park**

As the specific constructor of this project, the Contractors want to complete the construction with lowest cost, in the most economical way and within the shortest construction period so as to achieve the biggest economic benefits. Therefore, they are willing to establish a good environment for their construction. Meanwhile, to their own interest, the Contractor may take some measures which do harms to the daily access and life of surrounding residents during construction period so as to

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provide convenience for their construction. Their association with the project risks lies in whether they can strictly follow various regulations and rules about the project construction, avoid safety risks, ensure the construction quality and provide qualified results.

### **The Affected Residents, Enterprises and Units**

The group has complicated interests with the project. On one hand, land acquisition may exert influences on their normal life and even production and operation. Hence, they may have negative feelings towards this project. On the other hand, the obvious benefits brought by this project make them look forward to the project construction. What they care about is whether they can be reasonably compensated, whether the negative impacts brought by this project can be properly settled, whether the procedure of compensation can be reasonable, open and transparent and whether the construction and distribution of resettlement housing can be timely completed and improves their living conditions. Their association with the project risks lies in whether they accept the compensation and resettlement policies after land acquisition and whether there are channels to receive complaints and reasonable pathways and methods to solve the problems.

### **Other Similar Ports and Logistics Enterprises in Yichang**

For other ports and logistics enterprises within the service scope of this project, construction of this project will exert double impacts on them: on one hand, there will be inevitable competitiveness among enterprises, which will exert negative impacts on operation of other enterprises; on the other hand, construction of Baiyang Port may add momentum to construction and improvement of the ports and logistics system in this region and establish effective cooperation with due labor division, thus achieving the goal of co-existence and common prosperity. Therefore, the competition and cooperation relationship between Baiyang Port Logistics Park and other similar enterprises make other similar enterprises have both negative feelings and positive attitude towards the project. Planning, communication and cooperation of the enterprises and relevant management departments are needed to transfer the disadvantages into advantages and realize win-win.

### **Service Objects of this Project**

Service objects of this project include both enterprises and units in Baiyang Logistics Park and the surrounding users connected by comprehensive logistics system of water, railway, road and air. They look forward to the convenient traffic and logistics by construction of this project and hope that the project will provide convenience for and reduce the cost of their production and operation. Hence, they positively support the project but have little impact and action on this project since they are not the direct party to the construction of the project.

### **Enterprises, units and residents surrounding the project**

The indirectly influenced group of the project is mainly near the project boundary and the project impacts on this group are relatively complex. On one hand, the project construction may exert negative impacts on their access, life and operation environment, but may bring about some employment and business opportunities. They hope to minimize the negative impacts and expect the development chances brought about during and after the construction of the project. From the overall perspective, this group is supportive of the project. However, special attention

should be paid to the establishment of risk identification and pre-warning mechanism during construction. This group's association with the project risks lies in whether impact on operation and living environment caused in the construction and operation process of this project and other negative factors can be effectively solved.

### **Public media**

Public media is always very sensitive to the any information of major construction projects relating to people's livelihood. Any information may be spread via media, such as newspaper, TV and internet. In this process, its influence, positive or negative, can be magnified. Generally, media as an indifferent dissemination channel has no direct interest relation with the project, but due to the coverage and influence of public media and the public's sensitivity to bad news and their desire of getting to the bottom, great attention must be paid to public media during project preparation, implementation and operation. Public media is highly related to the project risks because it always acts as witness and participant in generation and development of social risks. Social impacts of the project will be widely disseminated via media. If appropriately publicized by the public media, the potential risk to social stability may be avoided and eliminated effectively. On the contrast, if not getting along well with public media, social risks may be enlarged and amplified.

### **9.3 Project impact and risks analysis**

Some investigations conducted for this project and social impact analysis experience of similar projects demonstrate that, this project will bring some adverse impacts and risks but also some positive impacts to the surrounding area. These positive and negative impacts must be identified and measures be taken to expand positive impacts, mitigate or erase adverse impacts, and prevent or eliminate social risks. The social risks of the project are shown in Table 9.3-1.

**Table 9.3-1 Identification of social impacts**

<b>Classification</b>	<b>Positive impacts</b>	<b>Adverse impacts</b>	<b>Social risks</b>
Economy	Improve local logistics and transport capability, promote development of Baiyang Industrial Park, promote local economic development	Almost no adverse impact.	No other risks except for the financial risk of the project
Social development and stability	Create more jobs, optimize local economic and social structure, promote urbanization and social stability	People on the land occupied by the project may lose their livelihoods and houses, women's livelihood and employment will be affected..	Social disputes may occur when the people whose lands are requisitioned or whose houses are demolished can't get appropriate compensation, good job or proper arrangements, especially for the women's livelihood and employment.

Classification	Positive impacts	Adverse impacts	Social risks
Transport	Promote formation of multi-modal transport system in project location and surrounding area	Operation of the port and logistics park will increase the pressure of road transportation.	Traffic accidents may occur along national road G318 and trunk roads at Baiyang Town.
Other impacts	Drive development of similar enterprises and related business.	Other similar enterprises may be challenged and shocked if lack of good planning and coordination.	This may lead to vicious competition and many workers may lose jobs.

### 9.3.1 Risks of Economic impact

This project will greatly promote the economic development of Baiyang Industrial Park and the local area. During 3-4 years' construction of the project, more than 200 labors will work at the site, with more than 800 laborers settled in the construction site. Their daily life and consumption will promote the sales of daily necessities and development of service industry in Baiyang Industrial Park.

After the port and the logistics park are completed and put into operation, more than 1500 labors will be employed here to promote development of counterpart industries, such as logistics, transportation, auto repairing, catering and real estate. A residential area with an area of 1.73km<sup>2</sup> is planned to be established 4000m away from the logistics park. Phases I & II of the residential area have been completed, and Phase III is to be completed by around 2020. The whole area will provide accommodation for 30,000 people and it will be a low-carbon and ecologically livable town.

In addition to promote the economic development of Baiyang Industrial Park, the project may also bring risks to the lifestyle of local residents by restructuring their lifestyle, damaging their livelihood or increasing their living expenses, etc.

The project mainly influences two villages, namely Cunyazi Village and Guixihu Village. The villagers make a living by agricultural production (mainly citrus). However, with the changes of rural economic structure, the proportion of income from agricultural production is consistently decreasing among the total revenue of the households, even as low as 1/4 for now. Most people seek for jobs or get employed in non-agricultural production activities to make a living. The households that make a living by citrus plantation account for less than 10% of all. With the implementation of the project, the percentage of citrus plantation will continue to decrease. As a result, for the households which mainly depend on citrus production, how to acquire sustainable income is one of the challenges that all communities have to confront.

**Table 9.2-2 Basic Economy Status of the Residents in the Project Area**

Item	Average	Maximum	Minimum
Monthly income per capita (Yuan)	1087.56	5000	600
Housing area (m <sup>2</sup> )	410.50	800	72
Period of Houses(Years)	18.8	41	3

Item	Average	Maximum	Minimum
Area of Citrus (mu)	4.70	14	0
Proportion of agricultural income among all (%)	24.30	50	0

Data source: Sampling survey on affected households by Wuhan University, Engineering resettlement research center, July 2015.

**Table 9.2-3 Proportion of agricultural income of all revenues**

Proportion of agricultural income among all	Quantity of Households	Percentage (%)
50-100%	2	3.23
20-50%	11	17.74
10-20%	29	46.77
0-10%	20	32.26
Total	62	100.00

Data source: Sampling survey on affected households by Wuhan University, Engineering resettlement research center, July 2015.

### 9.3.2 Project impacts on social development and stability

In spite of many positive social impacts, the port and the logistics park may bring risks to social development and stability.

In terms of positive aspects, this project offers a valuable opportunity for local development, since the port and the logistics park will create more jobs, drive local economic development and change the pattern of urban construction. However, in this process, some issues may bring risks to social stability if not well handled. For example, the port and logistics park both require land acquisition and those whose lands are acquired must be resettled and compensated reasonably; otherwise, the project may encounter obstructions. For another example, during project construction, most of the workers are not from the local and may have conflicts and disputes with the locals due to traffic, project impacts or other trivia things. Small conflicts may evolve into big problems if no proper measures are taken. Hence, PMO has formulated rules and regulations for elimination and control of potential risks.

It is worth-mentioning that the project will bring adverse impacts on the females in Yanzishan Village and Guixihu Village. In these two villages, the basic pattern of family economy is that the male are engaged in non-agricultural occupations outside to earn money for the family, whilst the female usually take care of the citrus at home. Upon the implementation of the project, these affected households will be resettled to the urban areas and no one will tender the citrus plantation. The females will be more influenced by this wholly new living environment and production mode.

### 9.3.3 Project impacts on local traffic

Baiyang port and the logistics park generally will promote the development of multimodal transport system in the local area. But during construction process, construction and transporting vehicles carrying construction materials will travel frequently on G318 which is nearby the logistics park and may increase the traffic

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volume of G318, especially that the heavy-loaded vehicles may damage the pavement of roads in the surrounding area. The traffic situation is shown in Figure 9.2-1 and 9.2-2.



**Figure 9.2-1 mixed traffic on G318m in the surrounding of the logistics park**



**Figure 9.2-2 No traffic lights at intersections**

According to the forecast of the FSR, the freight volume of the port and logistics park will exceed 14 million tons by 2025, above 50% of which depend on road transportation. That is to say, after the project is put into operation, the large transportation volume certainly will increase traffic pressure of G318, especially the section at Baiyang Town and will influence on road maintenance and livelihood of residents along G318. On one hand, current conditions of G318 may be unable to endure the heavy load trucks; on the other hand, non-motorized vehicle lane is not built at the section from the logistics park to Taibaochang, so the pedestrians, motor vehicles and non-motor vehicles travel on the road disorderly. No basic traffic safety

facilities and signs including traffic lights are installed at intersections of G318 in Baiyang Town, so traffic accidents may occur.

### 9.3.4 Other induced impacts and risks

The construction and operation of the port and logistics park may induce other impacts, positive or negative, mainly to the social public and other stakeholders in the local area. For example, the project may have impacts on the enterprises (of all kinds, such as transportation, logistics and port etc.) nearby Baiyang Industrial Park. Positively. *The project will influence the daily life of residents in Baiyang Township and the emerging Baiyang New City. Social infrastructures will be improved.* On one hand, the project may form scale economy with the enterprises, establishing the multimodal transport and logistics networks among waterway, railway, roads and air freights. *The project will promote the city development, commercial activities, public infrastructures and social services in Baiyang Township.* On the other hand, the port and logistics park have competition with other similar enterprises and a new market pattern may appear for local logistics industry. In order to pursue benefits and avoid risks, this project has been included in the *Master Plan of Local Economic and Social Development of the High-tech Development Zone*, for the purpose of rational layout, proper division of work, harmonious development and co-prosperity.

Another induced impact of the project is that, high mobility of people resulting from project construction and logistics may promote disease transmission and therefore expose threat to human health. So, prevention and response plan shall be developed. See details in Section 5.7.

## 9.4 Impact and risks of land acquisition and demolition

### 9.4.1 Impact of land acquisition and demolition

According to the survey of the project impact areas by the Baiyang Industrial Park Resettlement Office, the land acquisition and demolition of the project involves two villages, namely, Yazishan Village and Guixihu Village.

In terms of house demolition, this project needs to permanently demolish private buildings of 137068.18 m<sup>2</sup>, which will affect 252 households and 911 persons.

In additional to personal structures, the project also involves enterprises and structures of companies, totally 6, covering the total floor area of 6019.20m<sup>2</sup> and the affected staff 44.

The status of demolition is shown in Table 9.4-1 and Table 9.4-2.

**Table 9.4-1 Private buildings to be demolished**

Affected village	Number of household	Number of people	Area of demolition (m <sup>2</sup> )
Yazishan Village	33	110	124514.90
Guixihu Village	219	801	12553.28
Total	252	911	137068.18

**Table 9.3-2 Affected enterprises and companies**

Enterprise or institution	Area of demolition (m <sup>2</sup> )			Affected staff
	Brick-concrete	Brick-wood	Simple	
Guixihu Village Committee	300	500	100	0
Green Waxing Plant	600	700	300	20
Guixihu Waxing Plant	300	700	300	18
Guixihu Steel Pipe Rental Shop	0	200	500	4
Guixihu Sand and Stone Factory	800	500	200	
Pressurization room of Baiyang Water Plant	19.2	0	0	0
Total	2019.2	2600	1400	44

The land acquisition of the project involves permanent occupation of 2,139.8 mu, all being collective land, including: 1,716.18 mu of Guixihu Village and 417.82 mu of Yazishan Village. All the land is collectively-owned. In total, 463 households and 1,616 persons are affected, in which 192 households and 666 persons come from Yazishan Village, and 271 households and 950 persons come from Guixihu Village. The details of land acquisition are shown in Table 9.3-3.

**Table 9.3-3 Details of land acquisition (mu)**

Village	Orchard	Fish pond	Land for construction and other use	Total
Guixihu Village	1,154.72	184.2	383.06	1,721.98
Yazishan Village	361.99	0	55.83	417.82
Total	1,516.71	184.20	438.89	2,139.80

#### 9.4.2 Risks of resettlement

As seen from the social impacts and risks of major construction projects in China, land acquisition and house demolition carry high risks. Since the project requires many land acquisition and house demolition in Yazishan Village and Guixihu Village, it will exert significant impacts on the residents and have high risks in resettlement.

##### 1. Attitude of affected persons towards standards and policies of resettlement

The resettlement compensation standards for this project have been prepared upon negotiation and in compliance with applicable laws and regulations at all levels.

According to *Notice of the Hubei Provincial Government on Issuing the Unified Annual Output Value and Comprehensive Price of Acquired Land in Hubei (March 13, 2014)*, compensation will be paid according to the unified annual output value of the acquired land. The compensation should be 19 times of the unified annual output value, including land compensation and resettlement subsidies, among which land compensation shall be 9 times of the unified annual output value. 70% of land compensation will be directly paid to the land-acquired households and 30%

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will be paid to the village collective for public welfare undertakings. On the other hand, the resettlement subsidies are 10 times of the unified annual output value and it will be fully paid to the affected residents. Compensation for standing crops will also be directly paid to affected residents. The compensation coefficient for orchard is 1.2 times of the unified annual output value. Moreover, For land-acquired villagers whose average area of cultivated land is less than 0.3 mu, they will be insured under the social pension program with social pension compensation be paid off to them in full. For people below the age of retirement, they can choose to be insured either under the *Pension System of Urban Employees* or under the *Pension System of Rural and Urban Residents*.

Displaced families can either choose cash compensation or resettlement house compensation.

For families who choose cash compensation, compensation for the housing and ancillary facilities to be demolished will be paid in cash, and the families can use the compensation to get resettled by themselves. Cash compensation must ensure that the compensation payment is no less than the replacement cost of the demolished house.

For families who choose resettlement house compensation, they will be compensated with a free resettlement house according to the area of the demolished residential house. However, the maximum area of the resettlement house shall not exceed 240 m<sup>2</sup>.

Areas exceeding 240 m<sup>2</sup> will be compensated by cash.

However, if the average area per capita of the displaced families is less than 40 m<sup>2</sup>, the average area per capita of resettlement house shall be 40 m<sup>2</sup>.

Due to different types and structures of resettlement house, the area may exceed that of the demolished house. In this case, the excessive area shall be purchased by the displaced households by cost price of constructing the resettlement house.

The demolished house will be compensated by RMB 100-400 /m<sup>2</sup> for the compensation of decoration, varying from the complexity and quality of the decoration. Apart from the above compensations, the displaced households will also obtain compensation for moving out, transition and relocation.

Generally, the above standards comply with existing national and local laws and can meet the basic conditions for rehabilitation of affected persons. However, as the living conditions of each household vary from each other, they may hold different attitudes towards the above policies.

Particularly, Baiyang Industrial Park was formerly administered by Zhijiang City and managed by Yichang Hi-Tech Zone in 2013, so that the compensation standards may be executed in compliance with standards of Zhijiang City. This may result in differences between the executed standards and those of the Hi-tech Zone, and therefore cause suspicion and grievance of the affected persons. For this reason, public consultation and participation are of vital importance and should be referenced to confirm the feasibility of the resettlement compensation standards.

## **2. Difficulties for land-acquired households rehabilitation**

The land acquisition of the project will involve more than 2000 mu in Yazishan

Village and Guixihu Village. According to the survey, about 36% of the affected households (167 households) have more than 50% land to be acquired, and 23.97% have more than 75% of their land to be acquired. If the compensation is inadequate or no reasonable arrangement for their livelihood, then the income of this part of household will be seriously impacted. The impacts of land acquisition on the farmers are shown in Table 9.3-4.

Although, according to the social economic survey, the rural income only accounts for about 20% of the total family income for these affected households, but since some families (3% according to the survey) mainly rely on rural income for a living; land acquisition will have great influence on their income. Special attention shall be paid on these households although there are not too many households.

### 9.3-4 Impact rate of land acquisition on rural households

Percentage of orchard acquisition	Guixihu Village		Yazishan Village		Total	
	No. Of households	Percentage (%)	No. Of households	Percentage (%)	No. Of households	Percentage (%)
75-100%	62	22.88	49	25.52	111	23.97
50-75%	18	6.64	38	19.79	56	12.10
10-50%	25	9.23	45	23.44	70	15.12
0-10%	166	61.25	60	31.25	226	48.81
Total	271	100.00	192	100.00	463	100.00

### 3. Grievance with construction & allocation of resettlement houses

The affected households of this project are all resettled in Baiyang Industrial Township Phase II Resettlement Community. Baiyang Industrial Town is 1,000 m away from Taobaochang resettlement residential community. There are four types of resettlement houses: 89 m<sup>2</sup>, or 93 m<sup>2</sup>, 120 m<sup>2</sup> and 139 m<sup>2</sup> to choose from by the affected household. The PMO will ensure that the following basic living conditions are met when the resettlement houses are delivered to the households: Main structure of the house, roofing and waterproofing works are complete; internal and external walls are plastered with cement mortar; equipped with ordinary wooden doors, aluminum windows; supply of water, electricity, gas, cable TV and Internet. Currently, the main works of the resettlement houses have been completed and exterior wall decoration is in progress. The resettlement houses can be put into service after 2016.

