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World Bank Financed
Ningbo Sustainable Urbanization
Demonstration Project (Phase I)

Environmental Impact Report

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Ningbo Municipal Research & Design Institute

Of Environmental Protection

Project Name: World Bank Financed Ningbo Sustainable Urbanization Demonstration Project (Phase I)

Environmental Assessment File: Environmental Impact Report

Client: Ningbo Management Office of World Bank Financed Project

Xiangshan World Bank Financed Project Management Project

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World Bank Financed

Ningbo Sustainable Urbanization Demonstration Project (Phase I)

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Abbreviation, Acronyms and Some Chinese Pinyin and Han Characters

	Abbreviation	Acronyms	Chinese Character and Meaning of Directions and Common Place Names
Bei			北, north, northern
Cun			村, village
Construction supervision company		CSC	
Dadao			大道, avenue
Developmen and Reform Commission		DRC	
Dong			东,east, eastern
Development and reform bureau		DRB	
Environmental assessment		EA	
Environmental impact assessment		EIA	
Environmental impact assessment report		EIAR	
General Guidelines for Environment, Health and Safety	EHS Guidelines		
-he			河, river, canal
Huadong Engineering Cooperation Limited,		HECL	
Jie			街,street
Lu			路,road
nan			南, south, southern
Ningbo Municipal Research & Design Institute of Environmental Protection		NMRDIE	
Ningbo Project Office for World Bank Financed Project	Ningbo Project Office or Ningbo PMO	NPMO,	
shan			山, hill or mountain
Shanghai Municipal		SMEDI	

Engineering Design Institute (Group) Co., Ltd.			
Traffic Police Brigade		TPB	
Urban management bureau		UMB	
Xi			西, west, western
Xiang (County) Environmental Protection Bureau	Xiang EPB	XEPB	
Xiang (County) Housing and Urban & Rural Development Bureau	Xiang Construction Bureau (old abb.)	XHURDB	
Xiangshan Planning Bureau		XPB	
Xiangshan Public Transportation Company		XPTC	
Xiangshan Urban Management Bureau		XUMB	
Xilu			西路, western road

1 General Principles

1.1 PREFACE

New urbanization is an important goal of China's development in the current stage, and the enhancement of the new urbanization has been changed from undue emphasis on city size extension and spatial expansion to promotion of urban culture and improvement of public services, etc. so as to make our cities and towns become quality livable places.

The core of urbanization is urbanization of people, the key of it is to raise urbanization quality and the purpose of it is to benefit and enrich common people.

To accelerate the urbanization development in Ningbo, establish and improve a safe, rapid, efficient, clean, economical and integrated, modernized urban transportation system as well as a flood risk management system, the city intends to apply to the World Bank for its financing of the Ningbo Sustainable Urbanization Demonstration Project. Through implementation of the Project, Ningbo intends, by reference of the Bank's advanced experience in transportation management and flood risk management, to strengthen its management in the two aspects so as to improve urban infrastructures and public transport services to realize the objectives of urban sustainable development and livability enhancement.

The Project is planned to be implemented in three phases. The current phase is Phase I Project, for which 50-70 mil USD of the Bank loan will be applied for; under Phase I Project there are two components ---- the Integrated Transportation and Flood Risk Management ones (Detailed information is shown in Table 1.1-1; subproject locations can be seen in Fig. 1.1-1), both of which are located in the core urban district of Xiangshan County.. Ningbo PMO and Xiangshan Sub-PMO are project implementation agencies (PIAs). It is planned to start the construction in August 2016 and complete the completion acceptance in 2018.

In accordance with the Environmental Impact Assessment Law, Administrative Regulations on Environmental Protection for Construction Projects, Operative Policy OP 4.01 and other related regulations, the project development agency (PMO) entrusted the Ningbo Municipal Research & Design Institute of Environmental Protection to conduct an environmental impact assessment (EIA) on the Ningbo Sustainable Urbanization

Demonstration Project (Phase I) to be financed by the World Bank (hereafter referred to as this or the Project), so as to have the Project developed in a way coordinated with the environment.

After being entrusted, our institute organized resources immediately to carry out field investigation and data collection, having prepared this environmental impact report for this Project in line with the related provisions of the Bank and national technical guidelines and standards for environmental impact assessment.

Table 1.1-1 Project Components and Main Construction Contents

Subproject			Main Construction Contents
Integrated Transportation System Component			
of Old Town Upgrading and of Accessibility Promotion	Public Space Retrofit	Wenchang Jie	Tiananlu-Xinfenglu segment with an overall length of about 360m. Major contents include: ①to standardize street function zoning, ②to improve public facilities such as benches for pedestrians, ③ permeable pavement renewal, ④architectural facade retrofit.
		Tianan Lu	Jianshelu-Xiangshanlu segment with an overall length of about 2.5km. Major contents include: ①to set pocket-shaped parking lots, ②to set parking areas for non-motor vehicles on sidewalks, ③to increase benches and other amenities in pedestrian space.
		Dannan Lu	Both sides of Xiangshan Experimental Primary School. Major contents include: ①to set parking areas for non-motor vehicles, ②to increase amenities such as parent waiting areas and benches, ③to set safety signs.
	Traffic Corridor (Tianan Lu)	Road overhaul	Overhaul of and road pavement and subgrade
		Optimization of public transportation network and bus stations	To extend some bus routes and increase departure frequency of some routes.
		Signal optimization	To add traffic lights in some intersections, to optimize duration of some traffic lights, etc.
		Intersection optimization	To set pedestrian twice crossings in some intersections and waiting areas for left-turning vehicles in some intersections.
	Traffic Management	Intelligent transportation system	To increase intelligent transportation systems in existing roads of Xiangshan urban areas, mainly include: ①high-definition electronic police system, ②high spot video monitoring system, ③dynamic traffic guidance system, ④dynamic parking guidance system, ⑤telecommunication network system.
	Road Network Improvement	Huancheng Xillu	A new road to be constructed, with an overall length of about 2.9km (north from Danshan Lu and south to Binhaidadao), standard cross section of 36m and its road grade is urban primary road.

		Baohai Lu Lu	To be built, with an overall length of about 0.7km (west from Laixun Lu and east to Xinyi Lu), standard cross section of 24m and its road grade is urban secondary road.
Public Transportation	Bus Station Construction		To build Tashan Terminal Bus Station. See Subsection 2.4 for details.
	Intelligent Public Transport System		Electronics including Global Navigation Satellite System (GPS) and Geographic Information System (GIS) will be configured to bus stations and vehicles.
	Bus Stop Pavilion Construction		To build 30 new bus stop pavilions and maintenance of some of the existing stop pavilions
	Vehicle purchase		To purchase 45 buses by 2018
Flood Risk Management Component			
Engineering Measures	Drainage Pipe Network Retrofit		Including dredging of 377.2km sewers and reconstruction of about 1.06km sewers.
	River Dredging Works		Dredging of main watercourses s in urban areas, 32,168m in total; dredging depth of the Xida River, Nanda River, Menqian River and Xiangshan River will be 0.5m, others will be 0.2m.
	Drainage Pumping Station Construction		To build 3 new boosting pumping stations. See Subsection 2.5.1 for details.
Non-engineering Measures	/		Mainly including (but not limited to): land use planning and development control, flood warning and forecasting, flood-fighting and emergency plan, public education and awareness publicity , flood insurance, etc.

Note: Please refer Section 2 for the specific construction schemes and capacities for the subprojects.

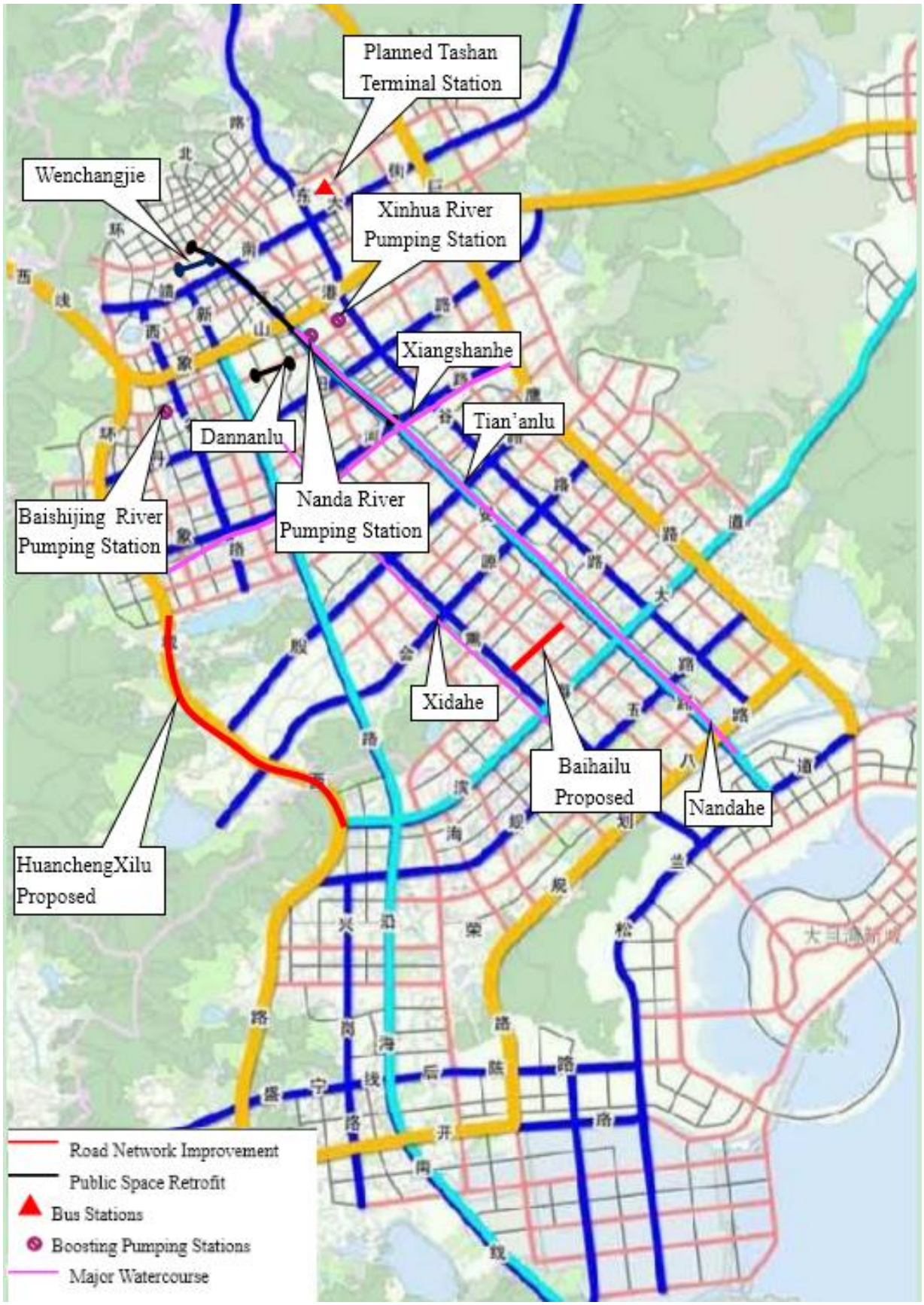


Fig. 1.1-1 Locations of Construction Sites of Major Subprojects

1.2 BASES FOR REPORT PREPARATION

1.2.1 Main Laws and Regulations

1) Environmental Protection Law of PRC (Jan.2015);

2) Environmental Noise Pollution Prevention Law of PRC (Mar. 1997);

3) Atmospheric Pollution Prevention Law of PRC (Revised), January 1, 2016;

4) The Environment Impact Assessment Law of PRC (Sep. 2003);

5) Law of PRC on Prevention of Solid Waste Pollution to Environment (Apr., 2005);

6) Water Pollution Prevention Law of PRC (Jun. 2006);

7) Administrative Regulations on Environmental Protection for Construction Projects (Decree 253 of the State Council, Nov. 1998);

8) Tentative Provisions for Public Participation in Environmental Impact Assessment (HuanFa 2006 [No. 28］;

9) List of Classified Administration on Environmental Impact Assessment for Construction Projects (Decree 33 of the Ministry of Environmental Protection, Jun. 2015);

10) Provisions on By-level Review and Approval of Environmental Assessment Documents (Decree 5 of Ministry of Environmental Protection, Mar. 2009);

10) Catalogue of Guiding Industrial Structure Adjustment (2011) (Revised 2013) (Decree 21 of NDRC, May 2013);

12) Notice on Further Promotion of Environmental Supervision Pilot for Construction Projects (HuanBan [2012] No. 5, Jan. 2012);

13) Zhejiang Environmental Protection Administrative Provisions for Construction Projects (Revised 2014) (Decree 321 of the Zhejiang Provincial People's Government, Mar. 2014);

14) Notice of General Affairs Bureau of Ningbo Municipal People's Government on Limits of Authority of Environmental Protection Bureaus at Municipal and County (city at county level) Level in Review and Approval of Environmental Impact Assessment Documents for Construction Projects (YongZhengFa [2015］No. 21, Mar. 2015);

15) Ningbo Administrative Provisions on Civilized Construction under Construction

Projects (Decree 195 of the Ningbo Municipal People's Government, Jan. 2012.

1.2.2 Related Regulations of World Bank

1) Environment Assessment (OP, BP and GP 4.01);

2) Physical and Cultural Resources (OP 4.11);

3) Non-voluntary Resettlement (OP.BP 4.12);

4) Business Information Disclosure (BP 17.50);

5) General Guidelines for Environment, Health and Safety (EHS Guidelines).

1.2.3 Related Technical Guidelines and Standards

1) Technical Guidelines for environmental impact assessment – General Principles (HJ2.1-2011);

2) Technical Guidelines for environmental impact assessment – Atmospheric Environment (HJ2.2-2008);

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

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

5) Technical Guidelines for Environmental Impact Assessment – Ecological Impact(HJ19-2011);

6) Zhejiang Technical Key Points of environmental impact assessment for Construction projects (Revised version) (Zhejiang Environmental Protection Bureau, Apr., 2014).

1.2.4 Plannings Concerned

1) The Master Planning for City (CoreUrban Area) of Xiangshan County (2006-2025);

2) Integrated Transportation Planning For Core Urban District Of Xiangshan County;

3) Specialized Public Passenger Transport for Urban and Rural Areas in Xiangshan;

4) Integrated Planning for Drainage (Rainwater) and Flood Prevention in Urban Area of Xiangshan.

1.2.5 Environmental Function Zoning

1) Functional Zone Planning of Xiangshan for Ecological Environment (Xiangshan Environmental Protection Bureau, XiangZhengFa [2008] No. 73, May 2008;

2) Water Functional Zone and Water environment Functional zone division scheme of Zhejiang (ZheZhengBanFa [2005] No. 9, Dec. 2005);

3) Functional Zone Division Scheme of Ningbo for Ambient Air Quality (YongZhengFa [1997] No. 67,Apr. 1997.4);

4) Notice on Adjustment of Functional Zoning for offshore Sea area of Zhejiang (Zhejiang Development and Plan Commission and Zhejiang EPA, ZheHuanFa [2001] No. 242, Oct., 2001).

1.2.6 Technical Documents Related to Project

1)Feasibility Study Report on Integrated Transportation System Subproject (Phase I) in Xiangshan of Ningbo under the Sustainable Urbanization Demonstration Project Financed by World Bank (SMEDI);

2)Feasibility Study Report on Flood Risk Management Component under Ningbo Xiangshan Sustainable Urbanization Demonstration Project Financed by World Bank (HECL);

3)Other Materials Provided by Project Development Agency (PMO).

1.3 Related Plannings and Their Relations to This Project

1.3.1 Master Planning for City (Core urban district) of Xiangshan County (2006-2025)

The plannings under the Master Planning for urban drainage, flood prevention and road system are briefly introduced as follows:

1) Urban Flood Prevention Planning

(1)Standard for Planning

The Flood control standard for the core urban district of Xiangshan is defined as 50-year return;

The Water-logging prevention standard is defined as 20-year return, 24 hr rainfall to be

drained out in 24 hr.

(2) Engineering Measures for flood control and Logged Water Drainage

(i) Regulating area shall be controlled to be 4.5 km2 within the whole catchment, 2.0 km^2 of which is the total bottom area of watercourses for drainage according to the requirements of river network layout, the rest 2.5 km2, for retarding basin.

(ii) Because the communication time of the River network in the whole catchment will be affected to some extent by land development sequence and other factors, the elevation is selected 4.3 m of the ground surface north to outer ring Chengnan Lu (road) and that is ascertained 4.0 m of that south to outer ring Chengnan Lu.

(iii) To respectively add a 35 m flood outfall and a 15 m flood outfall on the Menqiantu Seawall and Xingfu Seawall.

(iv) To widen main watercourses and dredge transverse canals, and excavate flood interception ditches where appropriate.

2) Urban Drainage Engineering Planning

(1) Drainage system

In the old urban are, a combined system is adopted in the short term, and a separate system will be employed in the long term. In the new urban area, a separate system will be adopted.

(2)Wastewater Works Planning Three wastewater treatment plants are set in the core urban district, one for Dandong and Danxi Sub-districts with a capacity of 120 000 $m^{3/}d$; the other two set in Juexi, one of which is set in Zone C of the new industrial park for centralized treatment of industrial wastewater with a capacity of 35000 m^3/d and the other is a domestic sewage treatment plant with a capacity of 30,000 m^3/d.

In Qiangtou, Tuci, Maoyang Towns small-sized WWTP need to be built, each with a capacity of 3000-8000 m3/d, sewage from townships and villages will be collected for treatment in nearby WWTP in the urban area.

Wastewater Works Planning for Core urban district can be seen in Fig. 1.3-1 below.

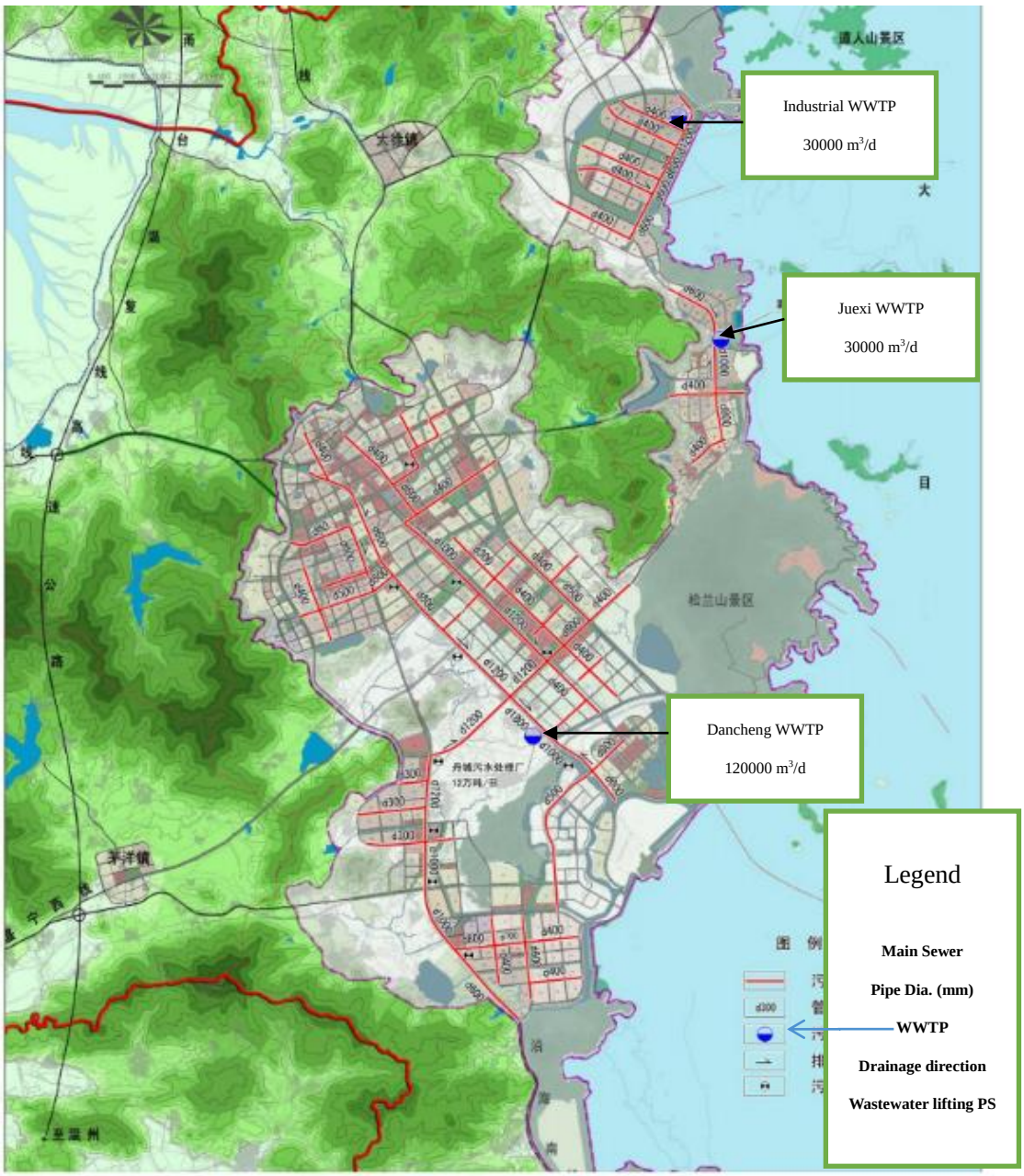


Fig1.3-1 Wastewater Works Planning for Core Urban Dis trict

(3) Rainwater Works Planning

A separate system is adopted in the new areas of the core urban district, under which rainwater pipe network will be laid, while in the built-up area, on the basis of adequate use of the existing combined system, the rainwater system will be improved according to the planning standard. Nearby drainage principle is adopted for rainwater in the urban area, which will be drained into nearby watercourses.

3)Urban Road System Planning

The road system in the core urban district of Xiangshan consists of four level roads: key

primary road, primary road, secondary road and branch with a basic framework composed of two horizontal and two vertical key primary roads, continuing the chessboard pattern and forming a pattern of 8 vertical and 10 horizontal road network. "Two horizontal" refer to Xiangshangang Lu and Binhai Dadao (avenue), and "two vertical" , Xinfeng Lu and Juying Lu.

"Eight vertical" are: HuanchengXilu, Xiguhu Lu, Xinfeng Lu and YanhanNanxian, Laixun Lu (south to Danyang Lu), Tianan Lu, Donggu Lu, Juying Lu and Xinjiang Lu;

"Ten horizontal" are: HuanchengBeilu, JingnanDajie, Xiangshangang Lu, Danyang Lu, Xiangshanhe Lu, Danshan Lu, Danfeng Lu, Zhengshi Lu, BinhaiDadao and the planned primary road south to BinhaiDadao.

1.3.2 Integrated Transportation Planning for Core Urban District of Xiangshan County

The planning horizon of the Planning is 2011 ~ 2020, and the long term horizon is to 2030. Under the Planning, the objective of the urban road system planning is: with the existing road network and urban road network under the Urban Master Planning as a basis, and in combination with the layout form of urban land use and the orientation of future city expansion, to reasonably supplement, improve and finalize the optimized road network scheme, which allows the urban area and transportation to be developed harmoniously, and create basic advantageous conditions for the road network to ameliorate the traffic environment in the core urban district of Xiangshan county.

Road Network Structure Map of Integrated Transportation Planning for Core urban district of Xiangshan can be seen in Fig. 1.3-2.

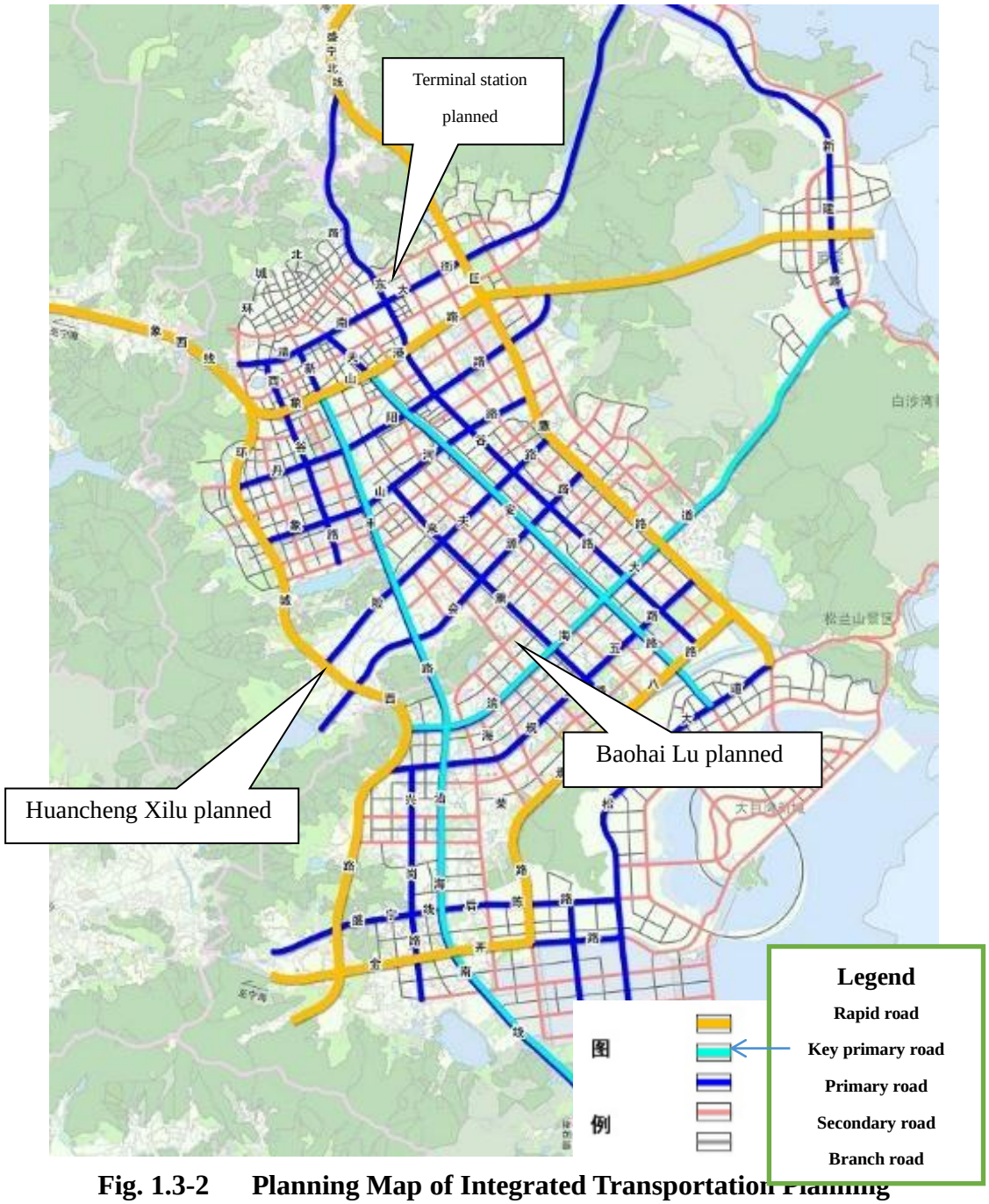


Fig. 1.3-2 Planning Map of Integrated Transportation Planning For Core Urban District of Xiangshan - Road-Net Structure

1)Rapid Road Net Planning

According to the spatial distribution in the core urban district and land use planning, and in combination with both of the existing road conditions and analysis of motorized vehicle flow through cross-sections of main passages, a #-shaped rapid road-net scheme is proposed for the planning of Xiangshan core urban district. As per the planning, such six roads will be upgraded to rapid road as Xiangxi Line, Xiangshangang Lu, Huancheng Xilu, Juying Lu, Guihua Balu (Planned Road 8).

Among them, the function of HuanchengXilu is to assume through traffic and link Xiangxi Line northward and Jinkai Lu southward to facilitate communications passing into and out of the city.

2)Secondary Road Net Planning

Secondary Roads are main roads between the urban clusters, which link with primary roads to form the urban primary road net. From the viewpoint of transport, the main function of the secondary roads is to gather and distribute traffic flows, meanwhile they also have the function of facilitating daily life. The width of red boundary line of the road is 24 ～36 m, and the number of motorized vehicle lane can be basically ensured 4 lanes, two-way.

1.3.3 Specialized Public Passenger Transport for Urban and Rural Areas in Xiangshan

1) Planning Horizon: Short term 2018 and long term 2025.

2) Planning objective: to gradually carry forward the transformation and upgrading of urban and rural passenger transport, improve the urban public transit system in the core urban district, so as to allow urban and rural residents to enjoy convenient, comfortable, safe, efficient, rapid, environmentally-friendly and economical public passenger transport services;To realize the intercoordination between the public passenger transport route-net,land use and industrial distribution, And accomplish reasonable resource arrangement of public passenger transport infrastructures.

3) Key Planning Indicators

(i) Maximum trip duration: to take 30 min or less to travel between any two points in the Xiangshan core urban district, and no more than 50 min to travel from the core urban district to each center of a town/township.

(ii) Public transport sharing rate: in the short term, the proportion of trip by bus would amount to 15%, while in the long term, 20%.

(iii) Holding quantity of public bus (HQPB): in the core urban district, HQPB 10 standard buses per ten thousand people in the short term (2018), while 12 in the long term (2025).

(iv) Density of Public Transport Route Net (DPTRN): in the short term, DPTRN in the

core urban district would reach 3 km/km2 or so, while in the urban fringe, 2.0 km2 or so; in the long term, 3.5 km/km2 or more in the core urban district, while in other areas, 2.5 km/km^2 or above.

4) Public transport terminal station planning:

Based on the existing terminal stations in the core urban district, 20 terminal stations named Tashan, Laocheng etc. will be built under the planning. Among them, Tashan Terminal Station has been included in the short-term construction plan,which is sited on the side southwest to the intersection between Tashan Lu and Xingsheng Lu (Please refer to Fig. 1.3-2).

1.3.4 Integrated Planning for Drainage (Rainwater) and Flood Prevention in Main Urban Area of Xiangshan

The Integrated Drainage and Flood Prevention Planning Report for the Main Urban Area of Xiangshan has been approved recently, the primary coverage of this planning is cited as follows:

1) Planning Coverage

The scope of this planning covers the main urban area of the county, including major watercourses within the main urban area of the county. The planning scope starts from Waihuancheng Beilu (north outer ring road) in the north of the urban area, and ends at the seawall at Menqiantu Erxian (Line 2); and borders Waihuancheng Xilu in the west, and links the foot of a hill in the east, with an area of 36 km2 occupied by the planning zone, and a catchment area of 79.55 km2.

2) Planning Horizon

In general, the horizon of the drainage and flood prevention planning should be consistent with that of the Master Planning for the Core urban district of Xiangshan (2006-2025). However, because the year of 2015 will be over soon, the planning horizon is adjusted to be 2018 in the short term, and 2025 in the long term.

3) Standard for Planning

(1) Flood prevention standard: 50-year return decided;

(2) Rainfall runoff control standard

(3) Drainage standard for rainwater pipe and ditch

The design recurrence interval P selected is 2 - 3 years for rainwater in average areas; P 3-5 years, in main areas where governmental, military, educational, medical organizations and other important institutions and entities are located; P 20 years for underground passages, submerged squares etc.

(4) Water-logging prevention standard

In the short term: The construction standard for water-logging control facilities is that under the operation condition of Typhoon Fitow (10~15-year return), no overflow will occur through 24 hr. rainfall;

In the long term: The construction standard for flood control facilities is that under the operation condition of flood tide (20-year return), no overflow will occur through 24 hr. rainfall;

4) Scheme for the Planning

The drainage and flood prevention system (systematic scheme) for the main urban area of Xiangshan is based on the drainage system which comprises "three verticals" (Dongda, Nanda and Xida Rivers) and "four horizontal" (Magang'an and Menqian Rivers, Xiangshan, Hengjiang and Hengda Rivers) as backbone drainage watercourses, with Caizuitou Gate, Yuetouzui Gate as terminal drainage facilities and with Phase 2 of Damutu retarding basin as safeguard. Furthermore, drainage and flood prevention subzones are divided in consideration of the landform, metrological condition, water resource status of Xiangshan and situation of the built-up drainage and flood control facilities in the county. The general scheme of the planning is that giving priority to drainage with storage as supplement; laying emphasis on pre-lowering water level, and controlling runoff".

5) Main Planning Coverage

The main planning coverage is separately described item by item as below:

(1) Urban rainfall runoff control and Utilize it as Resource

(2) Planning for Flood Prevention System

According to the results of flood prevention subzones, the flood prevent planning is carried out respectively for the subzone of the old urban area, that of the economic development park and that of the new urban area; among them, in the old urban area, such measures will be taken as construction of closed conduit works, pre-lowering water level of reservoir and tunneling for flood diversion, etc.; in the economic development park, closed conduit will be

constructed or retrofitted,water level of reservoir pre-lowered and flood intercepting ditch will be constructed; in the new urban area, linking with the Nanzhuang River net system on the plain and water level of reservoir pre-lowered, after these measures being implemented, the once per 20-year water logging drainage standard can be met in all the subzones, also the standard for prevention of 20-year return flood can be satisfied in the county.

(3) Planning for Urban Drainage (Rainwater) Pipeline Net System

Pursuant to the characteristics of the landform and watercourse distribution in Xiangshan and in combination with the status quo of urban rainwater drainage, the county is divided into three drainage subzones (old urban area drainage subzone, economic development park subzone and new urban area subzone), with a total area of 31.48 km2.

As per the planning, the drainage system in these subzones will adopt completely separate system (among the subzones, in the old urban area the interception type combined system will be reconstructed to be completely separate one).

(4) Construction arrangement in the near future

Under this drainage (rainwater) flood prevention planning, the near future construction scope mainly includes the works related to watercourse realignment as set forth in the Report 2010 on Planning for the Core urban district (Dancheng subzone) of Xiangshan County as well as correlated works to be reconstructed or extended under this planning.

1.3.5 Relations with This Project

1) Relations to the Master Planning for City (Urban Core Area) of Xiangshan County (2006-2025)

Under this demonstration project, the road net improvement component will be implemented, the scope of which includes construction of Huancheng Xilu and Baohai Lu, the former belonging in one of the eight verticals, a urban primary road; and Baohai Lu, a planned secondary road.

The aim of construction of the flood risk management component is to effectively cope with disaster of 20-year return stormwater caused inland water logging. The implementation of the component is in compliance with the standard of urban flood prevention. The drainage pipeline reconstruction and watercourse dredging under this component are basically consistent

with the engineering measures for flood control and water logging prevention as well as the requirements of the urban drainage works planning.

It is thus clear that the construction of this project overall conforms to the Urban Master Planning for the Core urban district of Xiangshan(2006-2025).

2) Relations to the Integrated Transportation Planning for Core urban district of Xiangshan County

As per the planning, both Huancheng Xilu and Baohai Lu are planned roads, the former being defined as an urban rapid road and Baohai Lu, an urban secondary road. Under this road net improvement component, the function of Huancheng Xilu is positioned as an urban primary road, being a rapid passage on the fringe of the core urban district, while that of Baohai Lu, an urban secondary road, an important horizontal passage for the built-up new urban area.

It can be seen that the implementation of this project is consistent with the Integrated Transportation Planning for Core urban district of Xiangshan County.

3) Relations to the Specialized Planning of Xiangshan for Urban and Rural Public Passenger Transport Development

The implementation of the public transport component accords with the development objective of the planning, in addition, tashan terminal station belongs in one of terminal stations to be constructed under the planning. Therefore, the construction of this project is consistent with the Specialized Planning of Xiangshan for Urban and Rural Public Passenger Transport Development.

4) Relations to the Integrated Planning for Drainage (Rainwater) and Flood Prevention in Main Urban Area of Xiangshan County

The reconstruction of drainage network and watercourse dredging works are basically consistent with the contents of construction in the near future.

1.4 ENVIRONMENTAL FUNCTION ZONING

1.4.1 Divisions of eco-environmental function zones

According to the *Xiangshan Eco-environmental Function Zone Planning*, the project involves 2 small ecological function subzones. See Table 1.4-1 and Fig. 1.4-1 for details.

Table 1.4-1 Eco-environmental Function Zones in Project Area

No.	Name	Category	Environmental Protection Requirements on Construction and Development	Protection and Construction of Eco-system
V1-20225D02	Dandong-Danxi Urban and Industrial Development Eco-environment Function Subzone	Optimized accessible zone	Industry-oriented policy shall be strictly followed; as specified in the *Catalogue of Prohibited and Restricted Industrial Pollution Projects (products and processes) in Zhejiang (Batch 1)* and *Catalogue of Industrial Development Orientation of Ningbo*, the development of projects shall be prohibited and restricted. The core functions of the core urban area such as residence, commerce & trade, tourism, logistics, industry and administration shall be further improved so as to build the zone into a service industry based hub and knowledge-intensive industrial center in Xiangshan.	The urban green space construction shall be strengthened with effective measures to protect urban greenbelts; the urban area should be developed orderly. The reconstruction of the old town should be speeded up, while villages should be replaced with communities of residents, and the development of ecological residential areas is encouraged; Ecological development of residential areas should be strengthened; urban green space should be expanded. Community infrastructure shall be improved and social service system ameliorated in order to create a harmonious and eco-friendly living environment.
V1-20225B01	Xiangshan eco-environmental function subzone for protection of offshore seawater area, basic farmland, wetland, water conservation and biodiversity	Restricted zone	Industrial expansion shall be restricted; the development of new enterprises of three types (mainly referring to papermaking, electroplating, textile dyeing and chemical industries); business featured of small volume of wastewater discharge can be developed at a controlled level, projects with less impacts on the environment are allowed to be constructed. The project to be constructed which require increase of total pollution discharge volume shall	1) By taking full advantages of ecological resources, to promote agriculture through applying scientific and technological means to develop eco-agriculture and moderately develop ecotourism. 2) The water conservation function shall be maintained, soil and water shall be preserved and biodiversity shall be protected; existing hilly vegetations and picturesque natural forest landscape shall be well reserved; by adhering to the principle of reasonable development and environmental protection, any development activity that jeopardizes the

			have the contaminant discharge volume of the same kind decreased by over 1.2 times in the same project area, or the discharge volume can be transferred from other area with the approval from the municipal environmental protection bureau.	ecological system shall be prohibited. 3) In addition to tidal flat reclamation which is encouraged, important wetland and major natural aquatic product breeding areas shall be protected, approved by law and developed with justifications. 4) Laws and regulations for basic farmland protection shall be implemented in a strict manner with intensified supervision and administrative means.