As seen from the construction site and the past experience of house resettlement in Baiyang Phase I Port, the relocated households' living conditions will witness four changes: First, the living area will be guaranteed or even expanded; secondly, the quality of houses and living environment will be improved; thirdly, relocated households will enjoy modern urban life; fourthly, relocated households' values of real estate will significantly increase. However, there are still some adverse effects in selecting the resettlement houses. Properly resolution of these issues will promote the progress of relocation and maintain a good social environment. Related issues in the public participation include:

1) Will the resettlement houses be delivered as scheduled? Some of the affected households are worried that the transition period by the PMO will be extended and

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influence the convenience of life;

2) Is allocation of resettlement houses open and transparent? The affected households strongly urge the transparency in house allocation.

3) Are construction quality of resettlement houses guaranteed? Affected households wish PMO and the construction unit will ensure the construction quality.

4) Will the size of resettlement houses meet the needs? Seen from past practice of Phase I Baiyang Port, the size of some resettlement houses hasn't met the requirement of relocated households. Hence, the affected households hope the situation will be improved in Phase I of the project.

5) Will supporting services and facilities be improved as soon as possible? Affected households hope that the various service facilities such as clinics, activity center, markets, and bus stations can be built and put into service as soon as possible.

To solve the above-mentioned issues, the PMO has prepared a detailed Resettlement Action Plan in accordance with the procedures of domestic construction projects and the requirements of WB. The social impacts of land acquisition and demolition will be mitigated to the largest extent.

#### **4. Grievance with the management and usage of the collectively retained part in land compensation fund**

30% of the land compensation will be retained as the collective fund, to be used for development of public welfare and collective economy. The management and usage of the funds is an important aspect to the villagers' concern. As seen from the current status of Yazishan Village and Guixihu village and the project impacts, the villagers of Yazishan Village and Guixihu Village both wish to develop collective economy with the fund. However, relevant plans and specific projects cannot be implemented in a short period. Messy fund management will damage the interests of all villagers and bring negative impacts on the implementation of the project. To solve this problem, the PMO has also prepared detailed measures in *Resettlement Action Plan*.

#### **5. Grievances with information disclosure and problem solving**

The resettlement works not only need to meet the national/local regulations and policies, but also need to be open and transparent. Information disclosure should be carried out in different channels and at different levels. Hence, smooth feedback channel and problem-solving mechanism shall be prepared. Therefore, the PMO and Resettlement Office at all levels have prepared detailed information disclosure system and complaints/grievances feedback mechanism in the RAP.

### **9.5 Management of construction teams and camps**

The construction period of the project is 3-4 years. The number of workers will be more than 200 (800 in peak periods). The workers of different construction teams may come from different construction units and regions. According to the general experience, 90% of workers come from the company of the winning bidder or the non-local places. The workers from the same geological areas may establish a relatively tight relationship. As the workers will live in a relatively narrow place, its management is a great challenge. From the past experience of domestic and

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foreign construction projects, the management of construction teams and camps has potential risks. Hence, relevant preventative measures shall be taken.

### **9.5.1 Management risks of construction teams and camps**

The risks that may arise on management of workers and camps during the construction period mainly include:

- 1) Grievance of local residents due to damages in road traffic, water, and other public facilities brought by construction machineries.
- 2) Conflicts and disputes between local residents and construction teams due to noise/dust/water pollution, etc.
- 3) Disputes with local residents due to use of local public services or maintenance of construction sites.
- 4) Disputes due to mismanagement of construction teams from different subprojects;
- 5) Disputes with local residents in economic activities and interactions.
- 6) Disputes and conflicts due to lifestyle, social customs, ethics and others,

### **9.5.2 Management measures of construction teams and camps**

In order to prevent the above-mentioned issues, Yichang Transportation Investment Co., Ltd has prepared the *Administrative Measures for Construction of Baiyang Port and Logistics Park Project* (see the annex of Chapter 11 environment management plan). The measures cover selections of the construction teams, daily management and code of conduct for construction workers. Yichang Transportation Investment Co., Ltd requires that all parties involved in the construction shall comply with the administrative measure and have it included in the two-side contract. Baiyang Industrial Park will arrange specialized agencies and personnel to help Yichang Transportation Investment Co., Ltd and the Construction Company to conduct monitoring and inspection works. PMO will carry out periodic inspections in every quarter. Any problems found will be timely rectified by the contractor. If the Contractor is detected with serious problems and ineffective rectification measures, he will be dismissed.

## **9.6 Mitigation measures of social impacts**

As the interests of the stakeholders are closely related to the project during construction and operation period, PMO will work with Yichang Hi-tech Zone Management Committee and Baiyang Industrial PMO in taking effective measures to minimize all the negative social impacts or risks. Detailed measures are shown in Chapter 11.

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## 10 Information Disclosure & Public Participation

Public participation is an important part in environmental impact assessment. It is a two-way exchange between PIAs, evaluation agencies and the masses. Through public participation, we can truly understand the environmental issues of public concern. By public participation, the work of environmental assessment will be more open, and the conclusion will be more practical.

### 10.1 Purpose & method

- 1) The aim is to let the public know about the purpose, scale, and location of the project, as well as its potential impacts during and after its construction period. Besides, the aim is to let the public know the policies and measures to be taken so as to win the public's understanding, support and cooperation;
- 2) The results of public participation will help us analyze the characteristics of polluted environment as well as the status quo of environmental factors, thus reflecting the objectives of EIA and protect the public's interest;
- 3) The public is familiar with the resources involved in EIA, such as natural, ecological, and living resources. Through public participation, the public are invited to participate in the confirmation of environmental protection measures. Thus, these measures will be more practical and efficient;
- 4) The public will get an opportunity to discuss the project feasibility.

### 10.2 Public participation method and survey scope

The EA consultant will survey the surrounding areas of the project, in accordance with the requirements of Interim Measures for Public Participation in Environmental Impact Assessment (H.F [2006] No. 28), WB's OP4.01-*Environmental Assessment* and BP17.50-*Information Disclosure*. The interviewers are mainly relevant functional departments and the directly influenced residents, relevant public institutions, etc.

### 10.3 First round information disclosure and public consultation

In accordance with the requirements of Interim Measures for Public Participation in Environmental Impact Assessment (H.F [2006] No. 28), WB's OP4.01-*Environmental Assessment* and BP17.50-*Information Disclosure*, the EIA unit will be entrusted by the owners and disclose the information of EIA to the public in a way that familiar to the public.

#### 10.3.1 Public disclosure

Public disclosure will be conducted at the project site on issues such as the project's basic information and environmental impacts. (See the link: [http://www.hbepb.gov.cn/wsbs/gsgg/hpgs/hpdwhp/201511/t20151110\\_81165.html](http://www.hbepb.gov.cn/wsbs/gsgg/hpgs/hpdwhp/201511/t20151110_81165.html)). See Figure 10.3-1. During the public disclosure, no feedbacks have been received.



First round online disclosure

Public disclosure on project site

Figure 10.3-1 Public disclosure

### 10.3.2 Opinions of the surveyed public

Central-Southern Safety & Environment Technology Institute Co., Ltd. has twice assigned designated persons to survey the public opinion on the project area. The designated person has provided the local people with the overview, scale and significance of the project, as well as the project's positive/negative impacts. After that, a questionnaire has been provided to the respondents. Then the results of the questionnaires will be summarized and analyzed. The questionnaire is as shown below.

#### 10.3.3 Questionnaire Survey

The main target of the questionnaire involves the residents in the affected area. The representatives include residents and workers in surrounding villages and communities of the project area.

##### 1) Basic situation of respondents

We sent out a total of 45 questionnaires and received 45 effective ones. The recall rate is 100%. Composition of respondents, see Table 10.3-1.

Table 10.3-1 Basic information of respondents

Project	Category	Population	Proportion(%)
Age	Under 30	3	7
	31-40	6	13
	41-50	14	31
	51-60	16	36
	Over 60	6	13
Occupation	Farmer	42	93
	Employee	2	4
	Unknown	1	2
Education level	Primary school	3	7
	Junior middle school	28	62
	High school / polytechnic school	10	22
	College degree or above	4	9

The table above shows that the participants in the survey are representative and typical, involving different ages, gender, education level, and occupation. The results are reliable.

## 2) Results and analysis of the survey

See Table 10.3-2 for the first results of the questionnaires for public participation in this project.

**Table 10.3-2 Summary of public opinions**

No.	Main survey items	Opinions	Number of people (person)	Proportion (%)
1	Attitude towards the construction of this project	Supportive	44	98
		Opposed	0	0
		Indifferent	1	2
2	Impact on personal income during project construction	Beneficial effects	25	56
		Negative effects	10	22
		No effect	10	22
3	How is the environmental quality in current residence?	Good	28	62
		Average	16	36
		Poor	1	2
4	Main environmental problem at project site?	Air pollution	17	38
		Water pollution	5	11
		Noise	13	29
		Ecological damage	10	22
5	Environment problems that you are mostly concerned about	Noise	10	22
		Ecological damage	14	31
		Landscape destruction	5	11
		Water pollution	9	20
		Air pollution	7	16
6	Which factor brings greater environmental impact?	Noise	20	44
		Exhaust	5	11
		Water pollution	7	16
		Dust	13	29
7	Land acquisition and house demolition are needed in this project. Which kind of compensation do you prefer?	Cash compensation	15	33
		Relocation	29	65
		Others	1	2
8	Degree of impact on the Yangtze River	Great	1	2
		Medium	25	56
		Little	19	42
9	<i>Impact on economic development of this region</i>	Great	44	98
		Little	1	2
		None	0	0
10	Can you accept the environmental impact?	Acceptable	44	98
		Unacceptable	1	2
		Indifferent	0	0
11	Will you accept land acquisition, house demolition and relocation?	Yes	40	89
		No	0	0
		Accept under certain conditions	5	11

No.	Main survey items	Opinions	Number of people (person)	Proportion (%)
12	As to mitigation measures, what is your recommendation?	Greening	35	78
		Watering	7	16
		Dust-proof windshield	1	2
		Others	2	4

According to our survey, most people think their surrounding environment is not bad. They have certain awareness on environmental protection. However, this awareness should be strengthened through propaganda and education on environmental protection is needed. On the other hand, most people are more concerned about environmental problems like ecological damages, noise and water pollution. During the construction period, the construction unit would take spray water to reduce atmospheric effects. The public also showed some concerns on the following matters: a) For land acquisition and centralized resettlement, part of the affected people still feel worried about living environment changes and future livelihoods; b) Before land acquisition of the project, in the citrus orchard, the number of women accounts for a large part. Hence, the land acquisition may affect their participation in economic activities and their economic status in the family. Some women worry that it will be difficult to find a non-agricultural job after land acquisition due to their poor education level; the women also worry that it will be difficult for them to adapt to the urban life style after centralized resettlement.

Solutions to issues like ecological damage and relocation will be further illustrated in EMP; as to problems caused by resettlement, measures will be provided in RAP; as to the recommendations of accelerating the construction speed, we will report it to the owners of the project.

### 3) Consultation with originations

We selected 5 unit/enterprises for investigation which are involved in land acquisition: Guixi Lake Village Committee, Guixi Lake Waxing Plant, Guixi Lake Gravel Plant, Guixi Lake Tube Rental Station, and Huacheng Machinery Plant. For details of the results of questionnaires, see Table 10.3-3.

**Table 10.3-3 Summary of public participation-units/enterprises**

No.	Main survey content	Opinion	Number of people(person)	Proportion (%)
1	Attitude towards the construction of this project?	Support	4	80
		Opposition	1	20
		Indifferent	0	0
2	Economic impact on the regional/departmental development brought by the construction	Beneficial effects	5	100
		Negative effects	0	0
		No effect	0	0
3	Environmental quality along the project site	Good	0	0
		Average	4	80
		Poor	1	20
4	The main environmental	Air pollution	5	100

No.	Main survey content	Opinion	Number of people(person)	Proportion (%)
	problem at project site? (Multiple choice)	Water pollution	2	40
		Noise	5	100
		Ecological damage	0	0
5	The environment issues that you are most concerned about (Multiple choice)	Noise	5	100
		Geological disasters	1	20
		Ecological damage	0	0
		Landscape destruction	0	0
		Water pollution	4	80
		Air pollution	3	60
6	Which factor brings greatest environmental impact in the operation phase? (Multiple choice)	Noise	1	20
		Exhaust	5	100
		Water pollution	2	40
		Dust	2	40
7	<i>Whether the construction will help improve people's life quality in the region</i>	Yes	1	20
		No	0	0
		Little impact	4	80
8	Impact on ecological environment and agricultural resources along the construction site	Great impact	0	0
		Little impact	5	100
		No impact	0	0
9	Impact on Yangtze River	Great	0	0
		Medium	4	80
		Little	1	20
		Almost no impact	0	0

**Statistical analysis:** The recovery rate of the questionnaires is 100%, indicating that most of the units/enterprises are willing to take this opportunity to express their opinion. They have great expectation that their voice will be heard. Guixi Lake Waxing Plant holds opposite opinions on the construction as they think the construction will expropriate the plant. Based on the survey, we find that the gravel plant shall only be temporarily occupied. Other units/enterprises are supportive of the project, and hope the progress of construction could be accelerated.

## 10.4 Second round of public consultation

### 10.4.1 Information disclosure

#### (1) Second round of online disclosure--abridged edition

After completing the EIA draft, we conducted online publicity (abridged edition) on the website of Hubei Provincial Environmental Protection Bureau on December 7, 2015([http://www.hbepb.gov.cn/wsbs/gsgg/hpgs/hpdwhp/201512/t20151208\\_81744.html](http://www.hbepb.gov.cn/wsbs/gsgg/hpgs/hpdwhp/201512/t20151208_81744.html)) in solicitation of public opinions and suggestions. Up to now, we haven't received any feedback yet.

#### (2) Online disclosure-whole copy

The project construction unit ((Yichang Transport Investment Co., Ltd.) provided information of EIA report and public participation on its company website in relevant to this project on February 4, 2016:

<http://www.ychxit.cn/zixunzhongxin/tongzhigonggao/2016-02-04/461.html>.

### (3) Newspaper disclosure

The Construction Unit provided information on EIA report (download link for whole copy) and environmental impact on paper of the three Gorges Evening News on February 5, 2016. And the full report can be downloaded from the website.

Please see Figure 10.4-1 for details.



Figure 10.4-1 Shots of information disclosure

### 10.4.2 Objectives of questionnaire survey and method

Questionnaires were provided to the affected people and units/enterprises in project affected area. Two types of questionnaire surveys are described separately in the following sections, including the questionnaire to the surrounding units of the project, questionnaires to the surrounding villages and residents.

### 10.4.3 Consultation with organizations

Questionnaires were provided to eight units/enterprises, The results of questionnaire survey are shown in Table 10.4-1.

**Table 10.4-1 Information of investigated units/enterprises**

No.	Units/enterprises	Contact tel.	Filled by	Attitude
1	Yichang High-tech Zone Land Resources Bureau	18907205101	Zhao Xizheng	Supportive
2	Yichang Management Office of Fishery, Ship Inspection and Port Supervision	15586377877	Chen Xueyong	Supportive
3	Yichang High-tech Zone Planning Bureau	13207224663	Jiang Yang	Supportive
4	Guixihu Village Committee (Baiyang Town, Zhijiang City)	15171777388	Jiang Bixin	Supportive
5	Yichang Baiyang Port Containers Co., Ltd.	13972010935	Man Yongjie	Supportive
6	Yichang Baiyang Logistics Park Co., Ltd.	13807203902	Liu Xu	Supportive
7	High-tech Zone Branch of Yichang Environmental Protection Bureau	18007201155	He Kun	Supportive
8	High-tech Zone Branch of Yichang Water Conservancy and Hydropower Bureau	15171746147	Li Yongtao	Supportive
9	Yichang Chinese Sturgeons Management Office	13618606080	He Bin	Supportive

In conclusion, all nine units/enterprises agree with the implementation of the project and they hold that this project complies with local plan and will promote local economic development.

### 10.4.4 Consultation with residents

To fully reflect the real ideas of the residents in project affected area, we conducted a site survey in March 2016. The investigated residents include local farmers, workers, enterprise employees and staff to be representative of all the affected residents. Totally 150 questionnaires were issued, and 143 were filled and recovered, accounting for 95.3%. Information of the investigated residents is shown in Table 10.4-2.

**Table 10.4-2 Information of investigated residents**

Investigated residents		Number and proportion	
		Number	Proportion (%)
Gender	Male	100	70
	Female	43	30

Investigated residents		Number and proportion	
		Number	Proportion (%)
Age	22-30	18	13
	21-40	20	14
	41-60	92	64
	Above 60	13	9
Educational background	Primary school or below	45	32
	Junior middle school	72	50
	High school and polytechnic school	12	8
	College degree or above	14	10
Occupation	Enterprise employees	11	8
	Farmers	89	62
	Workers	1	1
	Others	42	29

(7) Statistics of content of questionnaires

Before issuing questionnaires, we introduced the project and its impacts on environment to the investigated residents. Statistics of survey results are shown in Table 10.4-3.