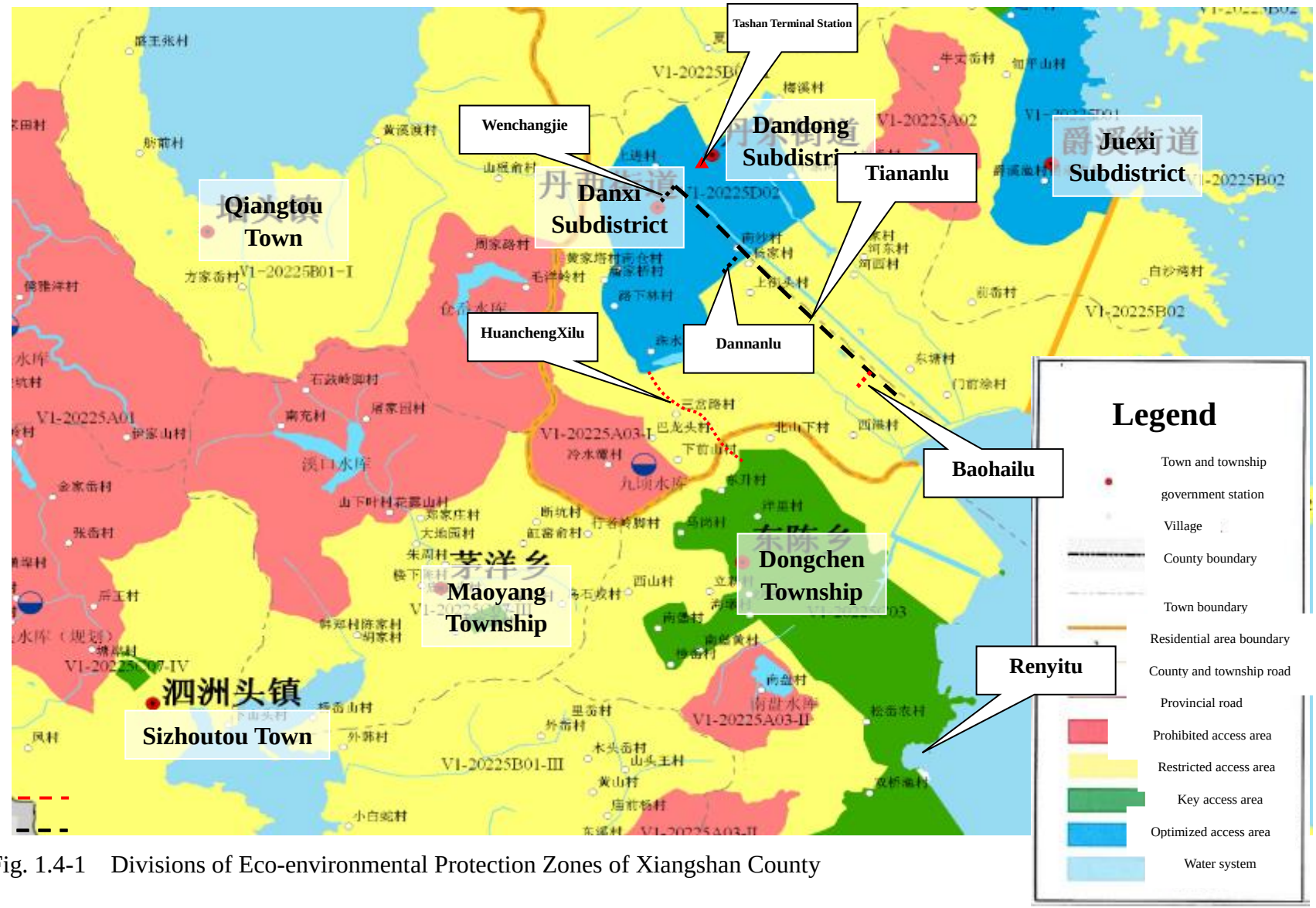


Fig. 1.4-1 Divisions of Eco-environmental Protection Zones of Xiangshan County

The project mainly aims to make Xiangshan an eco-county. The major construction works involve municipal infrastructures including public transportation station works, road works and municipal pipe network works and etc. for the purpose of optimizing the urban public traffic condition, traffic management level, road network condition and flood control capability. However, the prohibited and restricted works included in *the Catalogue of Prohibited and Restricted Industrial Pollution Projects (products and processes) of Zhejiang Province (Batch 1)* and *Catalogue of Industrial Development Orientation of Ningbo* and those with heavy pollution such as papermaking, electroplating, textile dyeing and chemical projects will not be introduced. Moreover, the project construction shall also be in compliance with environmental protection requirements for construction activities specified in the *Division of Eco-environmental Function Zones in Xiangshan* (DEEFZX).

The project will improve infrastructures in the region and better social service system. A harmonious and ecological living environment will be promoted in accordance with the ecological protection and construction requirements specified in DEEFZX.

Meanwhile, effective ecological mitigation measures shall be adopted in the process of engineering design and construction in order to maintain the water conservation and preserve soil, water and biodiversity. The existing hills, vegetations and picturesque natural forest landscape shall be well protected and any development activity that jeopardizes the eco-system shall be prohibited.

1.4.2 Ambient air function zoning

According to the *Technical Report on Ambient Air Quality Functional Zoning of Ningbo Municipality*, the area where the project is situated shall be classified as Class 2 Functional Area. See Fig. 1.4-2 for details.

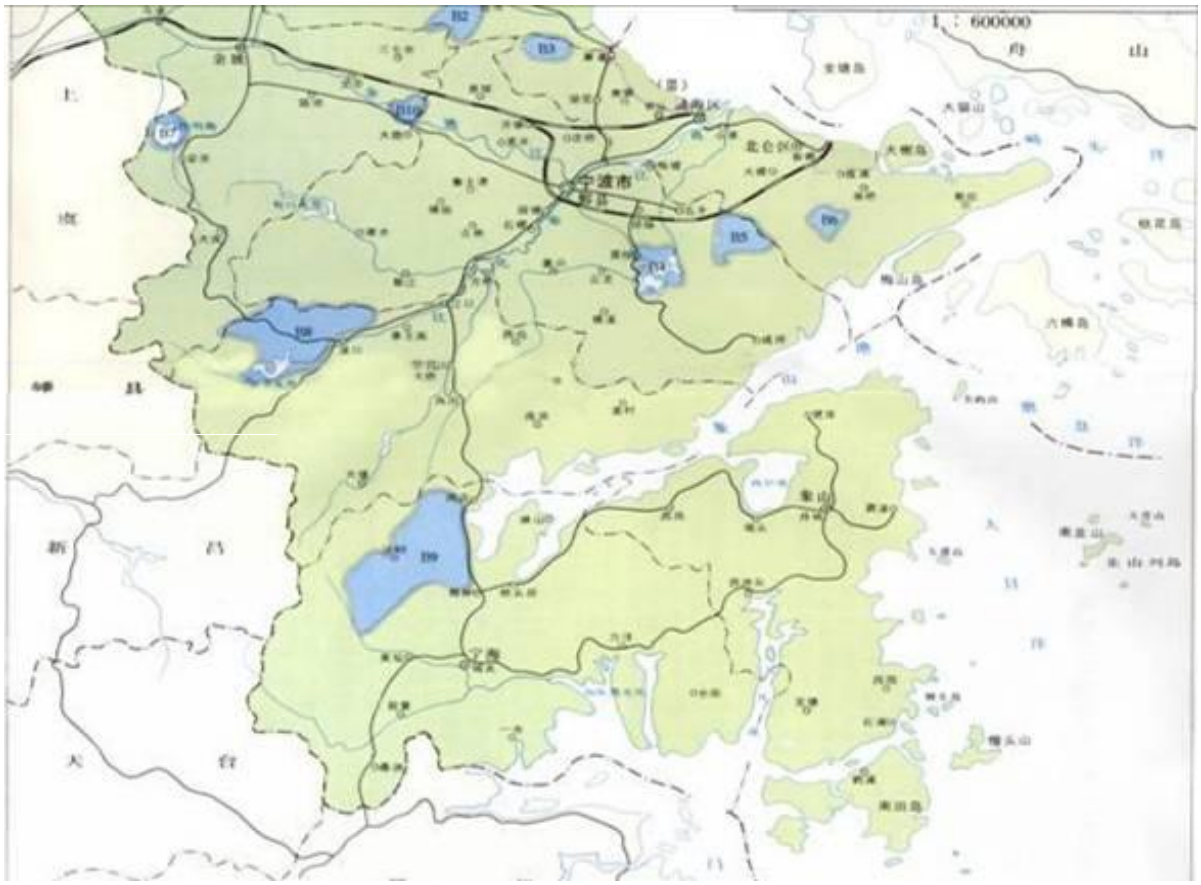


Fig. 1.4-2 Ambient Air Quality Functional Zone of Ningbo Municipality

1.4.3 Water environmental function zone

The surface water bodies involved in the proposed construction sites of the subprojects include the "Three Verticals and Four Horizontals" in the main urban district (i.e. the Dongda River, Xida River, Nanda River, Hengda River, Magang'an River, etc). According to the *Plan of Water Functional Zone and Water Environmental Function Zoning of Zhejiang*, the surface water system in the main urban districts of Xiangshan County belongs in the River network of the Nanda River, its water environment funcational zone is of multi-function and its water quality is expected to be classified into Surface Water Category III.

1.4.4 Acoustic environmental function zone

There has not been any acoustic environment function zone in Xiangshan yet. According to the *Environmental Quality Standard for Noise* (GB 3096-2008) and the *Technical Specifications for Environmental Noise Function Zoning* (GB/T 15190-2014), it is the suggested that the acoustic environment function zone along the new-built Huancheng Xilu

be Class 2 for that there are villages and industrial parks mingled; thatenvironment function zone on both sides of the new built Baohai Lu be Class 2 for that their primary planning functions include residential, commercial and financial land uses; and that environment function zone around the newly built terminal bus station of Tashan be Class 2 for that there are mixed land uses for residence and commerce.

In addition, the function of the Huancheng Xilu is a primary urban road and Baohai Lu is a secondary urban road. According to the *Technical Specifications for Environmental Noise FunctionZoning* (GB/T 15190-2014), areas within certain distance outside the boundaries of arterial traffic shall be divided into Class 4a Acoustic Environment function zone, i.e.:

1) The adjacent areas are Class 2 acoustic environmental function zone, with a distance of 35±5 m. According to the relevant provisions of Ningbo, for Class 2 Acoustic Environment function zone, within 35 m outside the boundaries of the road shall be classified as a Class 4a Acoustic Environment function zone, beyond 35 m shall be Class 2.

2) Providing that buildings close to the roads are higher than three-storey ones (three-storey buildings included), the areas from the side facing arterial traffic to the boundaries of the road shall be classified into Class 4a Acoustic Environment Function Zone.

1.5 ASSESSMENT STANDARD

1.5.1 Environment quality standard

1) Ambient air quality standard

Grade II standard of the *Ambient Air Quality Standard* (GB 3095-2012) shall be followed. See Table 1.5-1 for details.

Table 1.5-1 Ambient Air Quality Standard

Contaminant	Time of Sampling	Concentration Limit of Grade II	Unit
SO_2	Annual average	60	$\mu g/m^3$
	24 hours average	150	
	1 hour average	500	
NO_2	Annual average	40	
	24 hours average	80	

	1 hour average	200	
PM_{10}	Annual average	70	
	24 hours average	150	
$PM_{2.5}$	Annual average	35	
	24 hours average	75	
CO	24 hours average	4	mg/m^3
	1 hour average	10	

2) Surface water environment quality standard

Grade III standards of the *Environmental Quality Standards for Surface Water* (GB 3095-2002) shall be followed. See Table 1.5-2 for details.

Table 1.5-2 Environmental Quality Standard for Surface Water Unit: mg/L, pH excluded

No.	Contaminant	Standard Value of Grade III
1	pH	6～9
2	BOD_5≤	4
3	Petroleum and derivatives ≤	0.05
4	COD_{Mn}≤	6
5	NH_3-N≤	1.0
6	Total phosphorus ≤	0.2 (0.05 for lakes and reservoirs)
7	Sulfide ≤	0.2
8	DO≥	5
9	Volatile phenol ≤	0.005

3) Acoustic environment quality standard

Grade 2 and 4a standards of the *Environmental Quality Standard for Noise* (GB 3095-2008) shall be followed. See Table 1.5-3 for details.

Table 1.5-3 Environmental Quality Standards for Noise

Period of Time / Category of Acoustic Environmental Function Zone	Daytime (dBA)	Nighttime (dBA)
Grade 2	60	50
Grade 4a	70	55

4) Soil environment quality standard

Grade II standard of the *Environmental Quality Standard for Soils* (GB 15618-1995) shall be followed. See Table 1.5-4 for details.

Table 1.5-4 Soil Environment Quality Standard Unit: mg/kg

No.	Item	Standard Value of Class 2	
	pH	6.5~7.5	>7.5
1	Cadmium ≤	0.30	0.60
2	Chromium in: Paddy land ≤	300	350
	Dry land ≤	200	250
3	Arsenic in: Paddy land ≤	25	20
	Dry land ≤	30	25
4	Lead ≤	300	350
5	Copper in:Farmland ≤	100	100
	Orchard ≤	200	200
6	Zinc ≤	250	300
7	Nickel ≤	50	60

1.5.2 Pollutant Emission Standard

1) Wastewater pollutants

In the construction period: All kinds of wastewater shall not be discharged into Categories I and II surface water bodies, and natural reserves and swimming areas in Category III surface water bodies as specified in GB 3838-2002; other discharges into water bodies shall accord to the corresponding standard values of the *Integrated Wastewater Discharge Standard* (GB 8978-1996) by their category of receiving ability. See Table 1.5-5 for details.

Table 1.5-5 Wastewater Discharge Standard during Construction Period

Unit: mg/L except pH value

Item	Integrated Wastewater Discharge Standard (GB 8978-1996)		
	Grade I (Water Bodies with Category III Receiving Water Body)	Grade II (Water Bodies with Categories IV and V Receiving Water Body)	Grade III (Interception through Sewers)
pH	6～9	6～9	6～9
COD	100	150	500
BOD_5	20	30	300
SS	70	150	400
Phosphate (P)	0.5	1.0	/
Ammonia Nitrogen	15	25	/

Oil and Grease	10	15	100
Petroleum and Derivatives	5	10	20

The operation period: Wastewater generated during project operation is primarily domestic sewage discharged from the terminal bus station of Tashan. The municipal network around it is complete, so that the wastewater can be intercepted by sewers when Grade III of the *Integrated Wastewater Discharge Standard* (GB 8978-1996) shall be followed (some indicators shall perform the *Wastewater Quality Standard for Discharge to Municipal Sewers* (CJ 343-2010)). See Table 1.5-6 for details.

Table 1.5-6 Wastewater Discharge Standard during the Operation Period
Unit: mg/L, pH excluded

Item	(GB 8978-1996) Grade III	CJ 343-2010
pH (Dimensionless)	6～9	/
COD	500	/
BOD_5	300	/
SS	400	/
Phosphate (P)	/	8
Ammonia Nitrogen	/	45
Oil and Grease	100	/
Petroleum and Derivatives	20	/

2) Noises

The *Emission Standard for Environment Noise at Boundary of Construction Site* (GB 12523-2011) shall be followed during the construction, i.e. 70 dB(A) in daytime and 55 dB(A) in nighttime.

During the operation period, Grade 4 standard according to the *Emission Standard for Industrial Enterprises Noise at Boundary* (GB 12348-2008) shall be met to control noise at the north boundary on the side where the terminal station of Tashan adjacent to Tashan Lu, while Grade 2 standard shall be followed along the other boundaries. See Table 1.5-7 for details.

Table 1.5-7 Standard for Noise at Factory Boundary of Industrial Enterprise

Period of Time / Category of Acoustic Environmental Function Zone	Daytime (dB(A))	Nighttime (dB(A))
2	60	50
4	70	55

3) Sludge pollutants

The *Control Standard for Pollutants in Sludges from Agricultural Use* (GB 4284-84) shall be referred to for standard of sludge from drainage pipeline retrofit and watercourse dredging during the operation period. See Table 1.5-8 for details.

Table 1.5-8 Control Standards for Pollutants in Sludge for Agricultural Use, mg/kg dry sludge

Item	The Highest Allowable Content	
	In Acid Soil (pH<6.5)	In Neutral and Alkaline Soil (pH ≥ 6.5)
Cadmium and its compounds (Cd)	5	20
Mercury and its compounds (Hg)	5	15
Lead and its compounds (Pb)	300	1000
Chromium and its compounds (Cr)*	600	1000
Arsenic and its compounds (As)	75	75
Boron and its compounds (in Water-soluble B)	150	150
Mineral oil	3000	3000
Benzo(a)pyrene	3	3
Copper and its compounds (Cu)**	250	500
Zinc and its compounds (Zn)**	500	1000
Nickel and its compounds (Ni)**	100	200

Note: *Control standard of chromium shall apply to all kinds of sludge with agricultural usable value which contains tiny hexavalent chromium and shall not apply to industrial residues which contain abundant hexavalent chromium or sediments from some chemical plants.

**As tentative standard for references.

4) Air pollutants

For the emission of dust in the air during construction, the limits (1.0 mg/m^3)at the point with the highest concentration outside boundaries as specified in the *Integrated*

Emission Standard for Air Pollutants (GB 16297-1996) shall be applicable.

1.6 LEVEL AND SCOPE OF ASSESSMENT

1.6.1 Surface water environment

Domestic sewage discharged from the terminal bus station of Tashan is the major kind of wastewater during the project operation period. Its discharge amount is only 14.5 m^3/d, far less than 200 m^3/d. The complexity level of water quality is "simple" that the wastewater can be intercepted and transmitted into wastewater treatment plants in the core urban area of Xiangshan for centralized treatment after pretreatment. According to the *Technical Guidelines for Environmental Impact Assessment – Surface Water Environment* (HJ/T 2.3-1993), the EIA level of thesurface water of the project is lower (simpler) than Level III. The environmental impact on surface water in this environmental assessment primarily analyzes type of wastewater pollutants, its discharge amount and whereabouts. A simple analysis of environmental impact is also carried out.

1.6.2 Atmospheric environment

1) Assessment level

Vehicles exhaust after passage on the new built Huancheng Xilu and Baohai Lu is the major source of waste gas pollutant during the project operation period. Huancheng Xilu is an urban primary road, and Baohai Lu, an urban secondary road. According to the *Guidelines for Environmental Impact Assessment - Atmospheric Environment* (HJ 2.2-2008), for new-built and extension projects pertaining urban roads such as urban expressway and arterial road, the impacts shall be considered of traffic line sources on environmental protection objects on their both sides, where assessment level shall not be lower than Level II. Therefore, assessment level of atmospheric environment of this project is decided Grade II.