**Table 10.4-3 Statistics of survey results**

Content of questionnaire		Number	Proportion (%)
1. Attitude towards the construction of this project	Supportive	117	82
	Opposed	0	0
	Indifferent	26	18
2. Impact on personal income during project construction	Beneficial effects	105	73
	Negative effects	1	1
	No effect	37	26
3. How is the environmental quality in current residence?	Good	84	59
	Average	30	21
	Poor	29	20
4. Main environmental problem at project site?	Air pollution	66	46
	Water pollution	35	24
	Noise	66	46
	Ecological damage	17	12
5. Environment problems that you are mostly concerned about	Noise	66	46
	Ecological damage	32	22
	Landscape destruction	9	6
	Water pollution	35	24
	Air pollution	52	36
6. Which factor brings greater environmental impact?	Noise	87	61
	Exhaust	27	19
	Water pollution	41	29
	Dust	19	13
7. Land acquisition and house demolition are needed in this project. Which kind of compensation do you prefer?	Cash compensation	78	55
	Relocation	61	43
	Others	4	2

Content of questionnaire		Number	Proportion (%)
8. Degree of impact on the Yangtze River	Great	2	1
	Medium	59	41
	Little	82	57
9. Impact on economic development of this region	Great	137	96
	Little	6	4
	None	0	0
10. Can you accept the environmental impact?	Acceptable	133	93
	Unacceptable	3	2
	Indifferent	7	5
11. Will you accept land acquisition, house demolition and relocation?	Yes	132	92
	No	0	0
	Accept under certain conditions	11	8
12. As to mitigation measures, what is your recommendation?	Greening	72	50
	Watering	32	22
	Dust-proof windshield	18	13
	Others	56	39
	Supportive	18	13

### (3) Analysis of survey results

As calculated, opinions of investigated residents are analyzed:

#### ① Degree of satisfaction with current environmental conditions and the outstanding environmental problems

59% of the investigated residents thought that the current environmental quality was good, 21% thought it was common, and 20% thought it was poor. 46% of the investigated residents considered air pollution as the greatest environmental problem, 46% thought the greatest environmental problem is noise, 24% thought it was water pollution and 12% thought it was ecological damage. It is concluded that the environmental conditions have to be improved.

#### ② Environmental problem most concerned by the investigated residents

46% of investigated residents cared about noise, 36% cared about air pollution, 24% cared about water pollution and 22% cared about ecological damage, and 6% cared about landscape damage.

#### ③ Environmental impacts of the project

Among the investigated residents, 73% thought the operation of the project would cause noise, 29% thought it would cause water pollution, 19% thought it would cause automobile exhaust, and 13% thought it would cause dusts; 57% thought project impacts on the Yangtze River was small, 41% thought it was medium and 1% thought it was significant; 93% expressed the environmental impacts of the project were acceptable, 5% didn't care about that, and 2% couldn't accept. All concluded that all pollutants during project implementation must be well handled to avoid secondary pollution.

#### ④ Project impacts on local residents and society

Among the investigated residents, 73% thought the project would bring beneficial

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effects on their life and incomes, 26% thought it would bring no impacts and 1% thought it would bring negative impacts; 96% thought the project would greatly promote local economic development, and 4% thought it wouldn't greatly promote local economy. All concluded that the public show confident towards the construction of the proposed project.

⑤ **Attitudes toward land acquisition and house demolition**

Among the investigated residents, 92% would accept land acquisition, house demolition and resettlement but 8% wouldn't accept; 55% preferred cash compensation, 43% wanted to be relocated, and 2% preferred the compensation by the combination of the two.

⑥ **Basic attitudes towards the project**

100.00% of the investigated residents supported the construction of the project and no one opposed the project. This shows that the project complies with local residents' wishes and interests.

In conclusion, all of the investigated residents are supportive for the construction of the project.

**10.5 Conclusions of public participation**

To know the opinions of the local residents, a questionnaire survey was conducted and two public disclosures were conducted. The PIU should consider opinions and suggestions of the public and implement necessary environmental protection measures during project construction.

Survey results show that the project is supported by the majority of local residents. They consider that the project would promote local economic and social development, increase their incomes and improve regional logistics infrastructure. The residents believe that the project is beneficial to the local socio-economic development and will increase their income and improve the development of logistics infrastructures, i.e. project is consistent with the public's wishes.

The surveyed residents have provided lots of advices on environmental protection. These advices provide guidance for project design and construction and will attract attention of the PIU, government authorities and other relevant departments.

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## **11 Environmental and Social Management Plan**

This Environmental and Social Management Plan (ESMP) is formulated to provide measures to avoid reduce or mitigate the potential negative social and environmental impact of the proposed project identified in EIA to an acceptable level. It mainly consists of: institutional arrangement, major environmental impacts during project implementation and operation, mitigation measures during project phases, monitoring plan and reporting, training programs and budgeting. During project appraisal, this ESMP will be put upon review and approval by the PMO of WB Funded Yichang Three Gorges Modern Logistics Infrastructure Project. It will be carried out fully during the implementation stage of the project.

During project preparation phase, the EIAR is prepared to ensure all the proposed environmental issues will be settled and included in the phases of project implementation; ESMP is formulate to propose methods and measures to avoid reduce and mitigate these impacts to an acceptable level. Generally, the ESMP has the following components.

### **11.1 Institutional arrangement**

Hubei EPB is responsible for reviewing and approving the EIAR during project preparation phase and the inspection & acceptance of project completion. On the other hand, local EPB is responsible for supervision during project construction and operation.

PMO is located in the Management Committee of Three Gorges Hub and is responsible for coordinating related authorities and supervising project progress of the PIU, and communicating and reporting to the WB. The Management Committee of Three Gorges Hub is established by Yichang Party Committee and Municipal Government to accelerate the construction of the Three Gorges Pivotal Port and the Three Gorges Modern Logistics Center.

The PIU(Yichang Transportation Investment Co., Ltd.) is responsible for carrying out environmental management, formulating the environmental action plan, coordinating environmental management work between authorities and the Contractor, guiding the Contractor in the execution of the management measures, and execution and management of environmental action plan during project construction, and arranging feasibility study, environmental protection plan and environmental management during project design phase.

Responsibilities of related agencies and parties are listed in Table 11.1-1

#### **11.1.1 Project Management Unit**

The provincial environment protection department is responsible for the macro supervision and management of the project. With the leadership of the provincial EPD, Yichang municipal EPB will be responsible for the daily inspection and management of the project, monitor the PMO and PIUs to implement in accordance with ESMP; Responsible for the construction, completion and acceptance, review of operation, supervision and management of all environmental protection equipment.

The environmental management responsibilities of the PMO during construction

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period include:

1) Based on relevant national regulations and rules for construction management and with consideration on the specific construction plan of the proposed project and the pollution prevention measures proposed in this report, develop specific environmental protection management methods and detailed environmental management plans, in particular, conduct training for contractors and environmental supervising engineers on environmental knowledge and environmental monitoring.

2) Regularly inspect the construction sites, supervise the implementation status of the environmental protection management methods by the contractors, timely identify and correct activities that do not comply with the methods.

3) Timely handle complaints or pollution incidents during the construction.

### **11.1.2 Project Implementation Unit**

In order to effectively control the environmental pollution during the construction period, the project implementation unit should attach great importance to the construction quality, progress and safety while paying more attention to the implementation of the concept of civilized construction and the environmental mitigation measures.

The project implementation unit should employ an experienced consultant to carry out external environmental monitoring during the project implementation phase, supervise the implementation of the environmental protection measures during the construction period by the contractors, determine the effectiveness of the environmental mitigation measures through necessary sampling and testing, and propose improvement measures if necessary.

### **11.1.3 Contractors**

1) The contractors (i.e. the construction units) should follow the contractual requirements, relevant laws and regulations of environmental protection formulated by the state and local governments and organize the construction activities accordingly. They should also implement the environmental protection measures proposed in the EIA document and regularly submit the Environmental Management External Monitoring Report to the PMO.

2) The contractors should designate full time environmental management personnel and Environment, Health and Safety personnel to be stationed at each construction site to be responsible for on-site control and management. Especially for high-noise, high-vibration construction equipments, the operating time should be strictly controlled.

The environmental monitoring during the construction period and the operation period shall be carried out by qualified monitoring unit. The environmental supervision shall be implemented by the environmental supervision unit. After the completion of each sub-project, environmental protection departments will be set up with full-time staff to be in charge of the environmental protection work.

The responsibilities of the project management organizations can be referred to Table 11.1-1.

**Table 11.1-1 Key Environmental Management Responsibilities**

Stakeholder	Responsibility	Remarks
Design and preparation		
PMO/Project Owner	<ol style="list-style-type: none"> <li>1) Overall supervision of EMP preparation; Liaison with relevant government authorities for environmental management;</li> <li>2) Organize the FSR, and EMP preparation;</li> <li>3) Ensure inclusion of environmental measures in works contracts</li> </ol>	
Design Institute	Incorporate mitigation measures into technical specifications of bidding documents.	
Local EPB	Review and approve EIA, ensure EMP funding availability	
Others	Information disclosure and public consultation.	
Construction		
PMO/Project owner	<ol style="list-style-type: none"> <li>1) Ensure that contractors' environmental responsibilities are clearly specified in relevant contract documents;</li> <li>2) Manage and supervise the EMP implementation, ensure the contractors will fulfill their environmental responsibilities;</li> <li>3) Hire independent environmental monitor to check the EMP implementation and monitor discharges;</li> </ol>	
Contractor	<ol style="list-style-type: none"> <li>1) Implement mitigation measures as per bidding documents, contract and EMP, provide regular reports accordingly.</li> <li>2) Designate special staff to conduct on-site environmental management, and especially conduct management on various pollution sources.</li> </ol>	The main responsible body of the environmental protection measures
Supervision Engineer	Supervise the construction activities and the implementation of EMP measures by contractors as per contract requirements.	Submit the supervision report
Local EPB	<ol style="list-style-type: none"> <li>1) Inspect the operation of treatment facilities and discharge;</li> <li>2) Review the appropriateness of mixing stations, inspect the flying dust and noise control, determine the construction time.</li> <li>3) Receive and handle public complaints if any.</li> <li>4) Regular inspection to construction sites on implementation EMP measures, identify non-compliance and request corrections timely.</li> </ol>	Fulfill the management responsibilities of the region
Other government agencies	Accept public monitoring and develop the mechanism for the public to participate in the supervision; and ensure disposal and borrow that pits are well managed.	
Operation		
PMO	Project handover.	
Project Owner and operation units	Establish environmental protection teams to be responsible for the environmental mitigation measures and monitoring plan during operation stage; prepare emergency response plan and organize drills.	
Environment Monitor	Conduct monitoring upon request of project owner.	
Local EPB	Monitor the implementation of monitoring plans; Review the	Daily

Stakeholder	Responsibility	Remarks
Design and preparation		
	effectiveness of environmental protection measures and identify the needs of additional environmental protection measures.	managemen
Fishery bureau	1. Fish proliferation; 2. Supervise the fishing activities, including fishing boats, machines and nets.	Daily functional managnt
Chinese Surgeon Natural Reserve Managt Office	1. Protection and proliferation of Chinese Sturgeon, including: Developing the implementation plan; Establishing a supervision mechanism; and Supervising the special fund management.	Same as above
Water conservancy and Hydropower Bureau	1. Supervise the soil erosion control plan implementation, ensure relevant measures are taken accordingly; 2. Hydraulic monitoring; 3. River section stabilization to ensure flood safety and navigation safety.	Same as above
Maritime Affairs Bureau	1. Navigation management; 2. Ships management; 3. Pollution control in navigation routes.	Same as above
Ports and Navigation Bureau	1. Development, maintenance and management of navigation facilities; 2. Development and management of all ports, participate in port plans, develop port area border plan, and maintain the use of navigation routes and shoreline; supervise the port operation.	Same as above
Transportation bureau	1. Guide the highway and waterway science and technology, environmental protection and energy saving; 2. Organize management of key development projects for highway or waterway; 3. Logistic park management.	Same as above

## 11.2 Mitigation measures

The mitigation measures are formulated based on domestic laws, regulations, standards and specifications, past project experiences, and upon consideration of the General Environmental, Health and Safety Guidelines, Environmental, Health and Safety Guidelines for Ports and Ships, and Health and Safety Guidelines for Shipping Industry of the WB. Please refer to Table 11.2-1 for specific mitigation measures during project design, preparation and construction period, and refer to Table 11.2-2 for specific mitigation measures during project operation, and refer to Table 11.2-3 for potential risks and prevention measures during project construction and operation. Moreover, the PIU also formulated a general protocol (i.e. Environmental Code of Practice) on environmental protection during project construction (the ECOP) (See below).

The costs for mitigation measures will be included in the total budget of the project, or from the PMO of WB loaned project.

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**BAIYANG Port and Logistics Park Construction Management Measures  
( Environmental Code of Practice, ECOP)**

**By YICHANG Municipal Traffic Investment Corporation**

**Section 1 General Provisions**

1.1. In order to realize civilized construction management and improve the management level of construction site for the standardization, systematization and institutionalization of civilized construction, these management measures are hereby developed.

1.2. All organizations, units and individuals who participate in BAIYANG Port Logistics Park construction must strictly abide by the provisions of these measures.

1.3. The site's civilized construction shall be controlled and implemented by the project management office and the department of quality and safety shall be responsible for supervision.

**Section 2 Basic Requirements of Civilized Construction**

2.1. The construction unit shall take measures as stipulated to protect the working environment, urban sanitation quality and personnel health and safety.

2.2. Construction unit shall be responsible for civilized construction. If a general construction contract was concluded, the general contractor should bear the sole responsibility for civilized construction and the subcontractor should be subject to the management by the general contractor and responsible to the general contractor.

2.3. The construction unit shall organize the preparation and implementation of civilized construction method statement, establish a safe, fire protection, public security and health system, implement the responsibility system of civilized construction and conduct management on civilized construction by objectives.

2.4. The construction unit shall perform construction within the approved extent of construction site. If the construction site has to be expanded or any road, greenbelt or other municipal infrastructure has to be occupied, the construction unit should go through examination and approval procedures with relevant administrative department.

2.5. Construction site personnel should wear their work cards.

2.6. The construction unit should enclose and seal the construction site. The buildings' scaffold shall use fully-enclosed vertical safety net up to standard in order to avoid object falling from height and dusting. The safety net should be kept clean.

2.7. The construction site's ground and road should be hardened and maintained smooth and firm. The construction unit shall assign full-time personnel to be responsible for the cleaning work at the construction site.

2.8. The construction site's construction materials, components, tools and so on shall be stored within the area designated on the general planar arrangement, and shall be hang with the signboards indicating name, varieties, specifications and so on, instead of encroaching upon any access road and safety facilities or being

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mixed.

2.9. For stacking of sand, stone and other bulk materials at the construction site, a stack pond not higher than 50cm should be set with rainwater retaining measures. Residual soil produced at the construction site shall be stacked in a pond higher than 30cm, and the stacking location should not be close to the enclosure, and the piling height should be no more than 2m and measures should be taken for covering and the spoiled soil should be transported out in time.

2.10. Construction may cause barriers for entrance and exit to surrounding residents or cause road traffic jam. So the construction unit should take effective measures in advance and set up civilized public slogans and warning signs.

2.11. Before starting work, site formation, power and water utilities connection and access road and construction organization design should be completed as required and the construction organization design shall include the construction site's specific measures for civilized construction.

2.12. Civilized construction must adhere to the following five standards:

(1) Enclosed construction. The construction area shall be fully enclosed and isolated; the road, traffic and social operation area should not be mixed with the construction area.

(2) Meeting the need of temporary traffic organization.

(3) Clean transport.

(4) Minimizing environmental impact. Reducing the impact from noise, dust and night light arising from construction upon the surrounding environment to a minimum extent.

(5) Reducing the impact on the surrounding people's living and traveling

2.13 The construction site must be:

2.13.1. Unimpeded:

(1) The sidewalk at the construction site must be unimpeded;

(2) The units and residents' access road to and from the construction site must be unimpeded.

2.13.2. accident-free:

(1) No pipeline accident during construction period;

(2) No major industrial accident in construction;

(3) The road around the construction site should be smoothed without accumulation of sand.

2.13.3. Five Musts:

(1) The construction area must be strictly segregated from non- construction area;

(2) At the construction site tags must be hang for construction and the management staff shall wear name badges before taking up their jobs;

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(3) At the site the construction materials must be stacked in a neat and orderly manner;

(4) At the site the living facilities must be clean and civilized;

(5) At the site ideological work must be carried out, giving priority to create a civilized site and to create a safe and civilized environment.

2.14. The Engineering supervision institution should incorporate civilized construction in the scope of supervision, and should require the construction unit to take actions of rectification. If found any act not conforming to civilized construction requirement; if the construction unit refused to rectify, the Engineer shall promptly report to the Owner.

2.15. The construction unit should, based on the characteristic of the season, do good job of flood control and all temporary facilities should be provided various preventive measures against collapsing.

2.16. The construction unit shall make emergency plan against any public health event and shall be equipped with a set of emergency response personnel, health care medical kit and first-aid equipment.

2.17. In event that the construction site's operating personnel suffered infectious diseases, food poisoning or acute occupational poisoning, the construction unit should timely report to the Owner and the civilized construction administrative department or any other relevant administrative department, and cooperate with the investigation process.

2.18. Upon completion of this construction project, the construction unit shall timely remove all temporary facilities or enclosure and clean the construction site and the surrounding environment affected.

### **Section 3 Civilized Construction Organization Design**

3.1. The construction unit, in preparation of construction organization design, shall design civilized construction, and the relevant departments shall jointly review the construction organization design.

3.2. Detail of civilized construction organization design

(1) Construction site planar arrangement Including temporary facilities, on-site traffic, field operation areas, construction equipment and tools' layout, finished and semi-finished products, and stacking of raw materials, etc.;

(2) Design of construction site enclosure;

(3) Design of on-site engineering signboards;

(4) Individual design of temporary buildings or structures, ground hardening and temporary access roads and so on;

(5) Design of wastewater treatment and drainage at the site;

(6) Dust and noise field control measures;

(7) Protection of existing municipal piping network and surrounding environment or buildings and structures in the construction area;

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(8) Civilized construction management organization and responsible person at the site;

(9) Nighttime construction control measures.

3.3. Site enclosure and temporary facilities must be erected according to the approved design and should not be put into use unless and until self-checked and accepted by the construction enterprise security functional department and then submitted to and accepted by the Engineering supervision based on the self-inspection.

3.4. The construction unit shall, in accordance with the civilized construction design, develop civilized construction measures (including the construction site enclosure, ground hardening, large temporary facilities, and municipal pipeline protection and so on). The construction unit, in the tender offer, should incorporate the cost of the civilized construction measures into the contract price.

## **Section 4 Construction Site Enclosure Standard**

### **4.1. Construction Enclosure**

4.1.1. Around the construction site continuous enclosure must be provided. The enclosure shall be stable, safe, clean and artistic, and shall meet the following requirements:

(1) The height shall be not less than 2.5m;

(2) The gate shall be made of metal material. The office area shall be provided with automatic retractable doors. And at the construction site impenetrable metal solid doors shall be used.