2) Assessment scope

Within 200 m at both sides from the road axes.

1.6.3 Acoustic environment

1) Assessment level

The newly built Huancheng Xilu, Baohai Lu Baohai Lu, terminal bus station of Tashan and drainage pumping stations of this project are all located in Grade 2 Acoustic Environmental Functional Area; increments of noise level before and after construction are all less than 5 dB(A) and a small amount of incremented population affected by the noise. According to the *Technical Guidelines for Noise Impact Assessment* (HJ/T 2.4-2009), the assessment level of acoustic environment of this project is classified as Grade II.

2) Assessment scope

For Huancheng Xilu and Baohai Lu : within 200 m at both sides from road axes of ;

Terminal station of Tashan: a 100 m distance outside its boundaries.

Drainage pumping station: a 100 m distance outside its boundaries.

1.6.4 Ecological environment

1) Assessment level

In this environmental impact assessment, the impacts along the newly built Huancheng Xilu and Baohai Lu on their neighboring eco-environments shall be of a primary concern. Along Baohai Lu is mainly farmland eco-environment, while Huancheng Xilu is surrounded by villages, industrial parks, farmland and hilly forest land. There are no Special Ecological Sensitive Areas and Important Ecological Sensitive Areas along the new-built roads. The project area of the newly built roads has an area of less than 5 km^2 and a total length of less than 50 km. According to the *Technical Guidelines for Environmental Impact Assessment - Ecological Impact* (HJ 19-2011), the assessment level of eco-environment of newly built road works shall be classified as Grade III.

Table 1.6-1 Division of Ecological Impact Assessment Grade

Ecological Sensitivity of Affected Zones	Project Area (Water Area)		
	Area ≥ 20 km^2 or Length ≥ 100 km	Area 2 km^2 ~ 20 km^2 or Length 50 km ~ 100 km	Area ≤ 2 km^2 or Length ≤ 50 km
Special Ecological Sensitive Zone	Grade I	Grade I	Grade I
Important Ecological Sensitive Zone	Grade I	Grade II	Grade III
General Areas	Grade II	Grade III	Grade III

2) Assessment scope

On both sides, within 200 m from road axes.

2 Description of Construction Project

2.1 PROJECT BACKGROUND

The total investment of the World Bank financed Ningbo Sustainable Urbanization Demonstration Project (Phase I) is about 729 mil RMB, the activities for which will be concentralized in Xiangshan. Phase I Project includes transportation system component (577.34 mil RMB) and the flood risk management component151.66 mil RMB (Refer Table 1.1-1 for details and Fig. 1.1-1 for major subproject locations).. The subprojects are described below one by one.

2.2 ROAD NETWORK IMPROVEMENT SUBPROJECTS

2.2.1 Huancheng Xilu Construction

1) Major technical standards

① Road grade: primary road

② Design speed: 60km/h

③ Design working life: 20 years as per the traffic volume projection and analysis; 15 years for design working life of the pavement

2) Project scope and line route

HuanchengXilu, starting frrom Danshan Lu in the north and ending at Binhai Dadao (avenue) in the south, with as an overall length of 2.9km, a stake number range of K0+000 ~ K2+891.75, will pass by two hills, Huangtuling and Mulingdong along its route. Two crossing bridges shall be set at the planned watercourses (stake No. K1+191) and the Jiuqing River (stake No. K1+778).

Starting point of the project shall be converged with ending point of HuanchengXilu road works (Xiangshanhe Lu ~ Danshanlu), while its ending point shall be converged with the existing Binhai Dadao.

See Fig. 2.2-1 for details of road the path.

3) Functional orientation

① HuanchengXilu is an urban primary road , a fast passage in the outskirts of the core urban district;

② A major freight corridor, diverting freight vehicles on Xinfeng Lu;

③ Benefiting Jiuqing Logistics Park, villages and factories along.

4) Design traffic volume

According to the feasibility study report, results of traffic volume projections of HuanchengXilu (2018 as the baseline year) are shown in Table 2.2-1.

Table 2.2-1 Results of Traffic Volume Projectionsin Feasibility Study Report of Huancheng Xilu

Characteristic Year	Full Day (pcu/d)	Peak Hours (pcu/h)
2018	13578	1290
2023	17010	1616
2028	22242	2113
2033	27547	2617
2038	32220	3061

5) Crosssection option

The road shall be bi-directional four-lane highway in this design and its standard cross section shall be arranged as: 2.5m (sidewalk) + 4.0m (bicycle lane) + 2.0m (central reserve) + 8.0m (motorway) + 3.0m (central reserve) + 8.0m (motorway) + 2.0m (central reserve) + 4.0m (bicycle lane) + 2.5m (sidewalk) = 36.0m.

For high road base and deep cutting sections, cross-sections shall be reduced to 25m on the basis of guaranteeing lane capacity and safety of sidewalk and non-motor vehicle lane, and the cross-section structure shall be 3.5m (mixed lanes for pedestrians and non-motorized vehicles) + 8.0m (motorway) + 2.0m (central reserve) + 8.0m (motorway) + 3.5m (mixed lanes for pedestrians and non-motorized vehicles) = 25.0m.

Fig. 2.2-1 Route Trend Map of HuangchengXilu

See Fig. 2.2-2 ~ Map 2.2-4 for details of cross section layout.

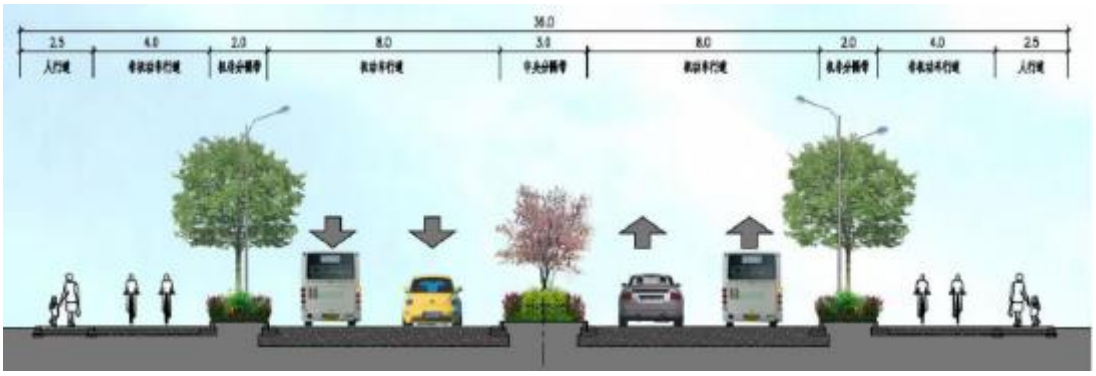


Fig. 2.2-2 Map of Standard Crosssection

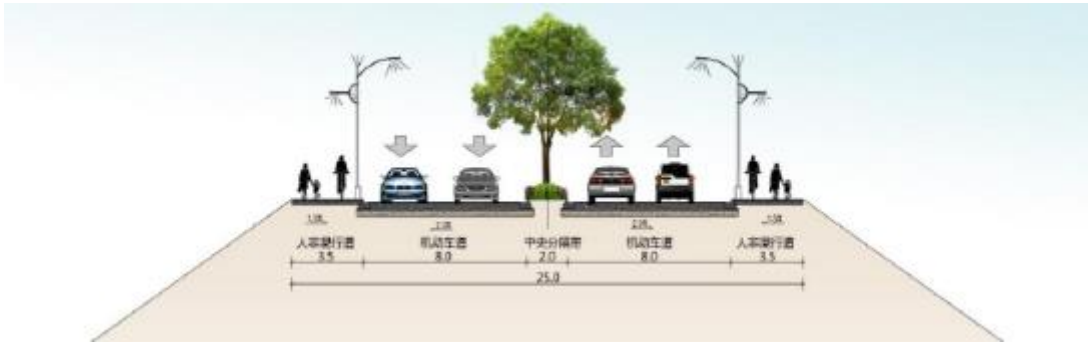


Fig. 2.2-3 Road Crosssection in High Road Base Section

Fig. 2.2-4 Crosssection in Deep Cutting Section

6) Pavement option

Asphalt concrete pavement shall be adopted. Total thickness of motorways is 98cm, their structure from top to bottom presenting:

4cm AC-13C fine-grained asphalt concrete (SBS modified asphalt)

Modified emulsified asphalt tack coat (0.5L/m^2)

8cm AC-25C coarse-grained asphalt concrete

1cm modified emulsified asphalt slurry seal

Modified emulsified asphalt prime coat (1.0L/m^2)

40cm 5% cement stabilized macadam base

45cm fine spoil bedding (leveling course)7) Pipeline integration

Rainwater, wastewater, water supply, power supply, telecommunication, gas and other professional pipelines are involved in this project. In the plan, telecommunication pipeline shall be arranged underneath side walks, gas and wastewater pipelines shall be arranged underneath non-motorized vehicle lanes northwest to HuanchengXilu; power pipeline shall be arranged underneath sidewalks, water supply pipeline and their main piping shall be arranged underneath non-motorized vehicle lanes southeast to HuanchengXilu; rainwater pipeline shall be arranged underneath its central reserve.

8) Pavement drainage

Rainwater pipes shall be laid underneath the central reserve of the road with their diameter designed to be D600-D1200; brickwork construction shall be adopted for gutter inlets; mortar laid stone outlets shall be adopted for rainwater outlets and rainwater shall be discharged into the water system nearby.

9) Bridge works

Two crossing bridges shall be set over the planned watercourses (stake No. K1+191) and the Jiuqing River (stake No. K1+778) with no requirements of navigation grade. Pre-stressed concrete of rigid connection with hollow slabs by prefabrication and pretensioning method shall be adopted for bridges. φ800 and φ1000 drilled cast-in-place piles shall be adopted as bridge pile foundation.

2.2.2 Baohai Lu Construcdtion

1) Major technical standards

① Road grade: Secondary road

② Design speed: 40km/h

③ Design working life: 20 years as per the traffic volume projection and analysis; 15 years for design working life of the pavement

2) Project scope and route

Baohai Lu, starting from Laixun Lu in the west and ending at Xinyi Lu in the east, has an overall length of 0.7km, a stake number range of K0+000 ~ K0+702.10. Starting point of the road has been already converged with the end point of existing Baohai Lu road works

(Tiananlu ~ Xinyilu), while its end point will be converged with Laixun Lu under construction. See Fig. 1.1-1 for details of road paths.

3) Functional orientation

① Baohai Lu is an urban secondary road and an important east-west passage for the built-upnew town in the south;

② Benefiting passage of its surrounding blocks including Jinxiu Jiayuan Residential Area, planned tourist distributing center and hub station of the new town.

4) Design traffic volume

According to the engineering feasibility study report, results of traffic volume projections of Baihai Lu (2018 as the baseline year) are shown in Table 2.2-2.

Table 2.2-2 Results of Traffic Volume Projections In the Feasibility Study Report of Baohai Lu

Characteristic Year	Full Day (pcu/d)	Peak Hours (pcu/h)
2018	7452	708
2023	9284	882
2028	11294	1073
2033	13631	1295

5) Crosssection option

The road shall be bi-directional four-lane highyway in this design and its standard crosssection shall be arranged as: 2.0m (sidewalk) + 2.5m (non-motorized vehicle lane) + 15.0m (motorway) + 2.5m (non-motorized vehicle lane) + 2.0m (sidewalk) = 24.0m.

See Fig. 2.2-5 for details of cross section arrangement.

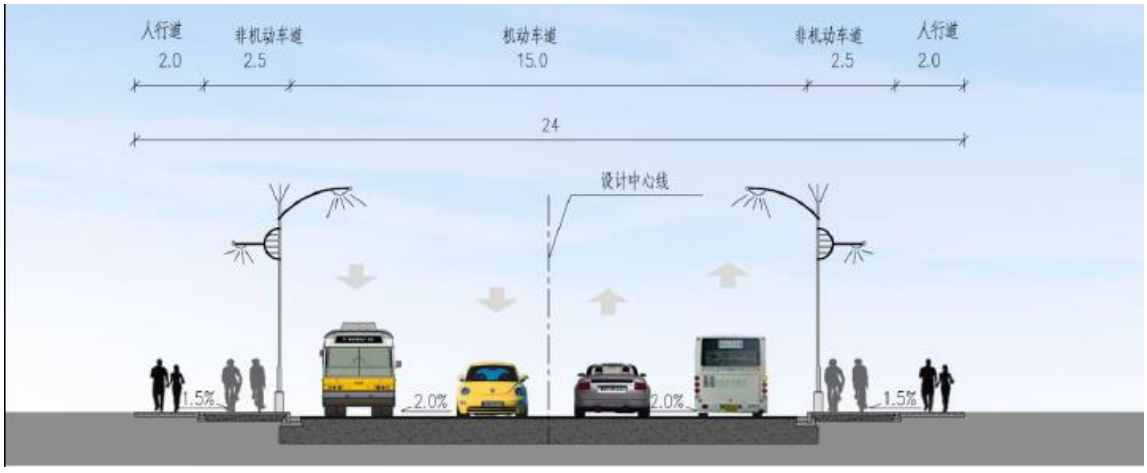


Fig. 2.2-5 Map of Standard Cross Section

6) Pavement option

Asphalt concrete pavement shall be adopted. Total thickness of motorways is 53cm, their structure from top to bottom presenting:

4cm AC-13C fine-grained asphalt concrete (SBS modified asphalt); 8cm AC-25C coarse-grained asphalt concrete; 1cm modified emulsified asphalt slurry seal; Permeable asphalt AL (M) -2 (1.0 L/m^2); 20cm cement stabilized macadam (4MP/7d); 20cm cement stabilized macadam (3MP/7d)

7) Pipeline integration

Rainwater, wastewater, water supply, power, telecommunication, gas and other professional pipelines are involved in this project. In this option, the telecommunication pipeline shall be arranged underneath side walks northwest to HuanchengXilu, gas and wastewater pipelines shall be arranged underneath non-motorized vehicle lanes northwest to Huancheng Xilu; power and water supply pipelines shall be arranged underneath sidewalks southeast to HuanchengXilu, rainwater pipeline shall be arranged underneath non-motorized vehicle lanes southeast to HuanchengXilu.

8) Pavement drainage

Rainwater pipes shall be laid underneath non-motorized vehicle lanes south of the road with their diameter designed to be D600-D1350; brickwork construction shall be adopted to gutter inlets; mortar laid stone outlets shall be adopted to rainwater outlets and rainwater shall be discharged into the water system nearby.

9) Bridge works

One crossing bridge shall be set at the existing watercourses (stake No.K0+322) with no requirements of navigation grade. Pre-stressed concrete of rigid connection with hollow slabs by prefabrication and pretensioning method shall be adopted for the bridge. Drilled cast-in-place piles shall be adopted as bridge pile foundation.

2.3 Public Space Retrofit Component

2.3.1 Wenchang Jie

Wenchang Jie is an old commercial precinct without recreation service facilities, where

such problems exist as disordered parking of non-motor vehicles, mussy public area, peeled building facades, stores with different forms and colors of signboards. Refer to pictures below.

Pictures of Current Situation of Wenchang Jie

The road section to be retrofitted under the Public Space Retrofit Component is between Tianan Lu and Xinfeng Lu, with a total length of 360m.

Objectives of reconstruction: to build Wenchang Jie into a uniform and clean commercial precinct with unique characteristics as well as to improve the public space of the old commercial area. Main reconstruction tasks: ① Dividing the precinct by functions, e.g. public area in the center shall be set as centralized parking area and resting area and public areas on both sides shall be set into dynamic passageways; ② perfecting public facilities by adding sheds for benches, non-motor vehicle parking areas, etc.; ③ overall reconstruction for street pavement; ④ reconstruction of building facades including unifying all signboards of stores and furbishing building facades.

Effect Picture of Wenchang Jie after Reconstruction

2.3.2 Dannan Lu

Alongside of Dannan Lu, there are the Xiangshan Experimental Primary School and Ningbo Binhai School. In the periphery of the road, there are a number of (grand-) parents seeing pupils off and pick them up, where there exist such problems as numerous vehicles on narrow road, the waiting parents having no place to stay, non-motorized vehicles having no place to park, the waiting parents occupying non-montorized vehicle lane and street pedlars operating their stalls on the road, which extrudes the space for pedestrians trips, also affecting the trip safety of pupils. The photos for the status quo of Dannan Lu are below.

Photos of Status Quo of Dannan Lu Surroundings

Objective of retrofitting the public space of Dannan Lu: To form the surroundings

unobstructed for pedistrians' trips, safe and comfortable for waiting beside the schools.

①Delimitation of non-motorized vehicles parking lot to form a safe and orderly waiting zone. ②In the original green spaces, parents waiting sub-zones and benches wil be added.③ Safety signs will be clearly marked; pedestrian crossing will be bright-colored on the pavement. ④On the sidewalk, special non-motorized vehicle parking lot will be set up to address the issue of non-motorized vehicles parking.

Effect Picture of Dannan Lu Retrofit

2.3.3 Tianan Lu

A south-northward primary road in Xiangshan, Tianan Lu is also an important commercial corridor and place for residents' activities in the county. On this road there are such problems as disorderly parking of non-motorzied vehicles of occupying pedestrians' traveling space, obsolete and damaged leisure amenities, etc. Photos of some road section are below.

Status Quo of Tianan Lu Surroundings

The range of retrofitting the public space of Tiannan Lu: the road section between

Jianshe Lu and Xiangshanhe Lu, with a total length of 2.5 km.

Retrofit objective: To renovate it into a comfortable commercial corridor and place for residents' activities. Main scope of renovation includes:

①To set up a pocket-shaped parking lot;

②To set up a non-motorized vehicle parking lot on the sidewalk.

③To add such amenities as rest-benches, etc. on the sidewalk.

2.4 PUBLIC TRANSPORTATION COMPONENT

Refer to Table 1.1-1 for more information about the public transportation which mainly focuses on the construction of the terminal stations of Tashan. The terminal station of Tashan was selected to be built on the southern side of Tashan Lu and western side of Xingsheng Lu, please refer to Fig. 2.4-1. The station without vehicle maintenance, cleaning and refueling stations and other facilities covers an overall area of 8344.77 m^2. It is established as an urban public transit terminal station as well as a stop for urbanrural route buses. See Table 2.4-1 for the major economic and technical indicators of the station.

Table 2.4-1 Major Economic and Technical Indicatorss on the Overall Layout Plan

S/N	Items		Indicators
1	Area occupied by construction land use		8344.77 m^2
2	Overall floor area		3132.22 m^2
	Including	Multiple-Use Building	1993.95 m^2
		Guard Room	42.47 m^2
		Power Distribution Room	140 m^2
		Corridor	955.8 m^2
3	Area of land occupied by buildings		1802.92 m^2
4	Plot Ratio		0.38
5	Ratio of Green Space		15%

Fig. 2.4-1 Sketch Map of Site Selection and Surroundings of Tashan Terminal Station

2.5 TRANSPORTATION MANAGEMENT COMPONENT

Under this component, an intelligent traffic system (electronic monitoring and management equipment, without civil works etc.) will be developed on some road sections in the urban district of Xiangshan to raise the Transportation Management level in the core urban district, the main development scope of which includes:

① High difinition electronic police system

② High-mounted video monitoring system

③ Dynamic traffic inducing system

④ Dynamic parking inducing system

⑤ Communications network system

⑥ Access system (server,storage device, network switch and other equipment) of command center of traffic police brigade.