4.1.2. Reflective logo signs shall be erected every other 2m outside the enclosure alongside the temporary carriageway. And reflectors shall be installed every other 4m outside the enclosure of non-temporary carriageway.

4.1.3. Outside the enclosure the background pattern designated by YICHANG Traffic Investment Corporation shall be adopted. And the promotional banners approved by YICHANG Traffic Investment Corporation shall be equipped.

4.1.4. The main entrance of the office area shall be installed with 7m-wide retractable doors. The main entrance of the construction site shall be installed with 8m-wide solid doors, and other entrances or exits shall be installed with 5m-wide solid doors.

4.1.6. Around the construction site's entrance door the security room shall be provided. The security personnel trained can take their job in uniform dress to register external personnel accessed. Establish a guard duty-watch system (including temporary entrance and exit management). The regulations concerning security should be posted on the wall.

### **4.2. Temporary Edge Protection**

4.2.1. In case of operation at the height of 2m or more above the base plane, the temporary edge must be provided with guard rails.

4.2.2. The buildings' scaffold shall use fully-enclosed veridical safety net according to the standards to avoid object falling from height and dusting. The

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safety net should be kept clean.

## **Section 5 Temporary Facilities**

### **5.1. Temporary facilities construction requirement**

5.1.1. The construction unit should make the erection positions that included in the civilized construction management plan on the planar graph explicitly. So as to setting up the temporary facilities, it also should be in a scientific and reasonable manner. The erection position is required to avoid high-voltage lines, flood control ditch, landslide, abrupt slope, spoil ground, waste soil yard and the like area, which all should be uniformly arranged as stipulated to keep the structure safe, neat and clean.

5.1.2. The erection position, height, structural strength, stiffness, stability and anti-wind capacity of steel-structured color plate house, cement composite board house and masonry-concrete structure house shall conform to design specifications, quality standards and the relevant requirement. The mobile house should have product qualification certificate and inspection report. All the mobile houses, before use, should be installed, checked and accepted. And none of them should be put into use unless checked and accepted by the Engineering supervisor with signature.

5.1.3. The materials for erection of temporary facilities should not be used unless approved by the Engineer. It is forbidden to use bamboo, scaffold plates, colored cloth, plastic cloth, single-layer colored plate, templates or the like materials for the erection. The wires or cables within the temporary facilities should be laid in sleeves.

5.1.4. Construction work area should be separated from the office and living areas. The office of the project management and dormitory living area should be fully enclosed and installed with mobile doors.

5.1.5. On the wall of office, safety operation and civilized construction management grid, management network graph and construction chart shall be mounted and hang up. The meeting rooms of double-floored mobile house shall be set on the first floor.

5.1.6. Within the living areas, no building materials, tools and inflammable or explosive dangerous goods should be stacked.

### **5.2. Staff Dormitory**

5.2.1. The construction unit shall not set up his staff dormitory in any buildings which have not been completed.

5.2.2. The dormitory (living area) should be equipped with signboards. On the dormitory doors' right to corner the dormitory personnel and the service list shall be posted. The terrace should be hardened and equipped with drainage ditches. Domestic sewage discharge should be handled following the specified procedures. If there is no drainage opening, the drainage pond should be equipped.

5.2.3. In the dormitory, unified standard bunk single beds shall be used, instead of using steel fasteners, bamboo chips, transverse board and other similar materials. In the dormitory, washstands and lockers shall be provided. It is

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forbidden to build a hearth or use gas and coal stoves in the same room.

5.2.4. The dormitory set at the construction site should have necessary living space, The indoor net height should be not less than 2.4m and the channel width should be not less than 0.9m. The dormitory shall be provided with open-type windows. The dormitory's beds shall not exceed two tiers and it is prohibited to use shared wide beds.

### 5.3. Staff canteen

5.3.1. The canteen shall meet all requirements under *the Food Hygiene Law of the People's Republic of China*.

5.3.2. The location shall be suitable. The distance between the canteen and the toilet shall be more than 20m. Its indoor and outdoor environment should be clean and neat. The cooking and eating area shall be separated. The raw material and cooked food should be stored separately. Measures on dealing with freezing, disinfection, anti-mosquitoes, anti-flies, and anti-cockroaches shall be taken easily.

5.3.3. The canteen must apply for hygienic permission and should conform to hygiene standards. The staff working in the canteen must have "health certification". All health certification shall be mounted on the wall. The staff should wear uniform with white dress and hats. In the kitchen it is forbidden to accommodate people and stack building materials, tools and so on.

5.3.4. The floor of cooking area and hearth shall be covered with ceramic tiles having antiskid and cleaning facilities.

5.3.5. The cooking utensils, tableware and public drinking utensils should be regularly cleaned and disinfected.

### 5.4. Toilet and bathroom

5.4.1. The construction site should be equipped with water-flush toilets. The toilet wall surface should be painted. The ground should be hardened. Toilets should have doors and windows should be all in readiness. Between each squatting positions a partition board higher than 0.9m should be installed.

5.4.2. Toilet and bathroom structures shall meet the requirement. Both utilities for different gender should be separated with clear marks. Indoor floor should be veneered with ceramic tile. Closet pans and water tanks shall be made into a certain gradient. Flushing or cleaning measures should be taken in time, Don't accumulated dirt or have water logging and so on.

5.4.3. Septic tanks and cesspits should be enclosed and regularly cleaned. No reverse osmosis, overflowing and pollution to the surrounding environment are allowed.

### 5.5. Temporary work shed

5.5.1. Work sheds temporarily erected at the construction site such as steel bar workshop, woodwork shop, repair shop or warehouse should have stable structure, which is in compliance with the requirement of withstanding Force-8 wind. Their erection height should not be more than one floor.

5.5.2. Each shed's signage shall be neat. Their fire equipment shall be

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complete, All flammable and explosive materials shall be stored in accordance with the relevant regulations.

5.5.3. The staff that are responsible for each job shop and place's sanitation, fire protection, safe operation procedures and so on should list names on an eye-catching signboard mounted on the wall. No operators are allowed to smoke and do any illegal hot work.

#### 5.6. Charts and Signboards

5.6.1. The following chart and signboards should be hung at the construction area:

- (1) The signboard of project overview;
- (2) The signboard of project profile;
- (3) The signboard of safety discipline;
- (4) The signboard of civilized construction;
- (5) The signboard of fire protection and security;
- (6) The signboard of safety target and security control elements;
- (7) The record board of safety production activities;
- (8) Construction site general planar arrangement

5.6.2. The following chart and signs should be hung at the office area:

- (1) Construction visual progress diagram;
- (2) Traffic, construction and pedestrian channels' map;
- (3) Temporary drainage and seal drainage piping map;
- (4) Distribution diagram of utility pipelines;
- (5) Layout of firefighting equipment;
- (6) Electrical wiring layout of temporary power supply for construction;
- (7) Civilized construction management network diagram;
- (8) The signboard of safe work management objectives;
- (9) The signboard of safe work management system's factors distribution;
- (10) The safe work management network diagram;
- (11) Labor protection management network diagram

5.6.3. The chart and signboards should be suspended normatively and neatly on conspicuous positions at the main entrance and exit of the construction area, firmly installed with neat and orderly typeface, and their set height, size and background pattern can be determined according to the project scale and the environment.

5.6.4. The Project Overview, Profile Signboards and construction site's planar arrangement should be made of 1.9m \* 2.85m \* 0.05m color steel plates. Other chart or signboard should be uniformly made of 0.9m \* 1.3m \* 0.05m color steel

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plates, with frame on the back, which should be installed in the vicinity of the construction site project headquarters and placed within the fixed bulletin board.

5.6.5. The construction site planar arrangement should mark with the site orientation and positions of all office, production and living facilities' location, fixed equipment, tools, fire control facilities, gates (including temporary entrances and exits), access road and orientation of water and power utilities. Once the construction stage is adjusted, the planar arrangement should be changed in a timely manner.

5.6.6. The site must be mounted with bulletin boards and timely reflect the field safety.

5.6.7. The construction unit should, based on the characteristic of the season, do good job of flood control and wind resistance. And all temporary facilities should be provided various preventive measures against collapsing.

## **Section 6 Environmental Protection**

### 6.1. Wastewater treatment and discharge

6.1.1. Domestic wastewater or other wastewater must be treated separately and then drained into the municipal drainage piping network or into the river.

6.1.2. The slurry produced in the process of construction, without sedimentation, should not be discharged into the municipal drainage piping network or into the river. While waste slurry or sludge shall be transported by enclosed special vehicles.

6.1.3. Construction site must be equipped with the vehicle washing pool (flushing tank) and sedimentation tank, and provided with a high-pressure water gun. The rinsing tank top shall be made of profile steel with qualified strength and wind resistance ability and smooth surface. When make flushing vehicles, staffs should ensure they are clean when driving out.

### 6.2. Dust Control

6.2.1. As for any portion of ground unhardened for any particular reason and with the approval of the Engineer and the Owner, the ground should be regularly compacted and water logged, which thereon should be removed so as to reduce pollution over the surrounding environment.

6.2.2. It is forbidden to burn any poisonous, harmful and foul substances at the construction site.

6.2.3. When loading or unloading any powdered material, watering should be performed for moistening and handling in the warehouse

6.2.4. It is forbidden to throw rubbish from the construction site to the outside.

6.2.5. The rubbish or muck and other waste tending to produce dust within the buildings or structures must be handled in containers, instead of dripping or shedding.

6.2.6. In Force-4 or above strong wind day, no earthwork is allowed.

6.2.7. In the process of handling any construction wastes, mucks and

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dust-producing waste, measures of spraying water for de-dusting and using enclosure vehicles for transporting shall be taken. No vehicle is allowed to leak or hit the road with mud.

### 6.3. Noise control

6.3.1. Low-noise process and construction methods shall be taken.

6.3.2. If noise from construction work may exceed the field noise limit, before commencement the construction unit should make application to construction administrative department and environmental protection department. No work should be commenced without their approval.

## **Section 7 Construction Site Safety and Security**

7.1. Establish a sound safety and security system, and assign fulltime personnel to be responsible for public security and fire management.

7.2. Construction site's management staff and operators shall wear their job cards. The job card shall be made by the project management subsidiary and shall have their own photograph, name, department, type of work or job position; the management staff and work personnel's mark card should be distinguished by colors.

7.3. Establish visitor's registration system. DO NOT put up any family members and people irrelevant to the construction works.

7.4. Establish gatekeepers' registration system. Register all persons entering into the site for negotiation of business, DO NOT allow any irrelevant people to enter into the construction site. The security personnel shall have the right to expel offenders out of the site.

7.5. The license plate number of vehicles entering into the construction site must be registered. And all materials carried by any freight vehicle leaving the construction site should not be transported away from the site if no approval signature of the personnel in charge of the site was found; Otherwise, the guard and security personnel have the right to detain them. The site security personnel should abide by rules and regulations concerned and maintain their duty with shift record.

7.6. Strengthen education on construction workers in terms of law and disciplines and civilized construction. It is forbidden to fight and exchange blows at the site, or to commit any illegal activities. No construction worker is allowed to commit any act harassing local communities in terms of violating of customs or code of ethics.

7.7. Teach the migrant workers to observe laws, disciplines and civilized construction requirement. Guide them carefully in carrying out team activities. Install standardized publicity showcase with latest content in order to create civilized site atmosphere.

Yichang Transport Investment Company

April 2016

**Table 11.2-1 Main Environmental Impact and Mitigation Measures during preparation and construction**

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimate Cost (10,000 Y)	Supervised by
<b>A. Design phase</b>					
Bidding	-	(1) Include the mitigation measures as described in <i>Environmental and Social Management Plan</i> into the bidding documents; (2) Include the environmental management plan into contract of the contractor, project supervisor and environment supervisor for convenient implementation, supervision and check.	PIU	-	PMO
Before Construction	-	(1) Before any construction, contractors winning any bids are required to prepare and submit to the PIU and relevant authorities for approval their Site-Specific construction organization plan which should include environmental and safety arrangement/design based on the ECOP and ESMP as spelled out below and also in the Bidding Documents. (2) Project schedule shall be appropriate to make sure construction quality, which is not compromised for a tight cut-off date.	Bid winner	-	PIU
Scheme Selection	-	(1) Make reasonable layout, take full advantage of the depth and width of the construction area of logistics park. In the design phase, arrange the machine with large operating noise, equipments of long operating time, and storage yard that is easy to cause air pollution in places far away from the boundary of construction area. (2) From the perspective of environmental impact, allocating all of the earth & rocks in a longitudinal direction and putting them in balanced utilization are the best methods to reduce the impacts of borrow pit and dumping site. Allocation and balanced use of earth & rock should not only consider this project but should take the whole development zone into consideration. (3) Master plan should comply with the overall plan of Yichang Port and master plan of Yichang Baiyang Industrial Park .	Design institute: YTIC	-	PMO
Public consultation	affected; farmland acquisition; demolition	(1) Optimize and compare the construction scheme in one step and reduce the area of land to be acquired. (2) Formulation of resettlement plan should be fully negotiated with people in the project affected area before developing resettlement action plan.	Resettlement Office of Wuhan University	Reserve fund for the project	PMO
<b>B. Construction phase</b>					
Earthworks	Dust, soil erosion and land occupation	(1) Contractor must go through the procedures of dumping sludge and residues according to the regulations and pile them up in the designated backfill field of waste soil from construction upon approval. (2) Strengthen management over storage yard of earth & rocks used for backfill, develop surface compaction, regular water-spraying and cover measures of earth & rocks (increase the frequency of water-spraying during sunny and windy weather to avoid flying dusts on the roads and working surfaces); sludge and waste building materials that are not useful any more should be carried away timely and should not be stacked for long time. As for the allocation and use of earth & rocks from internal projects and auxiliary production buildings, amount of spoil (residues) should be minimized. (3) The temporary spoil storage site should not be in the range of 100m of the river. Meanwhile, protection measures such as covering should be taken. Avoid excavation in the wet season to prevent soil erosion and water pollution caused by rain.	Contractor (the design institute will incorporate it into the tendering document)	Included into the project cost	PIU, Yichang EPB; Housing Bureau, Yichang Water Resource Bureau
Clearing and transport of sludge and residues	Waste residues and land occupation of bored piles	(1) The spoil of #8 and #9 berths from drilling can be used for backfill in the land area. (2) Excavation, drilling and demolition and backfill in the land area should avoid dust pollution by watering;	ditto	Included into the project cost	The same as above
Site leveling	Construction site	(1) Strictly limit the construction scope, try not to occupy the water; establish signboard and safety fence on the construction site; (2) Hardening treatment must be done on the floor of construction site;	ditto	35.0	The same as above

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimate Cost (10,000 Y)	Supervised by
Drilling, living and maintenance and rinse of machine	Waste water from construction	<p>(1) Firstly, rely on the existing facilities for domestic wastewater in Guixihu and Yazishan Village. Otherwise, establish septic tank in the construction site. The domestic wastewater can be used for irrigation after the treatment of septic tanks;</p> <p>(2) The industrial wastewater of land area mainly comes from the artificial gravel scraps and wastewater in the production area of concrete, sewage and rainwater of backfill, flushing wastewater in the construction ground. The sewage is featured by high concentration of SS but low in organic substances. The processing is usually sedimentation methods with coagulant. The reduction rate of SS can reach up to 90% and more. After sedimentation, it can be used to water the construction ground or natural evaporation.</p> <p>(3) Try to avoid flushing the machines in the construction site and avoid the impacts of oily flushing wastewater. If the machines need flushing on the site, we should establish sewage collection tanks or take other methods to collect the flushing wastewater. Meanwhile, establish sedimentation and oil separation tanks inside. The flushing wastewater shall be collected and treated for reuse or watering purpose to avoid dust pollution.</p>	ditto	12.0	The same as above
Building and construction on land	Noise from construction	<p>(1) Operation of equipment with large noise and vibration at noon or night is strictly prohibited; the Contractor should use machinery equipment with low noise or with sound insulation or elimination equipment.</p> <p>(2) Reasonably arrange the construction time and construction site and the operation areas with large noise should be far away from the sensitive points;</p> <p>(3) Monitor the noise of the surrounding sensitive points when constructing at night.</p> <p>The following measures should be taken when construction at night: construction at night should be reported to Yichang Environment Protection Bureau for approval and record and announcement should be made to the nearby residents ahead of time; sound insulation measures and other noise reduction measures should be taken when constructing at night to reduce the impact of noise on the surrounding environment as possible.</p>	ditto	26.0	The same as above
Transportation and concrete placement	Exhaust gas from construction to the sensitive spots	<p>(1) Spray more water on the transportation road to reduce the impact of road dust on the surrounding environment (add the time and intensity of water-spraying during sunny and windy weathers) to reduce the impact of dust on surrounding environment (Yazi Village).</p> <p>(2) Fully enclosed construction method should be taken during the construction period to prevent dust pollution. Vehicles for materials transportation should be covered with tarpaulin or canopy or other falling-prevention measures should be taken. These vehicles should not be overloaded to prevent falling of materials in the transportation process and the transportation route and time should be well planned. Driving in the residential areas should be avoided as possible as practical. When it is unavoidable, the driving speed shall be less than 20 km/h, especially while passing through Guixihu Village and Baiyang Town, etc.</p> <p>(3) The construction wastes are strictly prohibited from burning as fuels in the construction process. Canteens on the construction site should use liquefied petroleum gas or electric cooking appliance but cannot use fuel cookers.</p> <p>(4) Reconstruct the access roads such as National Highway G318 according to the actual requirements and daily maintenance system shall be established.</p> <p>(5) Separate planning and design for logistics park and the Taibaochang National Highway G318 shall be conducted to set up special non-mechanized lanes and passage ways. In road crossings with a large flow of pedestrians, three-dimensional transportation facilities shall be considered.</p> <p>(6) Set up traffic lights in the main entrances of National Highway 318 across Baiyang Town.</p>	ditto	20.0	Yichang EPB
Concrete pouring	Impacts of concrete mixing on sensitive receptors	Purchase ready-for-use goods for wharf and building construction to reduce impacts on the air	Contractor	-	-
Building and construction	Domestic wastes and garbage construction wastes	Management of domestic solid waste: The Contractor should be responsible for cleaning and transporting away the brickbat, ash and broken plate materials and other project wastes from construction of the port districts and logistics center and dumping of them in the waste transfer station is prohibited. Domestic wastes can be collected and dumped into the nearby trash can and large amount of rubbish should be directly transported to the waste transfer station outside the project area. The cleaner should collect the rubbish in the trash can and transfer to the waste transfer station at the stipulated time.	ditto	-	Urban Management Dept.

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimate Cost (10,000 Y)	Supervised by
		<p>(1) Allocate in the wider range and backfill is encouraged.</p> <p>(2) Requirements on the management of storage sites:</p> <p>a. set up signs to explain the waste storage;</p> <p>b. take protection measures against water, wind and seepage;</p> <p>c. set up fences and ceiling to avoid from exposure to the open sunlight;</p> <p>d. enhance propaganda, and release publicity materials on waste management to the construction enterprises, transportation vehicles to inform them of the location to dump garbage.</p>	ditto	-	The same as above
Building of construction camp, vegetation and greening, construction of piles in water	Terrestrial and aquatic ecology	<p>(1) General measures of land construction:</p> <p>a) When the construction unit is working on the land surface, they have to peel off the surface ground to store the mature soil for farming. After construction, the land will be restored and rehabilitated. The mature earth is forbidden to be used for earthworks backfill. Instead, it should be stored in accordance with the principle of nearby, convenient and economic;</p> <p>b) When construction nearby the farmland, the construction activities shall be done in the range of the land acquisition area. The construction site should be within the red line. The access road mainly uses the roadbed to narrow the range of construction activities and reduce the occupation of citrus forest. Additionally, the construction shall be implemented in reasonable phrases, so as to reduce the impacts on local agriculture.</p> <p>c) Increase the protection awareness of the construction workers. Snakes, hares or egrets are strictly forbidden to be caught;</p> <p>d) Strictly implement the measures to protect water environment;</p> <p>(2) Road construction methods</p> <p>a) To deal with the issues of increase in signs, lane changing, disturbance of workers and equipment of the passing vehicles, a detailed plan on construction safety and rules and regulations shall be prepared. Moreover, safety supervision and road patrol shall be strengthened to avoid safety risks during construction.</p> <p>b) To ensure transportation safety during road construction, it should guarantee that the construction safety plan must be approved before construction, and the contractor must hold construction licenses, and all the workers shall have qualifications. Meanwhile, all the road signs, lamps shall be erected as required; all the construction workers shall wear the provided uniform and have safety construction labels.</p> <p>c) Award &amp; punishment system shall be implemented on the construction site. A part of the construction cost must be allocated for construction safety measures, such as purchasing temporary safety signs and labels and granting awards for workers and teams that comply with the safety construction requirements.</p> <p>d) Before project commencement, the contractor must check the design documents in detail, and formulate safety measures including safety management and accountability systems.</p> <p>e) The traffic signs on the construction site are a safety guarantee for road users and construction workers. The signs shall be erected on in areas in front of the construction sections.</p>	ditto	1003.04 (993.04 for soil and water conservation and 100 for others)	Yichang EPB; Water Resource Bureau
Pile foundation construction under water	Impacts on aquatic organisms	<p>(1) Strengthen education on the Contractor and construction personnel, strictly prohibit the construction personnel to fish rare aquatic animals under protection with the advantages of their operation on water; Organize the construction reasonably. The underwater construction should not be done in the spawning season of Chinese sturgeon in Yangtze River (February to middle April, middle October, middle areas in front of the construction sections. safety signs and labels antening period of fry (April to June) and peak time for rare aquatic animals under protection to go about (May to August) and should be done in dry season (December to February) to avoid migratory peak period of rare aquatic animals under protection. The contract signed between the construction unit and EA should cover the articles on environment protection and attached with the detailed content of environmental protection.</p> <p>(2) It is suggested to organize the construction units, EA, the technical staff on aquatic animals and experienced fishermen to monitor the rare protected animals such as the Chinese sturgeon, Martens, Dabry sturgeon and Bleeker in the water area. If detected, they should terminate construction according to the actual situation or drive the rare fish to swim away. During the construction or operation stage, if some rare fish like the Chinese sturgeon is hurt, we should report to the management agency of the natural reserve timely and take effective measures to cure them.</p> <p>(3) Optimize the construction technique plan and techniques</p> <p>In order to prevent the ships from damaging the rare aquatic animals in the river section, the Contractor should optimize the construction technique plan and control the drainage of pollutants from construction and the ships. Pay close attention to the construction progress and try to shorten the operation time on water as possible as practical.</p> <p>(4) All the solid wastes produced during construction period shall be collected and disposed together. It is prohibited from tossing solid wastes into the Yangtze River.</p>	The same as above	10	Yichang EPB; Water Resource Bureau; Yichang Agricultural Bureau; Maritime Affairs Office;; Chinese Sturgeon Nature Reserve Management

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimate Cost (10,000 Y)	Supervised by
		<p>(4) Piling on the wharf doesn't involve excavation because they use the piling barge; When drilling the piles, the mud tank should be surrounded by the enclosure weir. The height of weir should be about 0.3m. In the outlet of spill, work cloth is covered. The mud tank shall be installed with cover of rainy days. This measure will prevent from the impacts of SS in water body of the Yangtze River. The drilling dregs must be dried and disposed onshore. The drilling mud can be recycled. The mud after being dried should be used for the stone and earthworks to construct the backyard storage site, rather than transferred to the urban solid waste station. The solid wastes during construction period should be collected and treated. They are not allowed to be thrown into the Yangtze River randomly. The oily wastewater of construction period should be strictly managed and discharged. The oily wastewater should be approved by qualified receiving unit which has records in the maritime management department. It should be treated with oil-water-separator and mustn't be discharged in the water area of this project.</p> <p>(5) The construction unit of wharves project should use the vessels to the national requirements. In accordance with relevant requirements such as the <i>Regulations of Inland River Transport Safety in P.R.C</i>, <i>Regulations of Construction Activities Above-water and Under-water of P.R.C</i>, <i>Maritime Administration Regulations of PRC</i>, they should go through the procedures of water-related construction to the maritime management department. They are allowed to construct in the verified range of the certificate. They should prepare detailed maintenance scheme and apply the maritime management agency to add patrol boat to enhance on-site management, so as to ensure safe journey and sound construction.</p> <p>(6) The following matters shall be addressed for underwater works:</p> <p>a). When the project construction needs to occupy many waterways, please contact with the managing authorities to set up navigation marks, so as to ensure construction and shipping safety.</p> <p>b). During construction, the navigation marks shall clarify the shipping limit and the boundary line of the wharf, so that the passing ships can timely keep a distance from the wharf. Meanwhile, signal lights shall be equipped to provide signals accurately. Moreover, put up warning signs in prominent places to warn the other passing ships of safety.</p> <p>c). The management of ships approaching the wharf shall be strengthened. Coordination and communication for the wharf construction shall be strengthened.</p> <p>d). The contract shall strengthen safety management throughout project construction to maintain shipping safety and guarantee smooth proceeding of the project. The use of strong lights shall be restrained and eliminated to avoid disturbing the sights of the ship drivers.</p> <p>(7) An above-water construction plan shall be designed in advance to improve safety construction accountability. Meanwhile, emergency plans should be established; safety training shall be conducted on workers; During above-water construction, patrols and supervisions shall be strengthened so as to quickly identify abnormal situations and report them to maritime authorities for solution.</p> <p>(8) Wave-proof measures shall be formulated and implemented during the construction and operation period of the project to protect against waves; recommended to install anti-bumping devices in the front of the wharf to reduce damage of ships and wharf during possible collisions in the future; the ships Approaching and leaving the wharf shall operate carefully in strict compliance with <i>Regulation for Preventing Collision on Inland Waterways</i>, and take effective avoiding actions when encountering other ships to prevent collision.</p>			Office
Publicity on safety and culture protection	Social environment	<p>(1) PMO shall include the regulations and camp management documents of the construction teams into the bidding document, and require the construction contractors to establish its management system of construction workers and camps;</p> <p>(2) Conduct enclosed management of the construction camps;</p> <p>(3) Establish a standardized manual on procedures of construction works and carry out construction works according to it;</p> <p>(4) Formulate a detailed management manual of the construction camps and regularly check its implementation;</p> <p>(5) Establish a joint interaction system between Baiyang Industrial Park, PIU and Contractor to clarify accountability;</p> <p>(6) Set up stations of safety management and disease prevention.</p> <p>(7) Other measures:</p> <p>(a) If cultural relics are found in the construction process, excavation should be stopped immediately and relevant information should be reported to the local cultural relics protection department. Before the competent department completes the identification on cultural relics and takes necessary protective measures, the excavation should not be resumed.</p> <p>(b) Educate the construction personnel on the knowledge of diseases control and so on and provide necessary self-protection equipment for them, such as, safety helmet, earplug and other safety devices.</p> <p>(c) Announcement should be made through broadcast, TV and newspaper ahead of time and do well in the demolition and resettlement.</p> <p>(d) Epidemic prevention is mainly through good habits of the construction personnel and education on necessary schistosomiasis prevention and hygienic knowledge. Pay attention to the dietetic hygiene and take necessary measures for schistosomiasis control can control the development of communicable diseases. Enhance monitoring and control on key infectious diseases such as hepatitis A, diarrhea, etc., and improve the</p>	Contractor (the Design institute is responsible for including it into the bidding documents)	15.0	PIU

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimate Cost (10,000 Y)	Supervised by
		<p>contractor's understanding of health and epidemic prevention work, and the water quality as well as environmental sanitation in the construction camps.</p> <p>(e) Education, publicity and management on the construction personnel is the main means for epidemic prevention in the construction period. Hold thematic bulletin on AIDs in the residential area of construction personnel and the Contractors are suggested to provide healthy entertainment activities for construction personnel in their spare time to enrich their life; the Contractors are also suggested to take blood testing before recruiting the construction personnel to understand the physical conditions of them. Meanwhile, it is necessary for the managers to ban the construction personnel to take drugs and go whoring. Once found, they will be fired and transferred to the public security organ. Upon completion of the project, this place which is relatively closed and backward in the past will be urbanized, the transportation will be more convenient, the population of flowing people will be enlarged and hotels, entertainment and catering industry will be developed. At the same time, some undesirable social phenomenon will also emerge, which will nourish the potential spread of AIDs. After the project is put into operation, government of the development zone should also pay attention to this problem, guide the publicity department to regularly or publicity on knowledge of AIDs prevention through broadcast and bulletin board and other medias. Health and epidemic prevention station and the hospital should strengthen the check on AIDs and the public security organ should strengthen the management on registration of migrants, regularly rectify and clamp down the recreation places, hotels and hair salon and other places which are easy to spread AIDs and make sure their activities be legal.</p> <p>(f) Make sure the internal and external camp is clean, beautiful and hygienic and the planning is reasonable; set up dustbin (trash can) and arrange the specialized person to clean the rubbish, spray water and remove the dust.</p> <p>(g) Well disinfect and kill the rats, mosquito and flies.</p> <p>(h) Office and rest room of the construction personnel should be clean and hygienic and of no dirt and sewage. The tools and materials in them should be neatly placed.</p> <p>(i) There is good ventilation and lighting in the room and the humidity and temperature are comfortable. There are facilities for storing clothes and articles.</p> <p>(j) Implement the power and water consumption system. Connecting wire, lamp cap and socket at will in the room is banned. Faucet should be closed after using the water.</p> <p>(k) Sanitation requirements in the toilet: clean and have good ventilation, no faces and rubbish; frequently disinfect with lime or by spraying and scattering; arrange the specialized person to clean domestic wastes and do the cleaning.</p> <p>(l) Protect the environment and domestic wastes. Leftovers should be dumped to the designated location; make thorough cleaning once a week and specialized person should be arranged to take charge of the cleaning within their zone.</p>			
Land acquisition and demolition & allocation	Social impacts	<p>(1) For doubts of part of the residents on construction of the resettlement area and resettlement, make vigorous publicity on the policies of the similar projects within the region implemented at the earlier stage, publicize the preferential policies through calculation and organize them to visit Taibaochang resettlement area to assure them of the resettlement.</p> <p>(2) For the worry of household ready to resettle over the quality of resettlement housing, organize them to visit the construction of resettlement housing. Report the determined construction plan of resettlement housing in the future at any time to them and set up the communication channels and the construction unit. Through such channels, the households ready to resettle or their representative can regularly or irregularly inspect the quality of resettlement housing under construction.</p> <p>(3) For the worry of some residents over unemployment after land loss, PMO undertakes to give priority to employment of local labor force in the implementation process of this project. In the future, the enterprises of Baiyang Industrial Park will give priority to employment of the labor force from the two affected villages and carry out targeted training on the labor force in accordance with the needs of the project after completion and employment needs after the enterprises settle down in Baiyang Industrial Park.</p> <p>(4) For lack of transparency of capital distribution which may occur in land acquisition, PMO and Baiyang Town and various villages will set up the system of open account for income from land acquisition and regularly make income from land acquisition and its distribution public in PMO, Baiyang Town and various communities. Various villages will convene the mass meeting to decide the distribution of income from land acquisition and make it public through posting. Internal and external monitoring agency of this project will track and monitor the use and distribution of land income.</p> <p>(5) For the problem that part of residents are discontented with the compensation standards for land acquisition of Phase 1 and Phase 2 of Baiyang Port construction due to difference generated by new standard promulgated by the provincial government, PMO and Baiyang Town carefully explain, ensure the transparency of publicity on legal policies, report the actual conditions to government of High -tech Development Zone and PIU to obtain understanding and support from the superior departments and PIU, take unified compensation polices to eliminate potential factors of social instability through negotiation.</p>	Local government	-	

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimated Cost (10,000 Y)	Supervised by
		<p>(6) For difficulties that part of vulnerable people are faced in the demolition and resettlement process, PMO will coordinate Baiyang Town and various villages to develop special supportive measures for the vulnerable families and help them overcome the adverse impacts brought by this project and restore and improve their life. The main measures include: include the vulnerable families into the assistance list to accept the aid from civil affairs department and other channels; help the vulnerable families relocate; let them choose the resettlement housing first; if temporary dwelling is needed, the village and town government will help them with temporary dwelling; providing the employment opportunity created in the implementation process of this project to the vulnerable families first.</p> <p>(7) Other measures</p> <p>a) Prepare a compensation standard in compliance with the unified output value stipulated by the Hubei government;</p> <p>b) Make sure that the compensation is not less than the replacement cost of demolished houses;</p> <p>c) Provide two compensation options, i.e. cash compensation and resettlement housing for the choice of DPs;</p> <p>d) Make sure that the resettlement transition subsidies can meet the needs of the DPs; establish a monitoring system to supervise the allocation of resettlement transition subsidies; set up a deadline for the delivery of resettlement housing and increase transition subsidies if actual delivery goes beyond the time limit;</p> <p>e) The resettlement housing will be allocated by casting lots, whose procedure will be open to the public;</p> <p>f) All the compensation standards and reports shall be disclosed to the public and posted in the affected villages to be supervised by the DPs;</p> <p>g) All the eligible DPs will be insured under the urban and rural residents pension security insurance, and the professional training will be offered to the labor force;</p> <p>h) The job opportunities, especially the subservience jobs shall give priority to the eligible labor force among the DPs;</p> <p>i) The resettlement fund allocated to village collectives will be managed by the Baiyang Industrial Park. The use of this fund will be determined on the meeting of village representatives;</p> <p>j) Establish a system for collecting the complaints and grievances of the DPs;</p> <p>k) Establish an independent monitoring system of resettlement work.</p>			

**Table 11.2-2 Mitigation measures during operation phase**

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimated Cost (10,000Y)	Supervised by
Road, vehicle and transportation	Noise	<p>(1) Environment Impacts Assessment Report on the Rehabilitation and Expansion of Class I Wancheng Bridge to Yunchi Road of G318. The proposed project will install ventilation and soundproof windows for the residents in Yazishan Village. The investment of noise reduction measures is RMB 175,000. As this measure is able to meet the requirements of noise reduction, no further noise reduction measures will be taken temporarily on this sensitive spot in this assessment report.</p> <p>(2) Improve the performance of vehicles and operating machines to reduce the noise. Strictly supervise and control the operating machines and vehicles in and out of the Port and ban the vehicles which do not comply with the technological indicators of noise control from getting in the Port and eliminate the operating machines which do not comply with the standard on noise control.</p> <p>(3) Well afforest and strengthen maintenance on the road during the later stage to ensure flatness of road after the building of internal road (Guihu Road and Songgang Second Road) is completed.</p>	Yichang Transport Bureau	17.5 (noise control methods is from the EIA report)	Provincial EPB; Yichang EPB; Yichang Transportation Bureau;
	Traffic safety	<p>(1) Set zebra-stripe and other road-crossing facilities in accordance with the design.</p> <p>(2) Maintain the above facilities during the operation period.</p> <p>(3) Strengthen the traffic management and do well in traffic diversion to make sure smooth traffic.</p>	PMO	-	Yichang Transportation Bureau;
Life of management personnel	Waste water	<p>(1) Daily domestic sewage of Three Gorges Logistics Center enters into the urban sewer system after being treated in the septic tank and meeting Class III standard of <i>Integrated Wastewater Discharge Standard</i>.</p> <p>(2) Wastewater containing edible oil enters into the sewer system of the park after undergoing oil separation treatment and meeting Class III standard of <i>Integrated Wastewater Discharge Standard</i>.</p>	Construction unit	20.0	Provincial EPB; Yichang EPB; Yichang Maritime Affairs Office;