2.6 TRAFFIC CORRIDOR SUBPROJECT

The main coverage of this subproject is shown in Table1.1-1.

2.6.1 Road Overhaul

Tianan Lu is a primary south-northward road in Xiangshan. After being opened for traffic for years, there appear such phenomena as local damages, pits and grooves, rebar exposion, some parts of upper pavement having fallen off, etc. Pictures of Some Parts of Pavement are shown below.

Status of Damaged Pavement of Tianan Lu

Under this subproject, such surface and subgrade repair will be carried out for some damaged and rebar exposed parts of the pavement of Tianan Lu to raise riding comfort and safety.

2.6.2 Optimization of public transportation network and Terminal Stations

On Tianan Lu, there are seven public transit routes, on some of which there exist problems of high overlap coefficient and high empty-load rate, which makes transport capacity wasted seriously. Under this subproject, some route trends will be adjusted and optimized and dispatch frequency increased on some routes to enhance the attraction and trip efficiency of public transit service.

2.6.3 Optimization of Signal and Intersection

Main managament measures adopted include increase of signal lamps at some intersections of Tianan Lu and optimization of signal lamp durations, setup of twice zebra crossing, etc. to enhance the crossing efficiency and safety for pedestrians and vehicles.

2.7 Flood Risk Management Component

According to the data provided at present stage by the design institute of preparing FSR, the flood risk management component scheme mainly includes engineering measures and non-engineering measures.

2.7.1 Engineering measures

2.7.1.1 Retrofitof Drainage pipe network

Engineering Composition

Urban drainage pipe network reconstruction works includes drainage pipe network dredging work and drainage pipe network rebuilding work. Wherein, drainage pipe network dredging work is mainly to clean all sludge from all built drainage pipelines within Xiangshan urban area. The drainage pipeline is approximately 303 km long and drainage ditch about 74.2 km long. Drainage pipe network rebuilding work is mainly to rebuild some

drainage pipelines in the old urban area with a rebuilding length of about 1060 m.

Refer to Table 2.7-1 and Table 2.7-2 for pipeline dredging and rebuilding work amounts and refer to Fig 2.7-1 for rebuilding location of drainage pipeline.

Table 2.7-1 Drainage Pipeline Dredging Amount

S/N	Pipe Diameter (mm)		Length (m)
1	Drainage Pipeline	≤ DN600	282558
2		DN600 <D ≤ DN1000	17453
3		DN1000 < D ≤ DN1500	2981
4	Drainage Ditch	Breadth of Box Culvert Shorter than or Equal to 100	50599
5		Breadth of Box Culvert Longer than or Equal to 100	23585
6	Total		377176

Analysis results show that dredging of drainage pipelines can enlarge the flow cross section of pipeline which plays a certain role in lowering the waterlogging degree.

Table 2.7-2 Drainage Pipeline Rebuilding Amount

S/N	Location	Rebuilding Content	Length
1	Intersection of Xinhua Lu and Jianshe Lu	It was expanded to 0.8 m ×1.5 m from 0.8 m × 1.0 m	245 m
2	Penglai Lu (Jingnan Lu~Baishi Jing River)	To be expanded to 3.5 m ×2.0 m from 1.05m × 1.45 m	800 m
3	Intersection of Xiguhu Lu and Baihua Lu	To be expanded to 0.8 m × 0.8 m from 0.3 m × 0.5 m	15 m
4	Total		1060 m

Refer to Fig. 2.7-1 for the location of drainage pipeline retrofit

2) Construction mode

Mechanical washing shall be adopted for pipeline dredging. Wash the pipes with high-pressure sprayer. The sediments in the pipeline in upper stream will become removable suspended materials and be brought into the silt well built in lower stream along with water flow. Then suck the silt out from the silt well with vacuum suction vehicle.

Pipeline retrofit shall be conducted with excavator. The construction scheme mainly includes open excavation, hoisting of prefabricated concrete box culvert and recovery of

road pavement etc.

3) Construction waste amount and disposal

According to the estimation, urban drainage pipeline dredging would produce about 28,000 m^3 dredging waste and pipeline realignment produce about 10,000 m^3 waste earth and stone which means that the waste volume produced throughout the whole process of drainage pipe network retrofit works would be about 38,000 m^3. Silt produced thereby will be dried with the River mud after being sucked out by vacuum suction vehicle and then sent to Xiangshan Renyitu zone for backfilling and site leveling.

2.7.1.2 River dredging Works

1) Engineering Composition

Urban watercourses with a total length of 32168 m will be dredged under the River dredging subproject. Refer to the Table 2.7-3 below for the specific composition and refer to Fig. 2.7-1 for the sketch map of main dredging river.

Table 2.7-3 Drainage Watercourse Dredging Component

River Type	Name	Distance to Starting Point (m)	Distance to Terminal Point (m)	Length (m)
Three Vertical	Nanda River	1340	7913	6573
	Xida River	0	5889	5889
Four Horizontal	Menqian River	0	1245	1245
	Xiangshan River	0	3722	3722
	Hengjiang River (Central River)	900	2153	1253
Other Watercourses	Hujiaqi River	0	3488	3488
	Old Dongda River	0	884	884
	Meixi River	0	1643	1643
	Oujia River	0	1136	1136
	Shangpingfeng River	0	628	628
	Tianyangli River	0	1094	1094
	Waiyuan River	0	1039	1039

	Xinhua River	0	2067	2067
	Xinkai River	0	647	647
	Branch of Hengjiang River	0	860	860
Total				32168

Except for river dredging, the Project doesn't involve riverside retaining wall and landscape construction, gate building, bridge removal, or others.

2) Construction mode

According to different conditions of the construction sites, different construction modes for river dredging shall be applied accordingly. After finishing all preparation work including construction measurement, construction investigation and site cleaning, the construction shall be conducted section after section.

It is recommended that excavators be used as main tools for river dredging nearby the suburban farmland and movable dredge pump and manpower dredging as assistance. After drying the slurry in the small temporary drying yards set in sections on both sides of the River, the dried slurry shall be transported out for disposal mainly by trucks (drop-proof measures shall be taken) and less by tank trucks. Temporary small slurry drying yards shall be treated with seepage-proof measures on the bottom and enclosed with straw bags filled with soil. On the external side of the straw bags, simple drainage ditches shall be dug to lead the water isolated from the dried slurry and water from outside into the River nearby. Once its service ends, the temporary drying yards shall be removed to restore the fields to their original states.

Movable dredge pump and manpower dredging shall be applied to the River reach with relatively crowded buildings along the side and excavators shall be applied to the River reach with few and scattered buildings along the side. Due to the relatively perfect urban greenery on both sides of the River, it is proposed to set cofferdams (cofferdam distance of about 500-600 m) by sections along the River to minimize the damage on the greenery on both sides. The retained water in the cofferdam shall be pumped or diverted out to expose the River bed. After dredging, a gravel layer with a thickness of 300 mm shall be laid on the River bed, covering the gravel layer with geotextile tubes and filling the tubes with mud mixture

through slurry pump. Once press filtration and dewatering are done, use trucks to transport out the geotextile tubes full with slurry to a temporay sludge drying field for drying. After being dried, the sludge will be transported out to a designated place for disposal, Seeping water shall be pumped or diverted to the watercourses nearby.

Practical experience shows that slurry drying and dewatering through geotextile tubes is economic, fast and land-saving. In addition, the volume of mud mixture filled into the tubes can be reduced by more than 80% and harmful elements in water can be reduced by more than 90%.

3) Dredging amount and disposal

The FSR shows that the dredging amount of each watercourses is predicted to be about 242,500 m^3, as shown in Table 2.7-4 below.

Table 2.7-4 Watercourse Dredging Amount Estimation

S/N	River Name	Estimated Dredging Depth (m)	Estimated Dredging Amount (m^3)
1	Nanda River	0.5	81341
5	Xida River	0.5	61540
3	Menqian River	0.5	8217
4	Xiangshan River	0.5	28659
5	Other branches	0.2	62710
Total			242467

Sludge after drying shall be taken to Xiangshan Renyitu zone by trucks or tank trucks for backfilling and field leveling. According to the watercourses sediment monitoring results, the indicators of chemical elements like cadmium, mercury, lead, chromium, arsenic, copper, etc. of the sediments in the surface, middle and deep layers of the watercourses are all below the highest allowable content limits of the *Control Standard for Pollutants in Sludge for Agricultural Use* (GB4284-84).

2.7.1.3 Drainage Pumping Station Construction

1) Engineering Composition

To lower the water plane lines of rivers in the urban area, improve the urban area's ability of draining logged water to "three vertical" rivers and enlarge the drainage volume of rainwater pipe network in the urban area, the proposed plan is to establish three boosting

pumping stations in the main urban district according to the engineering model calculation results. Refer to Table 2.7-5 and Fig. 2.7-1 below for the specific locations and design flows of the pumping stations.

Table 2.7-5 Project Overview of Boosting Pumping Stations

S/N	Name of Pumping Station	Location	Design Flow (m^3/s)	Number of Pump (set)	Area of Land to Be Acquired
1	Baishi Jinghe Pumping Station	About 0.5 km at the lower stream from the intersection of Xinkai River and Baishi Jing River	15	1	1580
2	Nandahe Pumping Station	Intersection between the covered conduit of Tianan Lu and Nanda River	25	2	1680
3	Xinhuahe Pumping Station	People's Square Section of Xinhua River	15	1	3240

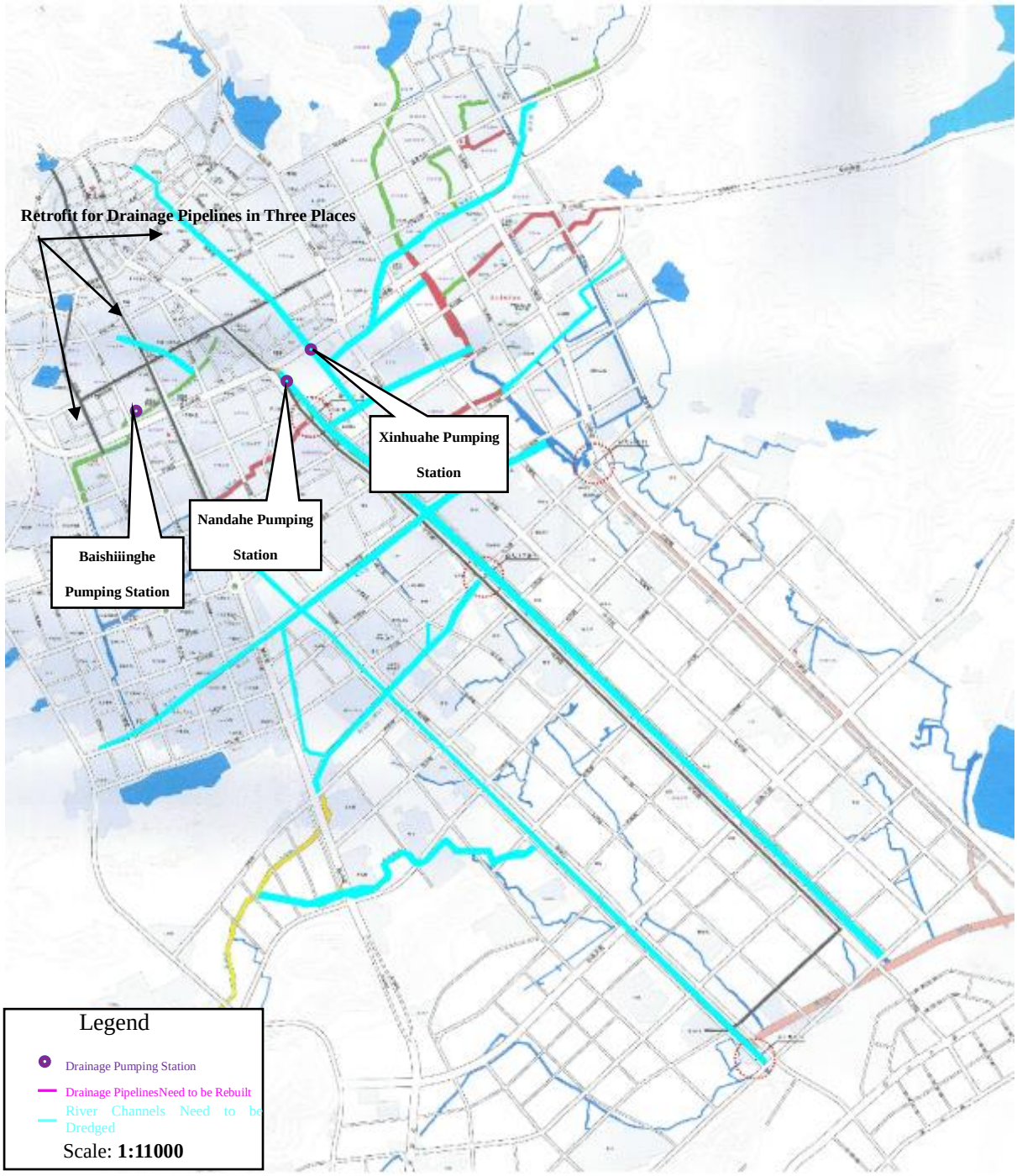


Fig. 2.7-1 Sketch Map of Urban Drainage Pipe Line Retrofit and Locations of Three Boosting Pumping Stations and Main Dredging Watercourses s

2) Pumping station building composition and construction mode

For the three pumping stations, the pumping stations and drainage gates will be constructed jointly. When at low water level, the water is discharged through gates and at high water level, the water is discharged through boosting drainage. The pumping station is made up of inflow section, pump room and outlet section. The pumping station is made in an open box structure,

water gate is in a shipyard-like structure and the gate is lift-type bulkhead gate.

Generally, the pumping station construction modes include river diversion and closure construction, foundation construction, concrete pouring work, grouted rubble or rock-masonry construction, cushion layer and riprap banket construction, water pump installation, etc.

3) Waste amount and treatment

According to the findings in FSR, the earth balance of each pumping station works is shown in Table 2.7-6.

Table 2.7-6 Earth Balance of Pumping Station Construction Unit: m^3

S/N	Name of Pumping Station	Excavation Volume	Filling Volume	Waste Amount
1	Baishi Jinghe Pumping Station	13931	10038	3893
2	Nandahe Pumping Station	15689	10038	5651
3	Xinhuaher Pumping Station	18029	11338	6691
Total		47649	31414	16235

Data above show that the waste earth with a volume of about 16235 m^3 produced throughout the pumping station works shall be transported to Xiangshan Renyitu zone for fill disposal.

2.7.2 Non-engineering measures

Non-engineering measures mainly include (but not limited to): land use plan and development control, flood warning and forecasting, flood-fighting and emergency plan, public education and awareness publicity, flood insurance, etc.

1) Land use planning and development

A flood risk area planning shall be prepared for land use in stages, which fits the social economic development level by analysis on the flood characteristics, flood risks as well as the urbanization development and population migration tendency.

2) Flood warning and forecasting

Flood warning and forecasting measures including flood prediction, flood control

scheduling, flood control scheduling and decision support system, etc., shall be taken to maximize the effects of flood control subproject and improve the benefits thereof.

3) Fighting Floods

A series of technologies including banking and walling, dry-type flood provention method and wet-type flood prevention method, etc. shall be applied to minimize the damages to buildings and properties caused by flood.

4) Emergency plan

The emergency plan is prepared for the main purpose of timely releasing the information when flood or waterlogging occurs for the areas easy to be flooded. corresponding emergency procedures and safety measures shall be worked out according to the specific features of potential flood at different stages. Assessment shall be conducted of the risk degree of flood and waterlogging in particular areas including culverts, overpass bridges, known blockage points and access points at floodable areas.

5) Public education and awareness promotion as well as flood insurance

Public awareness of floods can be improved by carrying out public education through media and activities. People shall be taught not to conduct behaviors which may aggravate flood and waterlogging, e.g. the serious consequences of dumping garbage into rivers and knowledge of minimizing the property loss in flood disaster, e.g. what to do after hearing the flood warning, etc. In addition, education about other issues related to flood and waterlogging shall also be provided. For example, people should know how to work with government to fight against the flood, who shall be contacted during emergencies, the importance of drainage system maintenance, building features for flood control, the way to access economic aids, etc.

6) Flood insurance

Flood insurance cannot reduce the damage caused by flood disaster but it can change the irregular flood loss distribution into a uniform annual installment payment system. By making up the losses of the victims with accumulated funds, the flood insurance can minimize the financial instability caused by catastrophic floods. Paying flood insurance which is with a certain proportion to the flood risk also has restrictive effect on uneconomical development in flooded area. This method can make an optimum utilization of land.

2.8 INVESTIGATION OF ASSOCIATED PROJECTS

Except for being used for filling in the Project, all the waste soil, stone and sludge generated under the Project will be employed in Renyitu (Renyi Beach Works) for filling as planned. Renyitu beach is located in the Dongchen Township of Xiangshan on the seaside, about 10 km to the south of the county. It is separated from the sea by Renyitu seawall on the eastern side. Wangjialan village is on the southern side of Renyitu, coastal south road is on the western side and Shuitong'ao hilly area is on the northern side (refer to Fig. 4.1-1).

In the past, Renyitu was a coastal shoreline. In 2003, the preliminary work of Renyitu reclamation project was carried out in Xiangshan and a proposal was put forward to build a seawall on the outer periphery of Renyitu for breeding. The proposal passed the review and approval by the Development and Plan Commission of Ningbo in September 2003 and environmental assessment of the project passed the review and approval by the Ningbo Environmental Protection Bureau in December 2013. (Refer to Table 2.8-1 for details.)

Table 2.8-1 Associated Details about the Approval of Foundation Treatment Project in Renyitu Zone

S/N	Project Name	Approved by	Approval No.
1	Project Proposal for the Xiangshan Renyitu Reclamation Project	Development and Plan Commission of Ningbo	YongJiNong [2003] No. 447
2	Environmental Impact Report of Xiangshan Renyitu Reclamation Project	Ningbo Environmental Protection Bureau	YongHuanJian [2003] No. 104

Renyitu (tu – beach, tidal land) reclamation project was launched in 2005 and completed in December 2007. After completion, the mud flat inside the seawall was idled for no use. Due to the construction of reclamation project, Renyitu has been completely separated from the sea and the function of mud flat in Renyitu has completely lost. There is no mud flat aquaculture or marine culture areas in Renyitu zone. Presently, Renyitu is a piece of deserted grassland as shown in the picture below.

Photo of Current Situation of Renyitu

In 2014, the regulatory planning for Renyitu zone was completely fulfilled, the purpose of which is to develop an industrial transforming and upgrading sub-zone in the southern part of the Economic Development Zone in Xiangshan. To reach the planning objectives of Renyitu zone, Xiangshan has started to implement Ground reatment Project and other projects in Renyitu of Xiangshan Economic Development Park. After ground treatment, Renyitu will be used as land use for construction.