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimated Cost (10,000Y)	Supervised by
	Solid wastes	(3) Domestic rubbish of the logistics park during operation period should be piled up at the designated location and the environment and sanitation department of the place where the project is located will regularly move and dispose of the rubbish.			
Loading and unloading	Waste water	(1) Ground flushing water and first-flush rainwater These mainly include flushing water on the wharf surface and runoff rainwater in storage yard. After being collected, this kind of water will enter into the sedimentation basin of this project and will be used for spraying in the storage yard after sedimentation. Hence, it will not exert impacts on water environment of Yangtze River. In particular, storage yard of phosphate should be covered to avoid leaching by rainwater and wastewater containing phosphorus. (2) Sewage containing oil from machine maintenance enters into the sewer system of the park after undergoing sedimentation and oil separating treatment and meeting Level-3 standard of <i>Integrated Wastewater Discharge Standard</i> ; domestic sewage of workers enters into the sewer system of the park after being treated in the septic tank; set up sound sewage collection system.	Operation unit	200.0	The same as above
	Exhaust gas and dust	<b>(1) Management Procedures</b> 1) Maintain good conditions of transferring equipment (such as, cranes, forklifts and trucks) 2) Upgrade and reform the ground vehicles, use trucks and vehicles causing low pollution and alternative fuel and mixed fuel. 3) Encourage to reduce the idle of engine in loading and unloading period. 4) Encourage the storage planning to avoid or reduce the re-storage and reshuffling of goods as possible as practical. 5) Design new facilities to shorten the distance between loading and unloading facilities of ships and the freight yard. <b>(2) Spraying water in the storage yard</b> 1) Spraying water for dust reduction can be considered when the portal crane unloads ships and the sprinkler should be simultaneously started with the unloading grab to prevent dust pollution. Single-scoop loading machine and discharge hopper should also be equipped with spray nozzles which should be started in the loading and unloading process to reduce dust pollution. 2) Try efforts to reduce free falling of materials, try to decrease the height from which the materials fall to the land in loading and unloading of bulk cargo and reduce the pile height of dry goods. Fetch the goods from the bottom and terminate operation when the wind speed exceeds the maximum operating conditions (namely 10m/s). (3) Arrange 150m windproof net at eastern side of bulk cargo storage yard, 460m windproof net at northern side, 320m windproof net at western side and 8m windproof at southwestern side. (4) Frequently clean the site and properly spray water to control secondary dust pollution. (5) Set up green belt along the boundary of the Port and choose the tree species that can absorb harmful gas and reduce the wind speed, such as, oriental arborvitae, bull bay, and pittosporum tobira and locust tree and so on. Afforest other land not used as possible as practical to prevent dust pollution.	Same as above	2800 (2790 for windproof net, 100 for watering cart and other capital is included in the project contract)	Provincial EPB; Yichang EPB;
	Noise	(1) In the layout of the parks, the noisy machinery should be arranged in the deep areas of parks; Arrange the office, accessory buildings in a reasonable manner, follow the principle of "the further, the lower" for noise reduction. (2) Keep good maintenance of operating machineries; Obsolete those not in compliance with the standards of noise; (3) Construct high fences of 2.5m to 3m surrounding the parks. Pay attention to the greening of parks to reduce and noise and beautify the work environment. (4) By reasonable allocation, control the traffic volume at night and mitigate the impacts of noise. (5) During operation period, strengthen the monitoring on the sensitive spots of Yazishan village. If exceeding the standards, install sound insulation windows.	Same as above		Same as above
	Solid wastes	(1) In accordance with requirements of <i>Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001)</i> , temporary storage facilities should be set in the Park and cotton yarn and cloth containing oil generated from equipment check and maintenance and the waste cutting oil should be held in container complying with the standard after being collected in a unified manner. Then the container should be marked with label to the standard. Finally, the above hazardous wastes should be submitted to the professional agency with relevant qualification for collection and disposal. In the operation period, records on conditions of hazardous wastes and regular check on containers holding the above mentioned hazardous wastes should be made. Once damages are found, measures should be taken to clean and replace them. (2) The waste spoil and refuse in the port area and logistics centers shall be cleaned by whoever produced them; it is prohibited to discharge these wastes into the temporary waste dumps; Domestic wastes can be transported to the nearby dustbins, while large quantities of wastes can be directly sent to the temporary waste dumps outside the project area. Cleaners shall timely transport the wastes in the dustbins to the temporary dumps. The domestic wastes produced during operation period will be cleaned and disposed by the local environmental protection department regularly; (3) Timely clean and recycle the scattered materials in the loading and unloading process.	Same as above	50	Same as above

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimated Cost (10,000Y)	Supervised by
		(4) Timely collect and recycle the packed materials that can be recycled.			
Production and processing	Solid wastes	(1) In accordance with requirements of <i>Standard for Pollution Control on Hazardous Waste Storage</i> (GB18597-2001), temporary storage facilities should be set in the Park and cotton yarn and cloth containing oil generated from equipment check and maintenance and the waste cutting oil should be held in container complying with the standard after being collected in a unified manner. Then the container should be marked with label complying with the standard. Finally, the above hazardous wastes should be submitted to the professional agency with relevant qualification for collection and disposal. In the operation period, records on conditions of hazardous wastes and regular check on containers holding the above mentioned hazardous wastes should be made. Once damages are found, measures should be taken to clean and replace them. (2) Domestic wastes of the logistics park during operation period should be piled up at the designated location and the environment and sanitation department of the place in which the project is located will regularly move and dispose of the rubbish. (3) Recycle and use the scraps from timber and steel processing. (4) Timely recycle, use or dispose packing materials.	Related enterprises in Three Gorges Logistics Park	20.0	The same as above
	Noise	(1) Eliminate the operating machines which does not comply with the noise standard; well maintain the processing machine; (2) Do well in shock absorption of the processing machine, close the operation area and reduce the noise.	Operating Unit		The same as above
Ship operating	Domestic sewage and wastewater containing oil	(1) Ships arriving at the Port shall not discharge domestic sewage and wastewater containing oil in the water area around the wharf. Where sewage and wastewater need to be received onshore, application should be made to the maritime safety administration which will entrust the receiving ships of the recognized department to receive and dispose of the sewage and wastewater of ships for value. (2) Equip the wastewater reception facilities and devices on land as soon as possible.	Construction Unit and Operating Unit	50	Yichang Fishery Management Office; Yichang Management Office Fishery Ship Port Supervision;; Yichang Maritime Affairs Office
	Exhaust gas	(1)Strengthening control and management from the source 1) Discharge of NOx and SOx should not exceed the limited value as specified by international treaties. 2) Use low-sulfur fuel if possible. 3) Slow down in access area of the Port and only when leaving the Port can ships sail at full speed. Avoid or restrict blowing to the pipeline or chimney of steam boiler when ships are in the Port or under unfavorable atmospheric conditions. 4) If power can be supplied to the ships by the Port from the land to reduce the power consumption of ships during loading and unloading and the berthing of ships exceed certain time period, then the ships are required to shut down the power generator (and only use power supplied by the Port)(2) The Port authorities should set the air quality for ground operation in accordance with local air quality problems which should be taken into consideration when necessary. (3)Air pollutants generated by ships should be subject to the provisions of supplementary provisions VI of <i>MARPOL 73/78 Convention</i> after it comes into effect.	Ship Operating Unit	10	Yichang Management Office Fishery Ship Port Supervision; Yichang Maritime Affairs Office; Provincial EPB; Yichang EPB.
	Noise	Sounding horns is banned when ships go into the port.	Operating enterprise		The same as above
	Solid wastes	(1) Strengthen supervision on wastes from ships. The harbor superintendence departments should formulate specific measures with strong operability, patrol more frequently and strictly ban the discharge in violation of regulation. Strengthen management of Recording Books of Ship Rubbish to provide basis for timely penalize the discharge in violation of regulation. (2) Join in the tracking system of ship wastes information jointly founded by the Ministry of Transportation and the Port, strictly prevent discharge of ship wastes without approval by technological means and do well in the relevant publicity and education. (3) Domestic sewage and production garbage of the port district are strictly prohibited from discharging into water. Ship rubbish should be put into sealed bag or bucket, collected and disposed of in a unified manner. Rubbish from ships from epidemic area and overseas should be quarantined and sterilization and disinfection should be done on the ship if epidemic disease is found. (4) Relevant management measures of WB: 1) As for general wastes: facilities of the port should provide sufficient means to receive and manage wastewater and wastes and satisfy the	Operating enterprise	50	Yichang Maritime Affairs Office; Management Department Port District;

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimated Cost (10,000Y)	Supervised by
		needs of itself, incoming ships and designed service of the port. Develop specifications on wastes reception facilities together with local government in accordance with commitment of the Port to MARPOL Convention. Wastes reception facilities of the Port should have adequate capacity to receive the wastes generated by the Port and ships, including receiving containers with suitable size and location, and have the capacity to deal with seasonal fluctuation of wastes. 2) Provide information on ship wastes to the capital so as to identify the facilities receiving solid wastes and the acceptable processing procedures. 3) Discharge of solid wastes by ships should be banned in accordance with provisions of MARPOL and the state. In order to protect environment of the Port, the strictest restriction measured can be taken when necessary. 4) Set up collection and disposal system for wastes generated by ships at berth and anchor in accordance with provisions of <i>Comprehensive Manual of International Maritime Organization on Port Reception Facilities</i> . Refuse hoppers that can be shut down should be offered at the berth and non-self-propelled or self-propelled barge with refuse hopper should be used to collect rubbish on ships at anchor. 5) As for food wastes transferred from the ships to the Port, management should be exerted in accordance with local law designed to protect health of human being and animals. The local requirements may include dispose, burn or landfill treatment of the wastes.			
	Leakage of diesel oil	(1) Prevention measures for vessel traffic accidents include: 1) Equipping necessary navigation aid facilities and other safety facilities in areas near the wharf; 2) Facilitating construction of vessel traffic management system; 3) Strengthening management over vessel traffic order in the waterway. (2) Risk management and emergency plan  Refer to Chapter 11.3 for emergency plan of sudden environmental events in Baiyang Port District.	Baiyang Port; Yangtze River Waterway Bureau; Yichang Maritime Bureau		Provincial EPB: Yichang EPB; Yichang maritime office;
	Cumulative impacts	1) Reduce impacts on the migratory passages of fishes, and prohibit ships passing through the scope of 100 m on the both sides of mid-stream line during February to mid April, mid October, from mid December to the end of December. The local requirements may include dispose, burn or 2) Conduct ecological compensation  Ecological compensation mainly refers to breeding. The project units provide fund, Yangtze River Yichang Chinese sturgeon natural reserve management department is responsible for implementation. Yichang port inspection management department is responsible for supervision. The proposed species including the Chinese sturgeon, Bleeker, the four Chinese major fishes, etc. The size and amount of detailed fish will be subject to the arrangement of the natural reserve. The timing can be the season when fishing is forbidden after the construction of the project. (April 1 to June 30). 3) The coastlines are rehabilitated with ecological methods during the period that Yichang is restoring the gravel wharves. We should take the ecological measures in the favor of plantation rehabilitation and use ecological materials. Hardening should be avoided. We should protect the water and air permeability, flexibility and comprehensive ecological effects of the embankments; (this part of costs will be calculated by the implementation department. It is not within the range of the project).	Project Leading Group	100	Yichang Management Office Fishery Ship Port Supervision;
Social impacts	Demolition and resettlement	As for the resettled households, the surrounding infrastructures (vegetables market, shops, schools, health care venues in the plan) should be strengthened. Increase the publicity degree and carry out various social activities, so that the residents can transform from farmers to citizens smoothly and adapt to urban life as soon as possible; As for the poor residents, the property costs can be reduced or remit; A small portion of land surrounding the community can be allocated to the residents so that the residents can reduce living expense by planting vegetables.	Local township government	-	Government of High-Tech District
	Employment	Encourage the enterprises and relevant department to hire resettled residents by beneficial taxation and financial items;	Local enterprises, residential property	-	Same as above

Activity	Potential Impact	Mitigation Measures	Implemented by	Estimated Cost (10,000Y)	Supervised by
	Special groups	Increase subsidies to the female over 55 years old, the elderly and the poor; The elderly residents can be arranged in the community as the security, cleaner, greening staff with lower requirements on physical agility.	Department of civil affairs	-	Same as above
	Traffic	<ol style="list-style-type: none"> <li>1. Rehabilitate the roads accessible to the outside such as G318. Design and construct the road in accordance with required quality level and establish the system of daily maintenance;</li> <li>2. Separation planning and design would be conducted in the road section from the logistics park to Taibaochang section of G318. Establish special non-motor vehicles lanes, passenger lanes. Consider the installation of under- or over-structure of three-dimensional traffic facilities;</li> <li>3. Install the traffic signal facilities such as traffic lights in the main road sections of G318 Road passing through Baiyang Township.</li> </ol>	Department of Transport	-	Same as above
	Market Competition	Encourage local enterprises to settle in the parks. Encourage the local enterprises to enhance their core competitiveness and actively join in the market competition with an inclusive and open attitude.	Logistics park	-	Same as above
	Communication	During the operation process, there may exist the issues such as the construction units neglect certain special conditions of residents, or the ecological environmental problems that residents care about are not settled appropriately, or the residents lack of life security. The conflicts may be intensified if the communication among local villagers, construction units and local government is not smooth, or the problems are not settled timely. The local government should collect data and ensure the smooth communication between the residents and government at the same time.	Residents' Committee	-	Township government

**Table 11.2-3 Major risk prevention and safety measures**

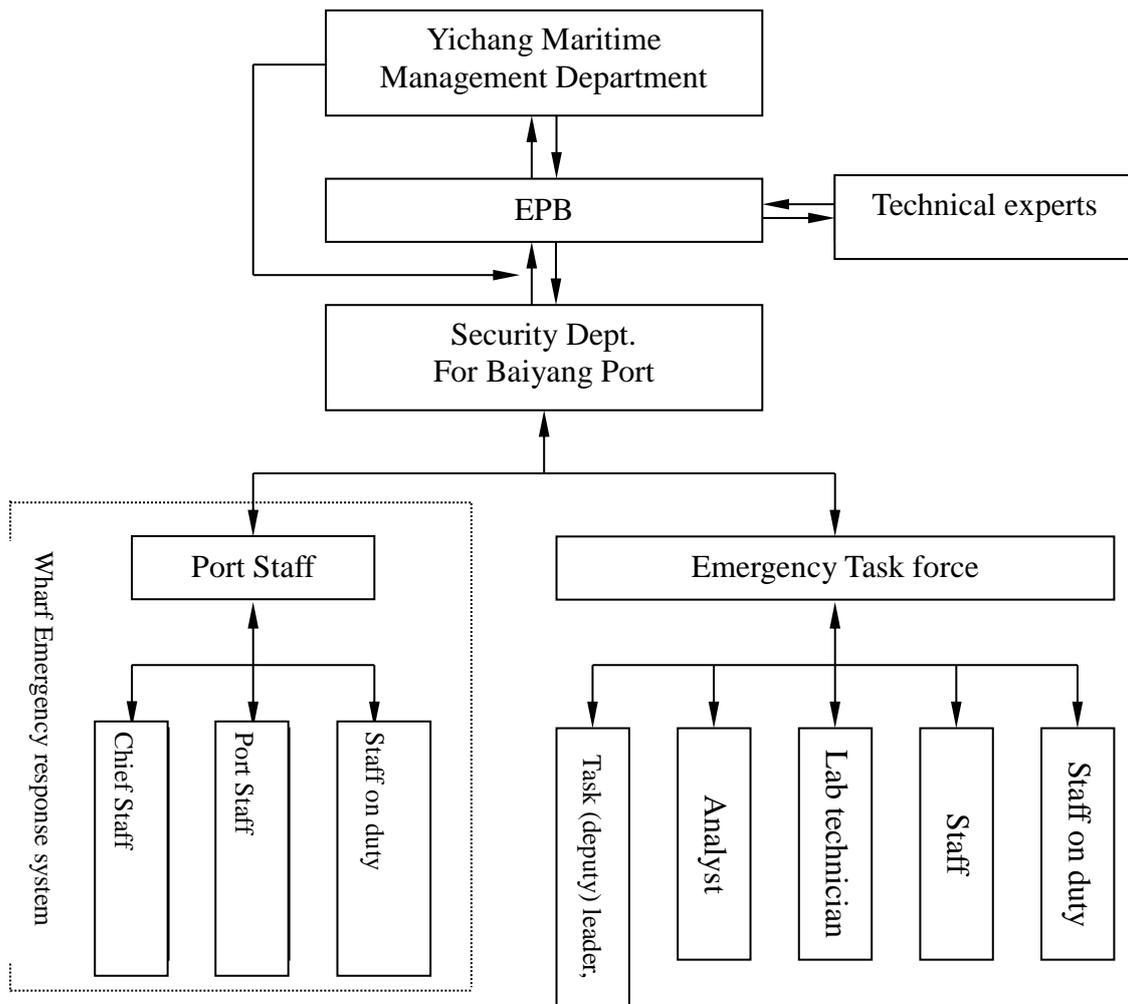
Major risks	Corresponding prevention measures	Supervisor	Implementers
1. Thunderstorm	<p>(1) Lightning protection facilities shall be provided on the tall machines and temporary structures such as crane and working-at-height platform during construction.</p> <p>(2) Lightning protection and grounding system shall be provided in the port area and the logistics park. Independent lightning protection and grounding device shall be provided for power substation and high-pole lamp.</p> <p>(3) Reliable lightning protection devices shall be designed for electrical equipment, electronic information system and buildings (structures) to prevent harm and damage of thunder to human body, equipment and buildings (structures). Lightning prevention design for buildings shall conform to national standards and relevant regulations such as <i>Design Code for Protection of Structures Against Lightning</i>.</p> <p>(4) Emergency response plan for lightning hazards shall be formulated to make it possible that organization and guidance, technical instructions, materials and funds, and rescuers will be in place in the shortest time to ensure highly efficient and properly handling of the hazard.</p>	Security inspection department	Contractor
2. Rain and snow	<p>(1) Workers shall be well equipped for antiskid protection and anti-freezing protection on rainy or snowy days; construction shall be suspended in extremely bad weather. When it freezes seriously, sacks or industrial salt may be used for antiskid and anti-freezing.</p> <p>(2) Since heavy rains and thick fog may result in bad visibility, when the visibility is less than 1km, the port must stop loading and unloading of ships and proper actions shall be taken for antiskid safety protection after rain and fog.</p> <p>(3) In the later stage of serious rainy, snowy or freezing weather, since the melting of ice and snow may cause large-scale secondary and derivative hazards, the engineering structure shall be inspected and potential safety hazards shall be eliminated in time to prevent accident due to immersion in rain and snow.</p>	The same as above	Contractor
3. Flood prevention at the port	<p>(1) Construction of underwater structure of the wharf project shall not be carried out in the flood control period of the Yangtze River if possible; the temporary barriers in the construction site shall be cleared off timely after construction to reduce the impacts on flood discharge of the watercourse.</p> <p>(2) Bank revetment reinforcement shall be provided along the river bank, and the connecting part of the bridge approach and the bank shall be stabilized; Disturbance of pile foundation construction to the river bank shall be reduced as much as possible; during and after construction, keep monitoring the watercourse and embankment, and handle any problems found immediately.</p> <p>(3) Flood prevention shall be done before the flood comes: loading and unloading at the wharf shall be stopped; emergency plan for flooded wharf shall be made and maneuver shall be arranged.</p> <p>(4) Bridge approach and belt conveyor shall be properly established to avoid disturbance to the road on the embankment (including sub-embankment) of the Yangtze River.</p>	The same as above	Contractor
4. Strong wind	<p>(1) When the wind force is stronger than Grade 6 at the port, lifting operation shall be suspended.</p> <p>(2) Reliable wind-proof and typhoon-proof devices such as anchor device and wind speed and force grade warning device shall be provided for large loading and unloading machines to prevent abrupt gust and typhoon.</p> <p>(3) Wind-proof devices for large machines shall be interlocked with the travelling mechanism of the machines to ensure that the wind-proof device will work after the travelling mechanism brakes the machine and the machine comes to a complete stop, so as to prevent the overturn of the machine.</p> <p>(4) All the transit openings of the belt conveyors shall be sealed to prevent dust.</p>	The same as above	The same as above
5. Loading and unloading in the port area	<p>(1) In accordance with relevant regulations, safety devices such as brake, travel limiter, anemometer, overload protection device, wind-proof device and light and sound warning devices shall be equipped to the lifting equipment including floating crane, quay crane and portal crane and shall be checked regularly.</p> <p>(2) Lifting equipment shall be in good conditions and quality; steel structure components shall be connected firmly; rotating part of winches shall be well lubricated; limit switches, brakes, lighting and firefighting equipment in machine room and operation room shall be complete and reliable.</p> <p>(3) The safety rails of the ladder, platform and walkway of the cranes must be kept in good condition, and any damage shall be repaired immediately once detected.</p> <p>(4) Sound signal device and lighting of cranes must be in good condition and all housings of live part shall be grounded reliably.</p> <p>(5) Manufacturers of lifting equipment must have appropriate qualifications and lifting equipment must pass the safety verification and acceptance check of competent authorities before commissioning.</p> <p>(6) Before lifting operation, all machines and tools such as the lifting equipment of crane, steel wire rope, mooring rope, chain and lifting hook shall be checked; ensure all machines and tools are in normal condition and no faulty ones shall be used. Workers shall wear personal protective articles as required.</p> <p>(7) When working, special person must be assigned to command, and operations shall be done in strict accordance with operation specifications; there shall be clear division of work among the driver, flatman, and the commander, who shall stick to their posts; and there shall be unified signal, gesture and whistle tone.</p> <p>(8) When in overhaul, the main switch must be turned off first, and a clear sign saying "No Turning On During Operation" must be put on the switch. If operation with power on is necessary, reliable safety protection measures must be taken and special person must be assigned to monitor the operation.</p> <p>(9) Safety protection devices shall be provided for the exposed rotating or transmission part of machines, and the safety protection devices shall have simple structure and proper layout, and must not have sharp edge or flange.</p> <p>(10) Pedestrian warning signals shall be provided for movable machines; sound and light warning devices shall be provided when the machines are starting or moving.</p> <p>(11) Safety rails shall be provided in at-height working face and guard net shall be installed at the margin, both shall have periodic inspection.</p> <p>(12) When working at a height of above 2m, workers shall wear safety equipment such as safety belt and antiskid shoes; workers working or doing repair work at height must wear safety belt and must have monitors beside.</p> <p>(13) Protection devices or other safety devices such as various protectors, guard fence, and guard rails shall be provided for large machines and lighting towers and at dangerous places and at-height working places where maintenance personnel comes frequently.</p> <p>(14) All workers shall be provided with personal protective equipment; above-water loading and unloading workers shall be provided with special protective equipment such as life jacket and antiskid shoes.</p>	The same as above	Operating unit