The environmental assessment of ground treatment project was approved by the Environmental Protection Bureau of Xiangshan County in July, 2015 and its sea area use demonstration passed the review and approval by the Ningbo Ocean & Fishery Bureau in April 2015 (refer to Table 2.8-2 for details).

Table 2.8-2 Associated Details about Approval of Ground Treatment Project In Renyitu Zone

S/N	Project Name	Approved by	Approval No.
1	Feasible Study Report of Ground Treatment Project in Renyitu Zone in Xiangshan Economic Development Park	Xiangshan Development and Reform Bureau	XiangFaGaiShenPi [2014] No. 361
2	Environmental Impact Report of Foundation Treatment Project in Renyitu Block in Xiangshan Economic Development Area	Xiangshan Environmental Protection Bureau	ZheXiangHuangXu [2015] No. 297

3	Sea Area Use Demonstration of Plot 1 in Renyitu in Xiangshan Economic Development Park	Ningbo Ocean & Fishery Bureau	YongHaiHuanHan [2015] No. 11
4	Sea Area Use Demonstration of Plot 2 in Renyitu in Xiangshan Economic Development Park	Ningbo Ocean & Fishery Bureau	YongHaiHuanHan[2015] No. 12

Abstract of approval opinions of the Ningbo Ocean & Fishery Bureau: sea area of Xiangshan Renyitu Zone proposed to be transferred is located within the Renyitu reclamation project area. After filling and field leveling, the field will be turned into a construction land use for uniform development and construction which almost has no impact on the marine ecosystem nearby. According to the functions and relevant planning of Renyitu Zone, the project will has no direct impact on the marine environment as the sea area to be transferred is located in the reclamation area.

The main engineering scope of the ground treatment project mainly involves the works of site leveling, site ground treatment and road subgrade treatment with an earthwork leveling area of 154.34 ha., a total excavation of 2.36 million m^3 and a total filling volume of about 3.28 million m^3, the balance between which, 920 thousand m^3, will need to be purchased from outside. The waste soil (sludge) generated under the Project will be 570 thousand m^3 approximately, which can be absorbed in Renyitu for use.

2.9 SENSITIVE OBJECTS PROTECTED

All of the newly built subprojects are located in the main urban districts of Xiangshan. Through field investigations, it is seen that there are no environmentally sensitive areas including natural reserves, scenic areas, distribution ranges of rare wild fauna and flora within the assessment scope of the project. The Sensitive Objects include residential areas, schools, hospitals and other areas within the assessment scope of all subprojects, which are much concerned by the society, as described as follows:

1) Terminal bus station of Tashan

See Table 1.7-1 for major environmentally Sensitive Object around the terminal station of Tashan according to the results of investigations.

Table 1.7-1 Sensitive Objects around Terminal Station of Tashan

Proposed Works	Sensitive Object	Relative Direction	Minimum Distance from Site Boundary (m)
Terminal Bus Station of Tashan	Xiangshan Middle School	S	115
	Tashan Garden Residential Area	E	110
	Shangjincun	SW	50

2) Huancheng Xilu

According to the investigation findings, the major environmentally Sensitive Objects along Huancheng Xilu include Zhushuixi Cun and Sanchalu Cun. Zhushuixi Cun is located at north to the north end of Huancheng Xilu; while Sanchalu Cun is located at southwest to the road in a distance of about 202 m to its boundary line.

3) Baohai Lu

As shown by the investigation findings, the major environmental Sensitive Objects along Baohai Lu include Jinxiu Jiayuan Residential Area and Lixin Cun. Jinxiu Jiayuan Residential Area is located east to the east end of the Baohai Lu. The housing area of Lixin Cun villagers who need to be demolished under the project is around 2000 m^2 (10 households). In addition, according to the *Meeting Summary of Xiangshan County Government* ([2015] No. 71), the remaining residential areas of Lixin Cun villagers are all listed in the resettlement action plan of Xiangshan County.

4) Drainage network retrofit

Sensitive Objects involved mainly surround drainage network retrofit works and are listed as follows from investigation:

Table 1.7-2 List of Major Sensitive Objects Involved in Drainage Network Retrofit Works

No.	Location	Sensitive Object	Relative Direction	Minimum Distance (m)
1	Intersection between Xinhualu and Jianshelu	Huifengyuan Residential Area	N	30
		Fanxing Kindergarten	N	110
2	Penglailu	Xiguyuan	W	75

	(Jingnanlu~Baishijinghe)	Residential Area		
		Ximen village	W, N	20
		Penglai Residential Area	E	20
		Fengmaoyuan Residential Area	E	30
		Rongxinyuan Residential Area	W	12
3	Intersection between Xiguhu Lu and Baihua Lu	/		

5) River dredging works

There are many Sensitive Objects involved in river dredging projects, mainly residential areas, schools and hospitals distributed on both sides of watercourses s. See Table 1.7-3 for details.

Table 1.7-3 List of Major Sensitive Objects Involved in River Dredging Works

No.	River	Sensitive Object	Relative Direction	Minimum Distance (m)
1	Nanda River	Century Garden Residential Area	E	90
		Xiangshan Chunhui Kindergarten	E	65
		Yujingyuan Residential Area	W	70
		Youyicun	W	80
		Xiajiacun	E	20
		Lanyuan Residential Area	E	15
		Qiaotouhucun	E	40
		Jiangjiacun	W	10
		Xinyucun	W	90
2	Xida River	Danyang Residential Area	N	50
		Dongyi Huating	E	20
		Hengtang'oucun	W	16
		Liushengcun	E	50
		Xiangshan No. 3 Middle School	W	50
		Wenfeng School of Xiangshan County	E	90
		Yangxincun	E、W	5
		Yangxin School	W	90
		Lixincun	E	75

3	Menqian River	Xiabanhecun	N	15
		Dancheng Middle School	E	50
		Haiyu Guandi Residential Area	S	20
4	Xiangshan River	Linghetoucun	S	5
		Shangwucun	N	5
		Xiaotingcun	S	5
		Gaoyucun	S	65
		Century Garden Residential Area	N	75
		Lujiacun	S、N	5
		Jinyu Huafu Residential Area	N	80
5	Hengjiang River (Zhongyang River)	Xiangshan No. 3 Middle School	N	40
		Wenfeng School of Xiangshan County	N	55
		Hanjiacun	N、S	20
		Office Building of Zhangshuxiacun	N	20
		No. 3 People's Hospital of Xiangshan County	N	20
		Xiaodongyangcun	N	5
6	Hujiaqi River	Hujiaqicun	N	5
		Hejiacun	N	10
		Qiujiashancun	W、E	5
7	LaodongdaRiver	Shanshuirenjia Residential Area	W、E	15
8	Meixi River	Baihe Apartment	N	60
		Baojilanjun	SE	10
		Mudanyuan Residential Area	SE	15
		Hongrun Garden	N	18
		Dandong Residential Area	N、S	10
9	Oujia River	/	/	/
10	Shangpingfeng River	No. 1 People's Hospital of Xiangshan County	SW	25
		Shangbanhecun	W	35
11	Tianyangli River	Tianyanglicun	N	10
		Shanshuirenjia Residential Area	W	15

12	WaiyuanRiver	Shangbanhecun	N	6
		Lijing Residential Area	E	60
		Zitingshengyuan	N	10
13	XinhuaRiver	Xinhua Residential Area	E	15
		Jinqiu Residential Area	W	15
		Danjingyuan Residential Area	E	20
14	Xinkai River	Penglai Residential Area	SW	10
		Wufengxincun	NE	8
		Yingzhou Residential Area	SW	8
15	Branch of Hengjiang River	/	/	/

6) Drainage pumping station works

According to the investigation findings, except for residential areas around the Baishijinghe Pumping Station, there are no environmentally Sensitive Objects such as residential areas, schools and hospitals within a range of 200m around the other two drainage pumping stations. The statistics of sensitive objects around Baishijinghe Pumping Station is as follows:

Table 1.7-4 List of Major Sensitive Objects around the Baishi Jing River Pumping Station

No.	Pumping Station	Sensitive Object	Relative Direction	Minimum Distance (m)
1	Baishijinghe Pumping Station	Fengmaoyuan Residential Area	NW	35

3 Comparison of Alternatives

3.1 Comparison of Huancheng Xilu Route Alternatives

Huangchen Xilu (Western Ringroad) to be constructed is an urban primary road with a total length of 2.9 km. FSR shows that five route location comparison schemes have been provided for it from Danshan Lu to Binhai Dadao.

1) Scheme I: high fill and deep excavation for planned route position

High fill and deep excavation measure shall be taken on the route crossing Huangtuling and Mulingdong hills. Partial optimization shall be conducted on the planned route location at Huangtuling and Mulingdong to stay away from the hill top to reduce the scale of hill excavation and lower the slope protection height. The route passing through the hill on the northern side with its elevation lowered to 130 m from 240 m and stay away from the hill top on the southern side (the hill top elevation at the central line shall be lowered to about 35.7 m from 50.7 m).

Fig. 3.1-1 Scheme I for Huancheng Xilu Route Position

2) Scheme II: tunnel scheme for planned route position

Tunnel scheme will be adopted on the route crossing Huangtuling and Mulingdong with a total tunnel length of about 710 m. Taking tunnel structure and cost factors into account, the two design schemes are compared: one is tunnel with pedestrian and non-motorized vehicle passage and the other is tunnel without pedestrian and non-motorized vehicle passage. Under

the latter scheme, pedestrians and non-motorized vehicles need to bypass Provincial Highway 71.

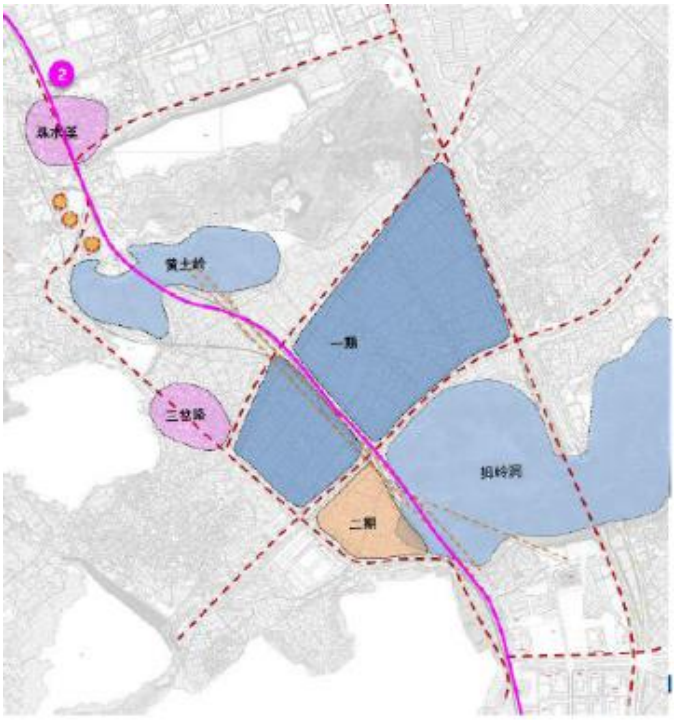


Fig. 3.1-2 Scheme II for Huancheng Xilu Route Position

3) Scheme III: bypassing the hills

The route runs towards Zhushuixicun, bypassing Huangtuling and connecting the planned route location at Yinfu Lu. When passing through Mulingdong by means of high fill (thick fill for lowland) and deep excavation (for highland) method.

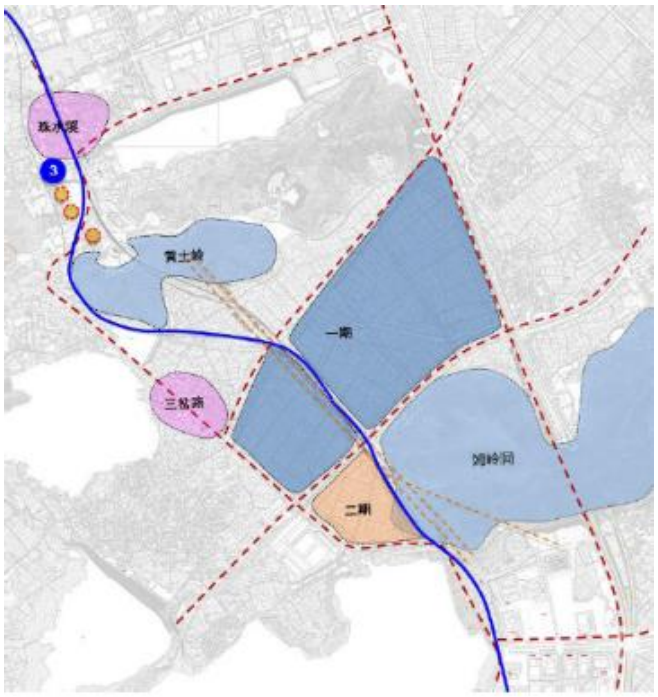


Fig. 3.1-3 Scheme IIIfor Huancheng Xilu Route Position

4) Scheme IV: bypassing the villages

The route runs towards the external side of Zhushuixi village, bypasses Huangtuling and connects with the planned route position at Yinfu Lu. When the road is constructed through Mulingdong, high fill and deep excavation method shall be applied.

Fig. 3.1-4 Scheme IVfor Huancheng Xilu Route Position

Comparison and selection between the routes in FSR are conducted according to the environmental restrictive factors. Refer to Table 3.1-1 for the comparison results.

Table 3.1-1 Preliminary Comparisons on Alternatives of Route Positions of Huancheng Xilu from Angle of Environmental Assessment

Item	Scheme I	Scheme II	Scheme III	Scheme IV
Whether it complies with the route planning	Basically conforms	Basically conforms	Major adjustments in some parts	Major adjustments in some parts
Whether it involves drinking water source protection objects	no	no	no	no
Whether it involves valuable and rare wild fauna and flora natural distribution area and other ecological sensitive objects	no	no	no	no
Residence demolition	None	None	None	None
Impact of traffic noise on the Sancha Lu during operation	Small	Small	Large	Large
Damage on hilly vegetation	Large	Small	Large	Large

The table above shows that:

1) No important ecological environment sensitive objects including drinking water source and valuable and rare wild fauna and flora natural distribution areas are involved and no major environmental constraint is present in the project area.

2) All schemes have limited impacts on the life of local residents as no residence demolition is involved.

3) Schemes I and II comply with the planning, while Scheme III and IV have relatively significant adjustments on the planned route location with difficulty in implementation; under Schemes I and II, the noise during the operation period will be less on Sanchalu village than that under Schemes III and IV. To sum up, Schemes I and II are better than III and IV.

4) During construction, Scheme I poses severer damages to the hilly vegetation than Scheme II.

Through environmental factor comparison, Scheme II is proved to be the best choice.

However, the elevation of the terminal point (7.9 m) in Scheme II is 3.1 m higher than that of Binhai Dadao (4.8 m), which brings about difficulties for the intersection connection, which needs to lift and rebuild the 150 m in-service section within the scope of Binhai Dadao near the intersection, the engineering feasibility being low.

Moreover, vegetation destruction during construction period can be made up through greening along the route of this Project and other subprojects. Its cost is preliminarily estimated to be about RMB 2 million. The ecological loss can be compensated and the cost is far below the investment margin (over RMB 116.73 million) between two schemes.

The overall comparison concerning the aspects of environment, economy and project feasibility, the environmental assessment shows that it is reasonable to recommend Scheme I as the preferred one.

3.2 Comparison of Terminal Station at Tashan

1) Functions of multi-use building

Tashan Terminal station serves as an urban terminal bus station as well as a stop for urban-rural public transit routes. The main building of the Project is a three-storey multi-use building with a total floor area of about 1993.95 m^2.

According to the scheme set forth in FSR, the multi-use building is mainly used for handling office affairs.

Considering that there will be a number of passengers in the terminal station of Tashan, a proposal has been put forward in the environmental assessment to optimize the multi-use

building by adapting the first floor of the building into a waiting hall with chairs, televisions and other amenities. In addition, a couple of public toilets shall be set in accordance with the passenger number predicted.

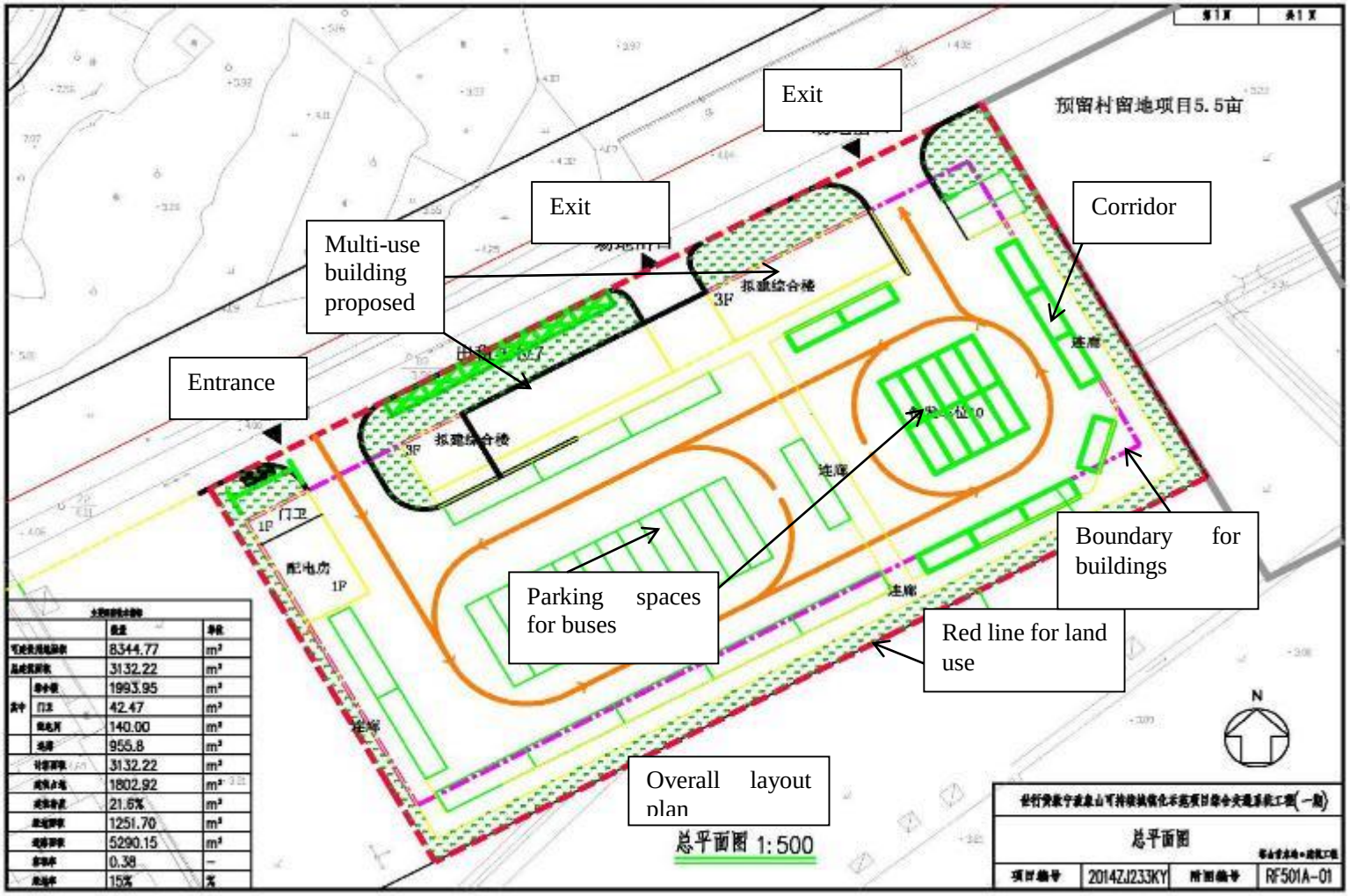
2) Overall layout

Tashan Terminal Station is divided into an urban public transportation area on the eastern side and an urban and rural public transportation area on the western side. A temporary taxi picking up station will be set up near Tashan Lu.

Refer to Fig. 3.2-1 for the layout.

Detailed building scheme for the multi-use building at FSR stage has not been confirmed yet. For convenience, passengers are suggested to get access to the waiting hall on the first floor on the north side of the building near the picking up area.

Fig. 3.2-1 Layout of Tashan Terminal Station



3.3 Comparison of Alternatives with and without Project of Flood Risk Management Component

The project data show that in the three areas of the main urban district in Xiangshan, thearea between Jianshe Lu andJingnan Lu in the old urban area, the partially low lying area of the economic development park and area south to Danshan Lu in the new urban area, the anti-flood and waterlogging prevention and control abilities are only to combat flood which happens once every five years. Furthermore, due to the small capacity of the internal river, the insufficient flood discharge ability and the poor water quality, if the flood risk management component is not to be included, the serious waterlogging and sewage overflow in the main urban district of Xiangshan will easily hit the areas in the flood season, especially typhoon season. Scheme Zero has a remarkable impact on environment.

On the contrary, if the component is included, a complete and sustainable drainage and waterlogging prevention system can be established through effective engineering and non-engineering measures so as to endow Xiangshan strong abilities to fight against 20 year return stormwater as well as to improve the self-cleaning capacity of rivers and their water quality and benefit the living and breeding conditions of aquatic species in the Rivers. Although the project will bring certain impacts to the surroundings, the environmental impacts of the project can be controllable by taking relevant pollution control measures as proposed in EA and the regional environment quality will not be affected in the project areas.

In conclusion, the project construction conforms with the national industrial policies and relevant planning requirements. Compared with Scheme Zero of maintaining the current status unchanged, the project will have remarkable positive effects on the environment during the operation period. From the viewpoint of environmental protection, it is desirable to implement this Project.

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4 Current Environmental and Social Condition

4.1 SUMMARY OF NATURAL ENVIRONMENT

4.1.1 Geographical Location

Ningbo is located in eastern Zhejiang Province, southeast of the Yangtze River Delta and at the east end of Ningshao Plain in Zhejiang. Neighboring the East Sea in the East, Ningbo holds the Zhoushan Islands as its natural cover for defense. Adjacent to Hangzhou Bay in the North, Ningbo faces to Shanghai across the sea; borders Shaoxing Municipality in the east where the Tiantai Mountain expands, and connects Sanmen Bay in the south, Ningbo also adjoins Sanmen County and Tiantai County. Ningbo is 175 km wide from the east to the west and 192 km long from the north to the south.

The Project lies in the core urban area of Xiangshan County in Ningbo. The county stands between the north latitude 28°51′18″ and 29°39′42″ and between the east longitude 121°34′03″ and 122°17′30. Standing in the middle of the eastern coast of Zhejiang Province and the southeast of Ningbo, the Project will be developed between Xiangshan Harbor and Sanmen Bay. Close to the Xiangshan harbor in the north, the county faces to Yinzhou District and Fenghua City across the harbor. Liuheng Isle of Putuo District in Zhoushan City and Meishan Isle of Beilun District in Ningbo City stand apart at a distance from the northeast of the county. Bordering the Damuyang sea in the east and Maotouyang sea in the south, the county stands against Sanmen County of Taizhou City across Sanmen Bay; the project stretches to Ninghai County to the west and Xiangshan Peninsula enters the sea to the east from Zixi and Meilin of Ninghai County to Yishi. Xiangshan County consists of mainland and 656 coastal isles islets, with a land area of 1382 km², a sea area of 6618 km² and a coastline of 925 km, characterized by “three sides surrounded by the sea and one line penetrating through the land”.

As a county town in Xiangshan County, Dancheng has two subdistricts named Dandong and Danxi separated by Tianan Lu. Wherein, Dandong Subdistrict is located at the middle part of the core urban area of aXiangshan, where the county Party Committee and county government are seated all long, serving as a hub of economic development, culture, education,

sport, medical care for the whole county. It covers a land area of 38 km², with an agricultural land of 8397 *mu* (5.60 km²), a forestry land of 38400 mu (25.60 km²) and a beach area of around 3000 mu (2.00 km²). Danxi Subdistrict is located in the west of the core urban disrict of Xiangshan, covering a land of 42 km².

See the Fig 4.1-1 for the geographical location of Xiangshan County.

4.1.2 Topography

Xiangshan is an extension from Tiantai Mountain which stretches to the sea and mainly covered by hills, with a name of "seven tenths of hills, one tenth of waters and two tenths of farmland". Situated in the coastal part of hilly areas of the east of Zhejiang, Xiangshan covers a hilly area of 793 km^2 which accounts for about seven tenth of its total area. Inside the county, hills below 200 m is seen mostly with slow slope and rolling ridges. The topography is mainly featured by enormous low hills with slow slope.

The county declines from the northwest to the southeast. Tiantai Mountain extends eastwards Ningshan Peninsula from Ninghai County, forming the highest junction part of Ninghai County and Xiangshan County inside the northwest of Ninghai County. These hills are magnificent with undulating ridges and peaks and most main peaks being above 500 meters. Wherein, Dongban Mountain made of chains of peaks wriggles from the Chashan Mountain in Ninghai County with the main peak of 810.8 meters high which is the highest in Xiangshan. With an altitude of 756 meters, Niuliaogang is located in the southeast as the second highest inside the county. There are over 20 peaks with altitudes from 300 m to 700m. Hilly lands are widely spread and normally 200-450m high, mainly including Juexi hilly area, Huangbi'ao hilly area and Nanxiang hilly area.

Plains of Xiangshan are mostly scattered in the coastal areas, which are evolved from beaches developed from silt under the effect of the sea bay, and later firstly and reclaimed to be plains. They belong in marine depositional plains, mainly distributed in Xiangshan Harbor in the North, bays in the east and Sanmen Bay in the south. They cover massive lands and spreads vastly, dominating the most part of Xiangshan plains. Nanzhuang Plain and Dingshan Plain rank top 2 in terms of coverage area, historically boasted as "80,000 mu (more than 5000 ha.) in the upper area and 80,000 mu in the lower area".

Besides, there are alluvial plains in Xiangshan with the main form of alluvial fan in the front of hill. Due to low and small hills as well as shallow and narrow hinterland, these plains cover small areas with typical characteristics in Dancheng, Baishi, Jiuqing and Meixi zones .

Located on the peninsula, Xiangshan has a long coastline with numerous harbors and cape corners. The county has a coastline of 800 km, including a mainland coastline of 300 km and insular coastline of 500 km. Main harbors include Xiangshan Harbor, Xihu Harbor, Taiping Harbor, Damu Bay, Changguo Bay, Shipu Harbor, Sanmen Bay, Yuejingyang bay/harbor, Xieqian Harbor, Nantian Bay, etc. Among them, Xiangshan Harbor, Sanmen Bay and Shipu Harbor are the provincially and even nationally famous harbors/bay.

Damutu (tu --- beach or tidal land) is also called Damuwan (wan --- bay) with a width of 14.8 km, depth of 7.2 km and a total area of 80 km^2, which is an open bay, within which there are three small sea bays. From north to south, there is Menqiantu Bay with an area of 24 km^2, Danmen Bay with coverage of 9 km^2 and Jiwu Bay with an area of 21 km^2 inside it. Large beach lands are seen in each bay with a total area of 30 km^2.

4.1.3 Meteorological and climatic characteristics

Xiangshan County enjoys a warm and wet climate influenced by subtropical oceanic monsoon with four distinctive seasons, abundant sunshine and rainfalls, long winter and summer, short spring and autumn and much disastrous weather. Perennial mean temperature lies at 17.5 ℃ with historically highest temperature of 39.6℃ and lowest temperature of -6.9℃; multi-year average precipitation is 1481.6mm with the maximum annual rainfall of 2177.6mm and minimum annual rainfall of 770.6mm. With multi-year average humidity is 58.3% with frost-free period of 248 days in average, the county belongsin humid and semi-humid region which indicates a basic balance between precipitation and evaporation; Main rainy seasons occur from March to June (i.e. spring rains and mould rains) and from August to October (i.e. typhoon rain and autumn rain) Typhoon comes to Xiangshan mainly from July to October with a number of 3 each year. Typhoon will bring about wind and high waves as well as the highest tidal level over the years, which is a big threat to this region.

The coastal annual average wind speed is 5.6m/s (Scale 4). The days reaches 98.9 in a year with a wind speed above 18m/s (Scale 8), 67 days at least; as to wind speed above 10.8m/s

(Scale 6), it reaches 254.6 days throughout a year, 288 days at maximum and 216 days at minimum.. Wind direction changes distinctly as season changes.Northern winds prevail in winter.Wind direction tends to change in autumn but southerly wind will be more frequent as time goes by. In summer, southerly wind will blow mostly.At the beginning of the autumn, wind is changeable in terms of direction but northerly wind will become the main source after midautumn.

Summer and winter are mostly influenced by the wet and warm airflow from the Indian Ocean and Pacific Ocean, thus rich rainfalls come; winter and autumn tend to be affected by dry and cold air from the center of Eurasia and Mongolian Plateau. Rain falls mainly from May to September every year with 15.5 days of not less than 25mm in terms of multi-year average daily precipitation.

Multi-year annual precipitation……1481.6mm

Maximum annual precipitation……2177.6mm

Minimum annual precipitation……770.6 mm

Maximum daily precipitation…… 103.6 mm

Longest consecutive rainy days……11d

Largest amount of storm precipitation…..353 mm

4.1.4 Hydrological characteristics

1)Inland river

Streams and rivers in Xiangshan are featured by short sources and rapid flows , which empty themselves into the sea alone. There are rivers named Datanggang, Nanda, Dangang, Xizhougang, Xiashengang, Dongtang, Fan'aogang, etc., each with a catchment area of more than 20km2. Among them, the Datanggang river system is located in Dingshan Plain with a basin area of 134km^2.As the trunk stream, Datanggang was originally an inland harbor of Sanmen bay, which was formed a river through plugging and storing fresh water, with a length of 18km and average width of 500m. This Project is located in the middle coastal plain of Xiangshan with multi-year annual precipitation of 1548mm, multi-year annual runoff of 816.2mm and multi-year annual runoff coefficient of 0.53.

Dancheng is the county seat of Xiangshan. Most watercourses in the planning area are

man-excavated canals belonging in the Nandahe water system. Among others, the Dongdahe Canal, Nandahe Canal and Xidahe Canal run through the urban district, being the three main south-northward canals (i.e., the "three verticals"), whose south terminals converge into the Hengdahe Canal in front of Menqiantu Seawall, and empty into Damuyang sea area after passing through Caizuitou and Yuezuitou tide-retaining gates; as to the east-westward canals, the Xiangshanhe Canal, Hengjiang (Zhongyanghe) Canal, Menqianhe and Hengdahe Canals are main ones (i.e., the four horizontals), the abovementioned major canals form an overall pattern of "three verticals and four horizontals".

Other major watercourses in the urban district include the Baishijinghe Canal, Shijiajinghe Canal, Waiyuanhe Canal, Menqianhe Canal, Shangpingfenghe Canal, Meixihe Canal, Xinkaihe Canal, Xinhuahe Canal, Oujiahe Canal, Zhongjiahe Canal, Tianyanglihe Canal and Hujiaqihe Canal.

2) Offshore area

T Rivers in Xiangshan all discharge into Damuwan (wan --- bay) in the south and into sea at last, and tides in Damutu seaside belong in non-regular semidiurnal shallow water tide. By gathering tidal information of the Songlanshan Hydrometric Station, it is concluded that multi-year average tidal level is 0.28m, measured highest tidal level is 4.54m and lowest tidal level is -2.64m and multi-year average tidal range is 3.04m.

As for tides of this region, Longdongmen has the eastern sea area as its rotating flow with a rotating rate of 0.60, the direction of the major axis of current ellipse is approximately in the direction of southeast-northwest. The averageflow speed of flooding and ebbing tidesis about 0.3m/s, which gradually turn into reciprocating currents after entering the beach area and meet Wankou (bay mouth) (line connecting Longdongshan and Danmenshan) vertically. The average speed of flooding and ebbing tides is 0.2-0.35m/s.

Water temperature of this sea area is 15.7℃ in average in the last ten days of April every year which gradually falls until the midmonth of October when the temperature reaches 16.2℃. The sea water salinity is 26.5-30%, rich in nutrient salts.

4.1.5 Seismic intensity

According to the Map of Seismic Ground Motion Peak Acceleration Zoning of China

(GB18306-2001)published by the China Seismological Bureau, the seismic ground motion peak acceleration is 0.05g, seismic basic intensity is VI correspondingly and regional crust is confirmed as stable.

4.2 Overview of Social Environment

4.2.1 Overview of Ningbo Municipality

As an important harbor municipality in the southeastern coastal region, Ningbo covers an area of 9365km^2 with a total population of 5.604 million and covers an urban area of 2560km^2 with a population of 2.158 million. Ningbo also forms as an important industrial base and important production base of special local economic products including grain, cotton, edible oil and aquatic productsin Zhejiang Province and owns 7 national-level cultural relics protection sites, ranking the first in Zhejiang Province.

In 2014, the whole municipality realized a local GDP of RMB 760.25 billion, growing by 7.6% compared to the previous year in terms of comparable prices; per capita GDP based on permanent residents amounted to RMB 98,972 (USD 16112 converted by annual average exchange rate); As for the distributions of three industries in GDP, the first industry accomplished RMB 27.517 billion (accounting for 3.62%), the secondary industry realized RMB 393.557 billion (accounting for 51.77%) and the tertiary industry achieved RMB 339.176 billion (accounting for 44.61%); financial revenue of the whole municipality achieved RMB 179.09 billion in which the public budget revenue reached RMB 86.06 billion with respective growth of 8.5% and 8.6%; average disposable income of urban residents reached RMB 44,155 with an increase of 9.2% and average net income of rural residents amounted to RMB 24,283, growing by 11.0%.

4.2.2 Overview of Xiangshan County

Xiangshan County is highly developed in economy which was listed as coastal economic development zone by the State Council in 1988 and leaped into national top 100 strong counties, thus becoming an area in the province with rapid economic and social development. Currently, 10 towns, 5 townships and 3 sub-districts are subordinate to Xiangshan County with a total

population of 540,000. The built-up area of the urban core district covers 28 square kilometers with a permanent residential population of 230,000, ranking 63rd among national top 100 strong counties in terms of national comprehensive strength.

In 2014, Xiangshan County realized local GDP worth of RMB 38.87 billion and financial revenue of RMB 5.477 billion with respective growth of 7% and 8.2%; three industries developed coordinately with the first industry achieving RMB 5.80 billion, accounting for 14.% of GDP, the secondary, RMB 17.6 billion, accounting for 45.3% of GDP and the tertiary industry, RMB 15.47 billion, accounting for 39.8% of GDP in terms of distributions of three industries in GDP; industrial economy grew steadily, achieving a total industrial output value above RMB 54 billion by the industrial enterprises with or above the designated scale, with a growth of 12% and building industry output value of RMB 111.9 billion, a growth by 12.1%; agriculture maintained a stable economic growth, realizing a total output value of RMB 10.7 billion;the modern service industry was accelerated development and value increment in service industry and total retail volume increase of consumables ranking top in the municipality; general revenue of tourism industry amounted to RMB 14.5 billion, growing by 20%. Per capita disposable income of resident in the whole town is RMB 33,069, increasing by 9.9% year-on-year.

4.3 Monitoring and Assessment of Present Condition of Environment Quality

4.3.1 Ambient Air Quality

Referring to the monitoring data of 2014 about the ambient air quality of core urban district of Xiangshan collected by provincial-level monitoring station in the Wenfeng School set up by Xiangshan Environment Monitoring Station, detailed monitoring results involving main pollution factors including SO_2, NO_2, PM_{10}, $PM_{2.5}$ and CO are obtained as follows:

Table 4.3-1 Statistical Table of Concentration of Various Pollutants in Core urban district of Xiangshan in 2014 Unit: mg/m^3

Monitoring Month	Item	SO_2	PM_{10}	NO_2	$PM_{2.5}$	CO
January	Sample number	31	29	31	28	31
	Minimum value	0.005	0.030	0.020	0.026	0.2
	Maximum value	0.073	0.227	0.084	0.152	1.4
	Average value	0.019	0.080	0.041	0.060	0.7

Monitoring Month	Item	SO_2	PM_{10}	NO_2	$PM_{2.5}$	CO
February	Sample number	26	18	26	26	26
	Minimum value	0.003	0.007	0.007	0.018	0.4
	Maximum value	0.036	0.115	0.043	0.090	1.1
	Average value	0.013	0.049	0.025	0.041	0.8
March	Sample number	28	28	28	28	28
	Minimum value	0.009	0.023	0.017	0.016	0.4
	Maximum value	0.031	0.125	0.042	0.088	1.3
	Average value	0.018	0.060	0.027	0.040	1.0
The First Quarter	Average value	0.017	0.063	0.031	0.047	0.83
April	Sample number	30	28	30	30	30
	Minimum value	0.010	0.019	0.015	0.010	0.3
	Maximum value	0.030	0.100	0.044	0.082	1.0
	Average value	0.015	0.048	0.023	0.034	0.6
May	Sample number	31	31	28	31	31
	Minimum value	0.004	0.024	0.010	0.013	0.5
	Maximum value	0.023	0.159	0.030	0.094	1.2
	Average value	0.010	0.069	0.020	0.044	0.8
June	Sample number	30	30	27	30	30
	Minimum value	0.003	0.011	0.003	0.012	0.4
	Maximum value	0.015	0.081	0.021	0.075	0.9
	Average value	0.006	0.039	0.009	0.038	0.6
The Second Quarter	Average value	0.010	0.052	0.017	0.039	0.67
July	Sample number	31	31	31	27	31
	Minimum value	0.004	0.016	0.002	0.011	0.5
	Maximum value	0.009	0.073	0.018	0.099	0.9
	Average value	0.006	0.038	0.007	0.039	0.6
August	Sample number	31	31	31	31	31
	Minimum value	0.004	0.012	0.004	0.012	0.5
	Maximum value	0.016	0.077	0.018	0.058	1.0
	Average value	0.007	0.034	0.012	0.031	0.7
September	Sample number	30	30	27	30	30
	Minimum value	0.003	0.011	0.002	0.004	0.5
	Maximum value	0.011	0.079	0.034	0.058	1.1
	Average value	0.007	0.038	0.017	0.026	0.7
The Third Quarter	Average value	0.007	0.037	0.012	0.032	0.67
October	Sample number	31	31	31	31	29

Monitoring Month	Item	SO_2	PM_{10}	NO_2	$PM_{2.5}$	CO
	Minimum value	0.005	0.028	0.012	0.007	0.4
	Maximum value	0.023	0.123	0.040	0.086	0.9
	Average value	0.010	0.056	0.021	0.030	0.6
November	Sample number	30	30	30	30	30
	Minimum value	0.006	0.021	0.014	0.017	0.5
	Maximum value	0.034	0.164	0.048	0.136	1.2
	Average value	0.013	0.062	0.030	0.044	0.7
December	Sample number	31	31	31	31	31
	Minimum value	0.007	0.047	0.022	0.029	0.6
	Maximum value	0.022	0.164	0.055	0.112	1.3
	Average value	0.013	0.095	0.043	0.066	0.9
The Fourth Quarter	Average value	0.012	0.071	0.031	0.047	0.73
Annual	Sample number	360	348	351	353	358
	Minimum value	0.003	0.007	0.002	0.004	0.2
	Maximum value	0.073	0.227	0.084	0.152	1.4
	Average value	0.012	0.056	0.023	0.041	0.7

By combining monitoring data shown above and adopting and comparing Level-II standard comprehensive pollution index of Ambient Air Quality Standard (GB 3095-2012), conclusions are drawn infollowing Table 4.3-2.