Major risks	Corresponding prevention measures	Supervisor	Implementers
	<p>(15) Loading of heavy and awkward cargo at 7# berth shall conform to <i>Technical Requirements for Loading and Unloading of Heavy and Awkward Cargo at Port</i>.</p> <p>(16) Appropriate tools and accessories shall be provided according to the type of cargo to be loaded or unloaded. No lifting machines or riggings shall be used with overload.</p> <p>(17) It is recommended that the layout of loading and unloading equipment at the wharf surface of 7# berth, 12# berth and 13# berth be well designed, and minimum distance warning device and emergency stop device be provided to prevent equipment collision.</p> <p>(18) Escape route shall be provided at the vestibule of the overhead belt conveyors at the back of the wharf of 8~11# berths, which shall be kept clear at emergency to guarantee life safety.</p> <p>(19) The rotating part of the movable steel bridge approach and the automatic lifting equipment at the back of 8#~9# floating wharves shall be well lubricated, and availability and reliability of safety devices such as brake protection device, overload protection device, and locking device shall be ensured.</p>		
6. Working at the container yard	<p>(1) Safe and proper vehicle route and footway shall be provided at the storage yard; clear signs of vehicle route, footway, traffic direction, vehicle speed limit, and no parking shall be provided; separation facilities (separation strip stone and separation fence) that separate container area and passageway shall be provided at the container storage yard.</p> <p>(2) Container bays at container storage yard shall be arranged properly according to different processes and location and code shall be marked.</p> <p>(3) Containers shall be stacked firmly and loaded evenly; overloading, concentrated loading, uneven weight distribution, uneven loading and container collision are not allowed.</p> <p>(4) Stacking of containers shall meet the following requirements:  1) No containers shall be stacked on another container which has smaller length and size;  2) No containers shall be stacked on another single container which has smaller length and size;  3) If one container is stacked on other two containers, the two containers below shall have the same height, otherwise the upper container shall not be stacked; the four corner fittings of the upper container shall be aligned with the external end corner fittings of the two containers below; to avoid displacement of the containers, spin locks or connecting fittings may be provided between the containers to make the dimensions of the upper container and lower containers consistent.</p>	The same as above	The same as above
7. Wharf structure	<p>(1) Special attention shall be attached to the design and construction of ground foundation and stabilization of wharves (especially the 7# general and heavy cargo wharf) and bridge approach, so as to minimize the influence of uneven settlement of foundation on wharf structure.</p> <p>(2) Intensify monitoring of 7# and 12~13# pier foundation stability to avoid unstable pier foundation caused by scoring of pier surface at the wharf.</p> <p>(3) The range and thickness of underwater riprap protection shall be determined according to the river regime analysis and requirement on bank stability, and design and construction of which shall be carried out in strict accordance with <i>Code for Design and Construction of Port and Waterway Revetment Engineering</i>. After the construction and delivery of the project, monitoring on the changes of front riverbed and river regime at the wharf shall be carried out and corresponding safety precautions shall be taken according to the actual situation.</p> <p>(4) Strength and loading capacity of foundation of lifting equipment at the wharf shall be taken into consideration to avoid subsidence of track.</p> <p>(5) Anti-collision facilities at the wharf shall be designed in accordance with relevant specifications.</p> <p>(6) During the construction period and after completion, close attention shall be paid to the deformation of bank slope; bank slope monitoring points shall be set; and any problems shall be handled immediately once detected.</p>	The same as above	The same as above
8. Dust and noise	<p>(1) In order to control noise, equipment with low noise shall be preferred and protection equipment shall be provided for workers.</p> <p>(2) Fans shall be provided at dusty places for local ventilation and dust exhausting; personal protective articles such as anti-dust mask shall be provided for workers.</p> <p>(3) Water atomization and spraying device shall be set at each transit place to remove dusts.</p> <p>(4) Dust concentration in the ambient air shall be tested regularly and publicity and education on the harmfulness of dust shall be strengthened so as to enhance the safety awareness of workers on prevention of silicosis.</p> <p>(5) Special cabinets for lifesaving devices (containing life jackets, apparatuses, protective clothing, protective rubber boots etc.) shall be provided at the wharf and shall be inspected and maintained regularly so as to be kept in good condition.</p> <p>(6) When at high temperature, working time shall be adjusted, and construction shall be suspended in the time period when the temperature is the highest of the day; sunshades shall be provided for workers to take a break; cool drinks shall be supplied and heatstroke prevention medicines shall be prepared; food safety and proper diet shall be ensured.</p> <p>(7) When at low temperature, winter protection and warm keeping shall be performed and winter clothing shall be provided for workers working at low temperature.</p>	The same as above	The same as above
9. Shipping	<p>(1) Strengthen management of loading and unloading ships: there is overlapping part between adjacent berths of the initial project wharf and second stage wharf at the turning basin, and the initial project and second project have the same PIU, therefore a transport scheduling organization shall be established for uniform on-site control.</p> <p>(2) A wharf ship management system shall be established; wharf communication and ship traffic management and auxiliary navigation facilities shall be well equipped; management of monitoring on water area at the wharf shall be strengthened; make sure that the ships load and unload with prescribed speed, direction and shipping lane.</p>	The same as above	The same as above

### 11.3 Emergency plan

Even though measures have been taken to prevent environmental risks, emergencies and accidents may still occur, so emergency response plan is necessary.

Yichang has developed a sound emergency plan; see Figure 11.3-1 for the information of emergency organizations.



**Chart 11.3-1 Emergency Response Organization**

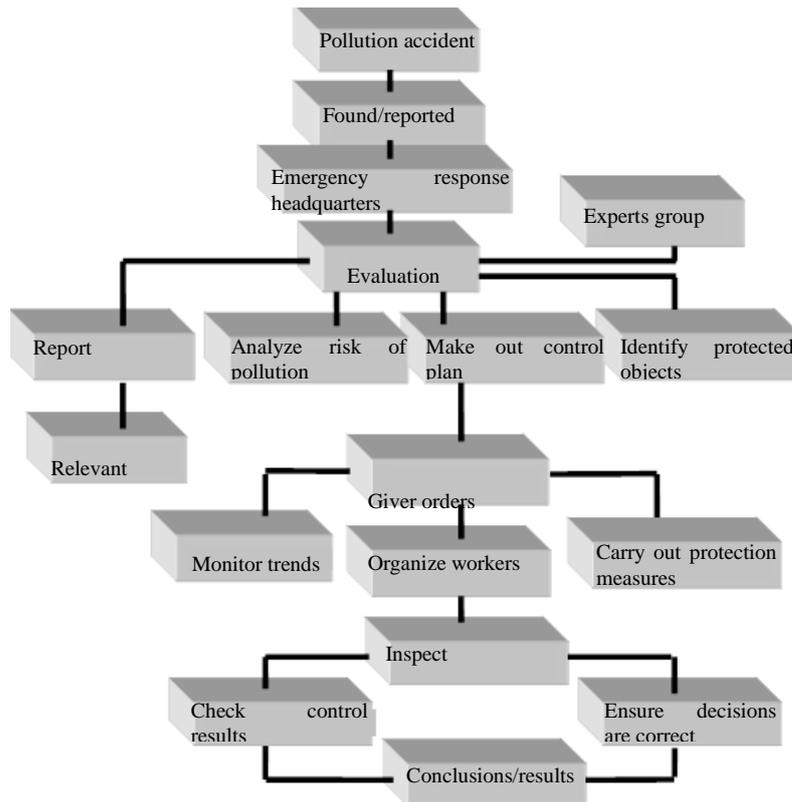
#### (1) Emergency Response Organization

The members of the emergency response organization include leaders of the Marine Control Center of Yichang Maritime Management Department, members of the Emergency Response Team under the leadership of Work Safety Department at Baiyang Port, and relevant technical advisory experts. The head of the emergency response team, led by the Work Safety Department of Three Gorges Modern Logistics Center should act as an incident commander before the leaders of the Marine Control Center of Yichang Maritime Management Department and the leaders of the company's Security Department arrived at the scene of an incident. When relevant

leaders reached the scene, they should serve as incident commanders in place of the head of the emergency response team.

According to the regulations of the Ministry of Environmental Protection, environmental pollution caused by work safety accidents should be reported to competent departments in the emergency response system. Any work safety accident should be promptly reported to Yichang Environmental Protection Bureau and Hubei Environmental Protection Bureau.

See Figure 11.3-2 for emergency action steps



**Figure 11.3-2 Emergency response action steps**

**Table 11.3-1 Responsibilities of the divisions of Emergency Response Organization**

No.	Members	Responsibilities	Notes
1	Yichang Maritime Management Department	Receiving reports on waterborne accidents; supervising implementation of the emergency plan for contamination caused by oil; coordinating with the emergency actions taken by waterborne accidents rescue teams and relevant transport departments; mobilizing the human resources, material resources, and logistics support of various departments; mobilizing emergency experts to provide technical advice for construction of this wharf.	
2	Competent	Organizing relevant experts for project technical	Hubei

No.	Members	Responsibilities	Notes
	departments of environmental protection	advice; organizing workers to monitor the potential environmental hazards that may be caused by accidents and providing relevant guidance; organizing workers from relevant organizations to monitor the scene of an accident and particularly the change in the water quality of the areas where the water intakes of water treatment plants at the upper and lower reaches of the Yangtze River are located; providing relevant technical support for environmental monitoring; making technical requirements for the clean-up, spilled oil recovery, and disposal of oil absorption felts after an accident.	Environmental Protection Bureau 027-87167130 Yichang Environmental Protection Bureau 0717-6448003
3	Technical advisory panel	Maritime and environmental protection departments organize for relevant experts to form a technical advisory panel, providing technical advisory services and taking part in decision making for emergency response. Chinese experts in oil leakage response may be employed, if necessary, to provide advisory services for estimating the impact of an accident, making decisions on emergency response, cleaning up, and compensating for pollution damage after an accident.	Formed for an accident as a makeshift panel
4	Safety department for Baiyang Port and operations area.	Director of the emergency command center acts as a commander for emergency response at the wharf. The director issues an order directing this subsidiary to mobilize its resources to take part in emergency rescue, makes decisions on serious accident management plans, and determines the time and method for reporting an accident to the competent department in the system or for requesting other rescues.	Legal representative Head of the department
5	Emergency Response Team of Work Safety Department for the Baiyang Port and operations area of Gorges Modern Logistics Center	The head of the team leads relevant workers to thoroughly implement this plan. When receiving the report on an accident, the team leader should organize for associates working at the port area to take emergency measures. He/she should act as a commander for emergency response before leaders of the competent department of the Maritime Management Department and leaders of the company relevant workers to thoroughly implement this plan. When receiving the report on an accident, the team leader should lead the duties of the team leader. The team members should execute the orders issued by the team leader or the commander for emergency response. Specifically, they organize workers at the scene to recover or remove the spilled oil.	Formed after the project is completed

**(2) Members of the emergency response team**

Members of the emergency response team include staff working in Baiyang Port and operations area and external support team members. External support teams are arranged by Yichang Maritime Control Center based on the impact of an accident.

### **(3) Emergency facilities, equipment, materials and management**

As oil leakage accidents occur abruptly, this wharf should be equipped with relevant emergency facilities and staffed with workers for implementing the emergency response plan, so that actions can be taken promptly when an accident occurs and the impacts can be minimized.

According to *Requirements on Emergency Response Equipment/Facilities for Oil leakage in Terminals in Ports (JT/T451-2009)*, this wharf should be equipped with the equipment listed in Table 11.3-2.

**Table 11.3-2 Emergency response equipment**

<b>Name</b>	<b>Specification</b>	<b>Quantity</b>	<b>Notes</b>
Containment boom	For emergency	1300m	
Oil collection equipment	Total capacity: 20m <sup>3</sup> /h	1	Relying on Phase I
Oil trawl	1 m <sup>3</sup> per set	1	Relying on Phase I
Oil absorption felt		0.5 t	
Oil leakage dispersant	Condensed	0.3 t	
Oil leakage dispersant sprinkler		1	
Light oil tank	Effective volume: 1 m <sup>3</sup>	1	
Boat used for placing containment booms		1	Relying on Phase I

When an oil leakage accident occurs, a containment boom should be promptly placed around the scene of the accident and oil absorption felts should be used to absorb oil. If the effect of an accident and weather conditions at the time exceeds what workers at the wharf can handle with the equipment at hand, relevant workers should promptly report the accident to the Maritime Control Center under Yichang Maritime Safety Administration for external support.

### **(4) Emergency response**

If an oil leakage accident occurs or possibly occurs in port, the control center and watch keepers in the port area should promptly report the accident to the emergency response team. Upon receives the report, the team should promptly organize technical staff to evaluate the area affected by the accident and estimate the direction where the spilled oil flows and the impacts of the oil leakage to water treatment plants upstream and downstream from the port, so as to develop the preliminary plan for emergency response.

After the preliminary evaluation of the oil leakage accident, head of the

emergency team will decide whether an emergency plan should be launched. If the area affected by the accident is relatively small and the workers at the wharf are capable of handling the accident with the existing equipment, the team should promptly organize to deal with the accident with selected equipment. Otherwise, an emergency plan should be promptly launched.

According to the emergency response plan, the emergency response team leader or the workers designated by the leader should report the accident to the competent department and to the accident-related shipper, insurance company, maritime safety administration, and environmental protection department. The content of report includes the following:

- i. When and where the accident occurred; name of the relevant vessel; where the vessel was when the accident occurred;
- ii. Weather conditions and hydrologic regime when the accident occurred;
- iii. Measures taken after the accident; accident control;
- iv. Accident developments and potential consequences;
- v. Necessary help (emergency response facilities, supplies, human resources, environmental monitoring, medical aid, etc.) ;
- vi. Emergency response organizations, contacts, and contact number.

All members of the emergency response team should promptly take emergency actions, including oil leakage control, clean-up and monitoring. In addition, right at the moment when an accident occurs, WTPs downstream should be informed immediately and relevant workers should be organized to closely monitor the water quality of the water intakes. Once contamination exceeding relevant standards is detected, people should immediately stop using water in the area.

See Table 11.3-3 for information about Tianjiahe water intake downstream from the wharf.

**Table 11.3-3 Information of water plant downstream nearest to the port**

Name	Location	Direction
Tianjiahe Water Plant's intake	3.8km downstream from Berth 11	North bank of the Yangtze River

### **(5) Emergency response time and control analysis**

Yichang Maritime Safety Administration is responsible for the water traffic safety control in the aforesaid water area. It usually takes 15 minutes to reach the scene of an accident/potential accident of the Yangtze River. When receiving the call of an accident, relevant boats will set out in five minutes. The oil leakage response mechanism has oil control capacity of 50t or more..

### **(6) Spilled oil recovery**

Oil absorption felts can be reused after being recycled. If there is still spilled oil

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on bank of the port area after being controlled and recycled, relevant organization should organize staff at the wharf, external support teams, and residents nearby to remove oil from the river bank. Collected oil should be transported to the waste oil recycling companies for recycling. These companies should be authorized by the Yichang Maritime Management Department and other competent authorities.

#### **(7) Accident reporting system**

Whenever an accident occurs, it should be promptly reported to competent authorities. After the settlement of the accident, the Three Gorges Logistics Company should report to the Yichang Maritime Safety Administration and Environmental Protection Bureau the information with regard to the cause of an accident, oil leakage, contamination removal, and the impact of the contamination. The Yichang Maritime Safety Administration and Environmental Protection Bureau should then organize workers to investigate the accident and determine the compensation for the loss caused by oil leakage. The compensation can be paid to relevant victims after it is approved by the court.

#### **(8) Trainings of staff**

The managers, equipment operators, and cleaners for emergency response at the wharf should receive relevant trainings to acquire the knowledge to execute their responsibilities. It is advisable that workers for emergency response should work with a license, so that they may be better prepared both theoretically and practically for emergency response, including oil leakage control and contamination removal.

#### **(9) Exercise**

Relevant exercises should be held as a way to improve emergency handling capability to waterborne emergencies. Such exercises can improve the emergency response team's ability to handle emergencies and ensure safety, increase communication and coordination between emergency rescue organizations, and test participants' ability to respond to emergencies.

#### **(10) Regular review**

It must be ensured that every worker concerned has a copy of this emergency response plan. The plan should be reviewed once a year, so that the information regarding the members of emergency response organizations and their contacts can be updated.

### **11.4 Environmental monitoring**

The impacts of construction and operation to the environment will be monitored. Environmental monitoring is aimed at ensuring that the environmental protection measures listed in the EIA are implemented, so as to keep the impacts of construction to the environment at an acceptable level and in accordance with relevant national laws, regulations, and standards.

Environmental monitoring in the operations area and logistics park during construction and operation should be undertaken by an organization qualified for environmental quality monitoring in accordance with relevant regulations. The organization should regularly monitor the environment, compile monitoring reports, and submit the reports to the competent authority. The monitoring reports are subject to review by environmental protection departments at all levels. In case of any problem identified during monitoring, the organization should report the problem to the competent authority so that effective measures can be taken to address the problem in a timely manner.

According to environmental monitoring results, sensitive spots that may be noticeably affected by contamination are used as monitoring points for monitoring contamination caused by the project during construction and operation. Noise, air environment, and surface water environment are primarily monitored. Factors to be monitored are determined based on the characteristics of pollution caused by the project.

Methods of monitoring and analysis that are listed in the *Technical Specification for Environmental Monitoring* issued by the Ministry of Environmental Protection are adopted for this project. National standards for environmental impact assessment are used for evaluating the project's environmental impact. Based on the features of the WB Funded Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project, an environmental monitoring plan involving different phases has been prepared. See Table 11.4-1 for the plan.

**Table 11.4-1 Environmental Monitoring Plan**

	<b>Project</b>		<b>Construction Phase</b>	<b>Operation Phase</b>
Ambient air	Source of pollutants		Construction dust	Dust, vehicle exhaust
	Factors to be monitored		TSP, PM <sub>10</sub>	TSP, NO <sub>x</sub>
	Standard	Quality standard	<i>Ambient Air Quality Standard</i> (GB3095-2012)	<i>Ambient Air Quality Standard</i> (GB3095-2012)
		Emission standard	—	—
	Monitoring spots		Concrete batching plant, lime-soil mixing station, Guixihu Village, Yazishan Village, Baiyang Town, Wanfunao Village	Guixihu Village, Yazishan Village
	Monitoring frequency		Once every quarter (increasing frequency during peak of construction) , 3-4days per quarter	Once a year, one day a time
Ambient noise	Source of pollutants		Mechanical noise during construction	Traffic noise
	Factors to be monitored		LAeq(dB)	LAeq(dB)
	Standard	Quality standard	Environmental Quality Standard for Noise (GB3096-2008)	Environmental Quality Standard for Noise (GB3096-2008)
		Emission	Emission Standard of	—

	Project		Construction Phase	Operation Phase
		standard	Environment Noise for Boundary of Construction Site (GB12523-90)	
		Standard of measurement	Environmental Quality Standard for Noise (GB3096-2008)	Environmental Quality Standard for Noise (GB3096-2008)
	Monitoring points		Guixihu Village, Yazishan Village	Guixihu Village, Yazishan Village
	Monitoring frequency		Once every quarter, two days a time, once during nighttime and once during daytime	Once a year, two days a time, once during nighttime and once during daytime
Water environment	Source of pollutants		/	Domestic/production wastewater
	Factors to be monitored		/	pH, NH <sub>3</sub> -N, COD, BOD <sub>5</sub> , oil, etc.
	Standard	Quality standard	/	/
		Emission standard	/	Integrated Wastewater Discharge Standard (GB8978-1996) Class III
	Monitoring points		/	General outlet of sewage
	Monitoring frequency		/	Once a year

## 11.5 Training program

The environmental protection training program is to familiarize project stakeholders with the ESMP, and national and local laws on the environmental protection of project construction and operation, so to as make sure that the mitigation measures are implemented as required.

The trainees are environmental staff and supervisors and the training constitutes a part of technical assistance. The training program during project construction is also available to the Contractor and construction workers. Before project construction commences, all the construction units, operation units and supervisors must attend compulsory EHS training. Specific training programs are listed in Table 11.5-1.

**Table 11.5-1 Training plan for technical staff**

Characteristics	Staff	Training content	No. of trainee	Duration	Year	Cost (10,000 Y)
<b>Overseas</b>						
Environmental management	Managers of Project Coordination Office	Experiences and best practices in environmental management during construction phase	5	10 days	2016	12.5
	Professionals from PMO and PIU	Environmental management technological management	20	10 days	2016	45.0

Characteristics	Staff	Training content	No. of trainee	Duration	Year	Cost (10,000 Y)
<b>Overseas</b>						
Domestic						
Environmental protection	Environmental workers from Contractor	Environmental monitoring methods, reports and post training; annually: ESMP, environmental monitoring and reporting, emergency plan	10~20	3 day / time	2016-2020	9.0
Supervision	Environmental supervision engineers, environmental managers	Environmental protection regulations, construction planning, environmental monitoring standards and planning, environmental air monitoring and pollution control, noise monitoring and control	5~10 people	5 day / time	2016-2020	7.5

## 11.6 Reporting and grievance handling

The overall period of project implementation is about three years. According to China's environmental management regulations and WB's policy requirements, the borrower shall be responsible for evaluation and monitoring of ESMP implementation (twice per year). The purpose is to make sure that all the requirements and measures in the approved ESMPs are carried out or met. Problems should be identified and solved in a timely manner, so as to mitigate the negative environmental impact in the follow-up work of the project.

Environmental supervision and reporting are arranged as below:

- 1) Project supervision engineer shall record the implementation of ESMP in details in the supervision log and monthly report, and shall submit weekly report and monthly report to the PMO;
- 2) PMO shall carry out on-site supervision on the implementation of ESMP regularly or irregularly, and shall take records for semi-annual report;
- 3) The external environmental supervision agency shall, after receiving entrustment, supervise the implementation of mitigation measures timely, monitor the quantitative indicators regularly, and prepare external supervision report and submit it to PMO as required by this section and the contract;
- 4) In case of complaints on environment, the external environmental supervision agency and the PMO must notify the local competent administrative authority of environmental protection, and shall report to all levels of superior authorities if necessary.
- 5) PMO shall, based on the information of 1-4 and the reports, with the assistance by external environmental supervision agency/experts, prepare the chapter on implementation progress of ESMP, which shall be

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incorporated into the semi-annual progress report and shall be submitted to the WB in time.

The chapter on implementation of ESMP shall mainly include:

- 1) Implementation of ESMP: main construction works in this stage, training on environmental management provided in this stage, implementation of mitigation measures, problems existed and causes; rectification measures for the next steps.
- 2) Results of environmental monitoring: give brief explanation of the data, describe the existing problems and non-compliance, analyze their causes, and propose rectification measures; grievances of residents and solution shall be included if necessary;
- 3) Overall evaluation and conclusion on the implementation of ESMP in this stage, suggestions and plan for the next semi-year.

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## 12 Conclusions

The proposed project is located in Baiyang Industrial Park, Yichang Hi-tech Industry Development Zone, in the territory of Baiyang Town, Zhijiang City (a prefecture-level city of Yichang) on the north bank of Yangtze River. The project comprises five primary components, namely Baiyang Port Operation Area, Baiyang Logistics Park, transport infrastructure, Three Gorges Modern Logistics Information Center and project management & capacity building, covering totally 17 secondary sub-components.

Baiyang Port area is located about 3.0 km outside the natural reserve of Chinese sturgeons. It is designed with cargo handling capacity of 7,000,000t/a including 1,200,000t/a general cargoes, 5,000,000t/a bulk cargoes, 80,000 TEU containers per year (equivalent to 800,000tons). In the port, one 3,000-ton berth for heavy lifts e.g. steels, four bulk cargo berths and two multi-purpose berths will be built, occupying totally 1036m long shoreline.

Baiyang Logistics Park covers an area of 76.6km<sup>2</sup>, comprising of mixed-use logistics area, trade and logistics area A and trade and logistics area B. Transport infrastructure component comprises of Shawan Road Overpass (urban secondary trunk road, total length: 675m, of aerial construction, two-way four lanes, bridge width: 17m, bridge length: 280m), Guihu Road (urban secondary trunk road, width: 30m, total length: 1,126m, two-way four lanes, width of carriageway: 16m), and Songgang Second Road (urban secondary trunk road, width: 30m, total length: 900m, two-way six lanes, width of carriageway: 24m). In the Information Center, the office building, dispatching building and information service building will be constructed.

Project management & capacity building refer to the project management system including project management office, project implementation unit and project monitoring organization.

The project is in line with industrial policies and plans of China and will achieve the following goals: improve infrastructure and investment environment of the Logistics Center, reduce logistics cost, improve logistics service quality, strengthen industrial management, establish an orderly, competitive and open logistics market, improve the integrated transportation system, promote the development of modern logistics and finally stimulate economic development of Yichang City.

The project site has good environmental quality, but large-scale construction may have environmental and social impacts.

It will generate domestic wastewater, noise and solid wastes and may cause ecological damages and environmental safety accidents. The project will have impacts on surrounding environment, especially water quality of this section of Yangtze River. But the adverse environmental impacts of the project can be well controlled by carrying out the "simultaneous design, construction and operation" of environmental protection facilities with the construction project, the trans-regional prevention and control of water pollution of Yangtze River and the measures proposed herein. In this way, the construction of the project

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will be accepted by the environmental functions of the target area.

In addition, the project has small incremental contribution to the cumulative impact. The cumulative impacts of past, present and future foreseeable activities are within the bearing capacity of local ecology, match with the shoreline resources planning and water functional zoning, and almost will not affect the migration and survival of Chinese sturgeon.

The project is environmentally feasible so long as it is constructed at the proposed site and within the proposed construction range and all environmental protection measures specified herein are strictly carried out.

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**Annex 1: Letters on site selection on Chinese sturgeon natural reserve in Yichang**

**Letters on site selection on Chinese sturgeon natural reserve in Yichang**

**To : Yichang Transport Investment Co., Ltd**

The project site selection of World Bank Financed Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project is located about 1 km from Baiyang downtown in Baiyang Industrial Park, Yichang Hi-tech Industry Development Zone.

As per the requests of the document *Approval on the Adjustment of Coverage of Chinese Sturgeon Nature Reserve in Yichang, Hubei* issued by the general office of the provincial government, ([2008]No.263), “the range of Chinese Sturgeon Nature Reserve in Yichang had been reduced from 80 km to 40 km. The functional zones had also been adjusted respectively, namely, the core zone is defined 20 km to the foot of Gezhou Dam Water Control Project. The buffer zone is defined 10km from the Yangtze River Road Bridge. The experimental zone is defined 20 kilometers from Yangtze River Road Bridge. The peripheral zone of the nature reserve starts from the end of experimental zone down to 30 kilometers.

Hereby, it is concluded that the project site is beyond the experimental zone. It is located at the specific location of Nature reserve starts from and within the range of peripheral zone of the natural reserve.

Regards,

Chinese Sturgeon Nature Reserve Management Department in  
Yichang, Hubei Province

Mar.14, 2016

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## **Annex 2 Clarification on the source of the borrowed earth**

Yichang High-Tech District Baiyang Industrial Park Development Management  
Office Document

Yichang-High-tech-Baiyang Office Letter No.2 [2016]

Signature: Wang, Keping

The Letter on clarification of the borrowed earth for the Yichang Three-Gorge  
Modern Logistic Center Infrastructure Project

– Yichang High-Tech District Baiyang Industrial Park Office

To: Hubei Provincial Water Resource Bureau,

The World Bank loan Yichang Three Gorges modern logistics center is the core port of the future development of Yichang Port. The project will make full use of the shoreline resources of the operation area of Baiyang Park, achieve scaled-up development of the area into a large-scale intensive port operation Area. It will also help the rapid increase in Yichang Port shipping capacity to meet the rapid growth needs of Three Gorges Dam cross-dam transportation and Yichang port throughput. The project is located in Baiyang Town, Zhijiang City, under the Baiyang Industrial Park of Yichang National Hi-Tech Industrial Development Zone. The designed throughput is 7 million tons per year. The project needs to borrow 526,300 cubic meters of earth. Based on the situation that the Baiyang Industrial Park New Town Core Area Site Preparation project will have a lot of spoil, the three parties including the Yichang City Transportation Investment Company, the Yichang Friendship Ecological Engineering Consulting Company, and the Yichang International High-tech Industry Development Zone Industrial Park Office met in the field to discuss and agreed that 526,300 m<sup>3</sup> spoil from the Baiyang Industrial Park New Town Core Area Site Preparation project will be used for filling for the World Bank loan Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project. This will not only solve the issue of spoil storage in the park but also can solve the borrow earth issue for the World Bank loan Hubei Yichang Three Gorges Modern Logistics Center Infrastructure Project. It is in line with the soil conservation and environmental protection requirement. If there is a time difference issue between the two projects, the project preparation unit should establish temporary storage site in the park and develop relevant control measures to minimize soil erosion and flying dust hazard.

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Sincerely yours,

Mr. Liu Xu 138072578398.

Yichang Hi-Tech District Baiyang Park Office

March 14, 2016.

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### **Annex 3 The approval letter on navigation safety from Maritime Affairs Bureau**

Yichang City Maritime Affairs Bureau of People's Republic of China

Yichang-MAB - Letter No.1 (2016)

Subject: The approval letter of Yichang City Maritime Affairs Bureau regarding the navigation safety for the Yichang Port Baiyang Operation Area Phase II project

To: Yichang City Transportation Investment Company,

We have received your letter regarding the navigation safety for the Yichang Port Baiyang Operation Area Phase II project. After careful study, our comments are as below:

1. The proposed port is close to the Baiyang Operation Area under construction. It is along the left side of the Baiyang Water Channel (Mid-stream of Yangtze River at 586-586.9 km and 588 km). The project site has smooth river section, smooth river flow and good navigation condition, thus the project site is feasible.
2. The project should further optimize the frontline wharf layout to have smooth connection with the Phase I project frontline wharf layout. In addition the docking number should be limited to reduce the impact on navigation safety.
3. Your company should take up the safety responsibility, follow the three-simultaneousness requirement in the national safety supervision and management, and prepare the corresponding anchorage, pollution prevention, video surveillance and other safety facilities and equipment.
4. After your company has received the shoreline approval letter and confirmed the coordinates and location of the wharfs, please apply from us the above- and under-water construction permit. Construction can commence only after such permit is received.

Sincerely,

Yichang City Maritime Affairs Bureau of People's Republic of China

January 20, 2016

CC: Yidu City Maritime Affairs Department.

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## Annex 4 Phase I Earth Borrowing Agreement

### Earth Borrowing Agreement

A: Village council of Wanfunao Village in Baiyang Township, Zhijiang City (hereinafter Party A)

B. Yichang Huaxin Transportation Investment Company (hereinafter Party B)

The Yichang Port Baiyang Port Operation Area (Phase I) and the Yichang Freight Transportation Center (Baiyang Logistics Park) are both key projects in the 12th Five-Year Transportation Plan of the Province and the Municipality. They are also the key supporting projects of the Baiyang Industrial Park. The project is of great significance to improve the investment environment of Baiyang Industrial Park and can drive the economic development of industrial parks and surrounding areas. The total quantity of earth work in the project is approximately 2.072 million m<sup>3</sup>, including cutting, earth utilization and borrowed earth filling.

Based on the construction needs, for the earth needed for filling, the earth will be borrowed from Wanfunao Village (earth reserves of about 4 million cubic meters). The earth will be transported to the project sites with vehicles. Both parties hereby sign the following agreement:

1. Party A will provide the earth source located at Wanfunao Village;
2. Party B will be responsible for earth digging and transportation;
3. Party B will pay to Part A the earth fee according to relevant regulations;
4. The detailed earthwork will be calculated based on actual project needs.