Table 4.3-2 Comprehensive Pollution Index of Various Pollutants

Year (Quarterly)	Pollution sub-Index					Comprehensive Pollution Index
	$P(SO_2)$	$P(PM_{10})$	$P(NO_2)$	$P(PM_{2.5})$	P(CO)	P
Annual	0.200	0.800	0.575	1.171	0.175	2.921
The First Quarter	0.113	0.420	0.388	0.627	0.083	1.631
The Second Quarter	0.067	0.347	0.213	0.520	0.067	1.214
The Third Quarter	0.047	0.247	0.150	0.427	0.067	0.938
The Fourth Quarter	0.080	0.473	0.388	0.627	0.073	1.641

As shown in the Table above, the main pollutant in the core urban district in 2014 was fine particle with annual average pollution sub-index of 1.171 and mainly distributed in the first and the fourth quarters; annual pollution sub-index of SO_2, NO_2, PM_{10} and CO were respectively

0.200, 0.575, 0.800 and 0.175, all satisfying the Level-II standard of Ambient Air Quality Standard (GB3095-2012).

4.3.2 Environment quality of surface water

1) Current situation of environment quality of surface water

From subsection 4.1.4 above it can be known that the surface water system in Xiangshan county seat mainly consists of three vertical and four horizontal canals, all of which finally empty into sea through the "three verticals" (namely, the Xidahe, Nandahe and Dongdahe Canals). Because it is impossible to monitor the water quality of all small streams, Xiangshan Environmental Protection monitoring station set routine monitoring stations on the representative three-vertical canals and Xinhuahe Canal. The results of main pollutants monitored there in 2014 are shown in Table 4.3-3.

Table 4.3-3 Nanda River Network Water Quality Data of 2014 Unit: mg/L (not applied to PH)

Cat.	Item	pH	Dissolved Oxygen	COD_{Mn}	BOD_5	Ammonia Nitrogen	Total phosphorus	Volatile phenol
Dongda River	Sample number	12	12	12	0	12	12	0
	Maximum value	7.70	8.70	9.88	—	37.80	0.803	—
	Minimum value	6.56	1.50	1.40	—	0.72	0.327	—
	Average value	7.29	5.05	5.16	—	6.75	0.589	—
	Cat.	Category I	Cat. III	Cat. III	—	Worse than Cat. V		—
Yuetouzui (Nanda River)	Sample number	6	6	6	6	6	6	6
	Maximum value	7.67	9.49	9.10	9.84	10.20	1.170	0.001
	Minimum value	6.50	1.30	1.20	9.18	0.65	0.075	0.001
	Average value	7.13	5.36	4.81	9.60	5.21	0.679	0.001
	Category	Cat. I	Cat. III	Cat. III	Cat. V	Worse than Cat. V		Cat. I
Xida River	Sample number	12	12	12	0	12	12	0
	Maximum value	7.80	10.30	7.18	—	45.10	0.930	—
	Minimum value	6.72	2.80	1.44	—	0.90	0.090	—
	Average	7.24	5.45	5.07	—	5.63	0.441	—

	value							
	Category	Cat. I	Cat. III	Cat. III	—	Worse than Cat. V		—
Xinhua River	Sample number	12	12	12	0	12	12	0
	Maximum value	7.90	6.40	5.55	—	10.70	1.250	—
	Minimum value	6.64	2.30	1.11	—	0.72	0.151	—
	Average value	7.25	4.94	3.77	—	3.50	0.454	—
	Category	Cat. I	Cat. IV	Cat. II	—	Worse than Cat. V		—

As shown in the Table above, only three pollutant indicators of the Dongda River and Xida River do not exceedthe standard limited values of Category III of the Environmental Quality Standard for Surface Water (GB3838-2002), such as pH, DO and COD_{Mn}, whereas ammonia nitrogen and total phosphorus exceed standard limited values of Category V; pH, DO, volatile phenol, COD_{Mn} of Nanda River meet the requirements of Category III standard while ammonia nitrogen, BOD_5 and total phosphorus all exceed the standard limits; pH and COD_{Mn} of the Xinhua River can meet the standard requirements on Category III, while DO, ammonia nitrogen and total phosphorus all exceed the standard limits. Therefore, it can be seen that the water quality of the waters mentioned above are assessed as being worse than Category V.

It can be known from the water quality monitoring results of the above representative watercourses that the existing status of water quality of the 15 watercourses to be dredged under the Project is overall bad, unable to meet the protective objective of Category III water quality.

2) Overview of sewage treatment plant in the core urban district of Xiangshan County

Wastewater produced by the Project will be discharged into municipal sewer net after pretreatment and then transmitted to the wastewater treatment plant in the core urban district of Xiangshan for final treatment.

The WWTP in the core urban district of Xiangshan is located inside Xiangshan County Urban Drainage Company in the south of Binghai Dadao and the west of Laixun Lu. This plant is engaged in providing service in the old urban district in the north of Dandong Jie and Danxi Jie as well as villages subordinate to Dongcheng Township (in the north of Jinkai Lu and on the both sides of the coastal south line).

The first-stage and second-stage projects have been completed in the plant with a design capacity of 2,5000m^3/d at the first stage; and that of the second-stage 2,5000m^3/d, totally50,000m^3/d. A2/O process is adopted for treating wastewater. First-stage effluent discharge adopts Level-I BStandard of Discharge Standard for Pollutantsfrom Municipal WWTP and second-stage effluent discharge standard is elevated to Level-I AStandard, and the tail water is discharged into the Xida River after being treated to meet the standard; the design capacity for reclaimed water treatment is 2,5000m^3/d, the process adopted for which is sand filtration plus disinfection . Sludge will be converted to aerobic compost by adopting mechanical thickening and centrifugal dewatering. The first-stage worksconstruction was started in September, 2005, including construction of pipe network, mid-way 1-5# lift pump stations, wastewater treatment plant, and reclaimed water reuse facilities, which were put into trial operation in September, 2006; the second-stage works started construction in August, 2009, including construction of sewer network, wastewater (reclaimed water) treatment, sludge disposal and reclaimed water pipe network without mid-way lift pump stations added, which were put into trial operation as of October 1, 2010.

In order to satisfy continuously increasing demands of treating urban sewage, Xiangshan County Urban Drainage Company invested to construct the third-stage works in 2014 toenhance the capacity to 70,000m^3/d from 50,000m^3/d and adopting A2/O technology. Tertiary treatment applies hybrid reaction and activated carbon sand filtration, new-added deep treatment adopts micro-flocculation and denitrification filtration technology and the effluent discharge still implements GB18918-2002 Level 1A Standard. Currently, the third-stage works is under construction.

4.3.3 Environment quality of underground water

The relevant data from EIAR for Xiangshan UrbanDrainage Company's Stage-III Wastewater Treatment Works in Core Urban Districtare referred for the regional underground water quality. Under this works, there are three wells set near the location of Xiangshan Urban DrainageCompany, phreatic aquifer sampling and monitoring were conducted for the three wells. See results of underground water quality after monitoring in Table 4.3-4.

Table 4.3-4 Monitoring Results of Underground Water Quality

S.N.	Item	Upstream Sampling Point		Downstream Sampling Point		Sampling Point inside the Plant		Category IV Standard (mg/L)
		Monitoring value (mg/L)	Assessed category	Monitoring value (mg/L)	Assessedcategory	Monitoring value (mg/L)	Assessedcategory	
1	pH(Dimensionless)	8.10	I	7.58	I	7.22	I	5.5-6.5, 8.5-9
2	Ammonia Nitrogen	0.245	IV	7.12	V	1.17	V	≤0.5
3	Total hardness	377	III	228	II	158	II	≤550
4	Total dissolved solids	1.34×10^4	V	600	III	434	II	≤2000
5	Permanganate index	2.82	III	7.12	IV	5.70	IV	≤10
6	Nitrate	0.99	I	3.16	II	7.44	III	≤30
7	Nitrite	0.002	II	0.092	IV	0.098	IV	≤0.1
10	Chloride	455	V	95.5	II	90.8	II	≤350
11	Volatile phenol	<0.002	III	<0.002	III	<0.002	III	≤0.01
12	Total coliform	33 pieces /L	IV	$>1.6\times10^4$	V	$>1.6\times10^4$	V	≤100

As shown in the table above, most indicators of sampling points meet Standard IV of Underground Water Quality Standard (GB/T14848-1993) except for total dissolved solids and chloride in upstream sampling point and Ammonia Nitrogen and total coliform of downstream sampling points and that in the plant, which exceed the standard.

4.3.4 Environment quality of offshore water

In 2014, Xiangshan County set up 3 monitoring stations along offshore waters with 2 monitoring stages during the whole year. The monitoring results of main pollutants are as follows:

Table 4.3-5 Monitoring Results of Offshore Water quality In Xiangshan County in 2014 Unit: mg/L except pH

Sea Areas	Station	Item	pH	SS	DO	Reactive Phosphate	Nitrite	Mineral Nitrogen	Ammonia Nitrogen	COD	Petroleum and Derivatives
Damuyang	ZJ0261Juexi	Sample number	4	4	4	4	4	4	4	4	2
		Maximum value	8.11	308	8.39	0.042	0.002	0.956	<0.001	1.06	0.0073
		Minimum value	7.98	168	7.2	0.028	0.001	0.578	<0.001	0.82	0.0021
		Average value	8.04	227	7.8	0.034	0.002	0.767	<0.001	0.97	0.0047
		Average value category	/	/	/	IV	/	Worse than IV	/	/	/
	ZJ0262Damuyang	Sample	4	4	4	4	4	4	4	4	2

		number									
		Maximum value	8.08	426	7.99	0.044	0.004	1	0.004	1.24	0.0074
		Minimum value	7.98	102	7.22	0.03	0.002	0.599	0.004	0.83	0.0041
		Average value	8.03	254	7.64	0.035	0.003	0.798	0.004	0.99	0.0058
		Average value category	I	/	I	IV	/	Worse than IV	/	I	I
Shipu Harbor	ZJ0263	Sample number	4	4	4	4	4	4	4	4	2
		Maximum value	8.06	664	7.71	0.046	0.005	1.08	0.056	1.84	0.0067
		Minimum value	7.87	271	7.1	0.032	0.004	0.611	0.005	0.611	0.0064
		Average value	7.97	419	7.40	0.038	0.0045	0.845	0.026	0.845	0.0066
		Average value category	I	/	I	IV	/	Worse than IV	/	I	I

It is thus clear that water quality of 3 offshore monitoring spots in the county is classified as worse than CategoryIV wherein pH value, dissolved oxygen, chemical oxygen demand and petroleum of Damuyang sea area comply with Category I sea water quality standard, reactive phosphate meets Category IV sea water quality standard and mineral nitrogen exceeds Category IV sea water quality standard; pH value, dissolved oxygen, chemical oxygen demand, and petroleum of Shipu Harbor all meet Category I sea water quality standard, reactive phosphate complies with Category IV sea water quality standard and mineral nitrogen exceeds Category IV sea water quality standard. Damuyang sea area and Shipu Harbor are both assessed as worse than CategoryIV sea water.

4.3.5 Acoustic environment quality

Xiangshan Environment Monitoring Station carried out 2-stage continuous monitoring work lasting 24 hours for noise of four-category acoustic function zones in the urban area respectively in March and October, 2014 and specific results are shown as follows:

Table 4.3-6 Monitoring Results of Acoustic Environment Quality of Core Urban District in Xiangshan

Category		Category I Standard Area		Category II Standard Area		Category III Standard Area	Category IV-a Standard Area		
Function Zone		Residential area		Mixing Zonea		Industrial zone3+6	Both sidesalongarterial road		
Monitoring Time	Monitoring point	Donghehuayuan	Yingzhou Residential Area	Pedestrian Street	Family Plan Bureau	Industrial park	Jingnan Lu	Xiangshan-gang Lu	Tian an Lu
March 2014	Day	42.8	54.9	44.8	42.7	49.7	67.4	59.9	64.2
	Night	38.1	37.5	39.0	32.2	36.5	65.0	39.2	59.7
	Day and night	45.3	53.5	46.7	42.5	48.9	71.5	58.3	66.8
October 2014	Day	47.8	51.8	50.1	54.2	59.1	63.4	62.8	62.2
	Night	37.0	37.8	41.3	41.2	42.9	57.7	56.9	56.2
	Day and night	47.5	50.8	50.5	53.4	57.8	65.3	64.6	63.9

As shown in the Table above, all the equivalent sound level-A of Category 1-3 acoustic environment function zones during day and night can satisfy the requirements of the Environmental Quality Standard for Noise (GB3096-2008) and the noise level of Category 4a function zone during daytime can also meet the standard. The noise levels on Jingan Lu and Tianan Lu during the nighttime in March and those on thethree roads during nighttime in October are beyond the standard limits.

4.3.6 Environmental quality of soil, watercourse sediments and sludge

To know well the status quo of the watercourse sediments, sewer sludge and soil environment in the project areas, our institute entrusted the Zhejiang Zhongtong Detection Sci-tech Co., Ltd. and Zhejiang Zhongyi Detection Research Institute Co., Ltd. to conduct sampling and monitoring of the soil, sludge and sediments in the peripheral areas around the urban district, as described below.

1）Monitoring items

Value of pH, copper, zinc, chromium, nickel, lead, cadmium, mercury, arsenic, benzene hexachloride, DDT, benzo -(a)pyrene, mineral oil and boron.

2）Sampling time and frequency

In Jan. 2015 sampling survey was conducted at such five points as 1# ～3#, 8# and 9#;

and in Nov. 2015, supplimentary survey was carried out at four points, i.e., 4# ～7 # according to the Bank's expert.

3）Sampling points

Two points were set for soil sampling, two for sewer sludge sampling and five for watercourse sediment sampling, the points distribution for monitoring are shown in Table 4.3-7.

Table4.3-7 Distribution of Points of Sampling Watercourse Sediments, Sewer Sludge and Soil

No.	Monitoring Object	Monitoring Crosssection or Point Location	Monitoring Factors
1#	Watercourse sediments	Dongda River to the east of Xiangshan Linhai Kindergarten	PH, cadmium,mercury, arsenic, copper, lead, chromium, zinc, nickel, benzene hexachloride and DDT
2#		At the joint between a tributary west to the Eryimingzhai Tourist Farmhouse and the Dongda River	
3#		Near the existing sluice at the joint between the Dongda River and Hengda River	
4#		At the intersection between the Nanda River and Xiangshan Lu	Benzo-(a)pyrene , mineral oil, total mercury, arsenic, copper, lead, nickel, zinc, boron and cadmium
5#		At the intersection between the Menqian River and Donggu Lu	
6#	Sewer sludge	At the intersection between Jianshe Lu and Xinfeng Lu	
7#		At the intersection between Xinhua Lu and Danfeng Lu	
8#	Soil	In the farmland across Juying Lu, east to Lindong Bridge at Qiaotou	PH, cadmium, mercury, arsenic, copper, lead, chromium, zinc, nickel, benzene hexachloride and DDT
9#		In the farmland west to Juyang Lu	

4)Monitoring results and assessment

Monitoring results of environmental quality status quo of soil sewer sludge and watercourse sediments are shown respectively in Table 4.3-8 ～Table 4.3-10.

Table 4.3-8 Monitoring Results of Soil Environmental Status Quo Unit: mg/kg (on a dry basis) except pH value

No.	Monitoring items	Detection results

		8#					9#
		0.2m	0.5m	1.0m	2.0m	3.0m	0.2m
1	pH(Dimensionless)	8.2	8.2	8.1	7.7	8.3	8.0
2	Cd (mg/kg)	0.08	0.07	0.04	0.04	0.04	0.06
3	Hg(mg/kg)	0.09	0.05	0.01	0.10	0.04	0.03
4	As(mg/kg)	<0.01	2.18	1.87	1.09	0.62	<0.01
5	Cu(mg/kg)	21.5	25.3	23.4	24.2	24.3	20.1
6	Pb(mg/kg)	19.1	23.1	12.6	24.4	21.3	17.9
7	Cr(mg/kg)	57.3	88.1	90.8	105	113	57.7
8	Zn(mg/kg)	90.5	117	114	119	119	84.5
9	Ni(mg/kg)	31.5	46.9	43.1	44.0	43.0	30.4
10	Benzene hexachloride(mg/kg)	Not detected out				0.0528	Not detected out
11	DDT(mg/kg)	Not detected out					

Table4.3-9 Monitoring Results of Sewer Sludge Unit: mg/kg (on a dry basis)

Monitoring Point	Cd	Hg	As	Cu	Pb	Zn	Ni	Benzo(a)pyrene	Mineral oil (mg/g)	B
6#	0.730	0.423	7.7	89.5	77.5	474	60.6	< 0.01	1.73	< 1.0
7#	2.199	0.747	13.7	194	89.9	400	29.1	0.05	2.82	< 1.0

It can be seen from the monitoring results in Table 4.3-8 ~Table 4.3-10 that all indicators of soil, sewer sludge and watercourse sediments can satisfy the maximum permissible concentration limits of Class II standard of the soil environment quality Standard (GB 15618-1995) as well as the pollutant control standard for agricultural use sludge (GB 4284-84) (Refer to Tables 1.5-4 and 1.5-8), the current quality status of soil, sludge and sediment being good, which are suitable to be used for backfill later.

表 4.3-10 Monitoring Results of Environmental Status Quo of Watercourse Sediments

Unit: mg/kg (on a dry basis) except value of pH

Monitoring point	Layer	pH	Cd	Hg	As	Cu	Pb	Cr	Zn	Ni	Benzene hexachloride	DDT	Benzo(a)pyrene	Mineral oil (mg/g)	B
1#	Surficial	7.9	0.08	0.11	0.47	39.7	5.0	35.6	188	47.6	0.0200	Not detected out	/	/	/
	Mid	7.6	0.04	0.05	0.25	24.5	2.1	28.0	113	47.1	0.0628		/	/	/
	Deep	7.8	0.03	0.02	0.02	16.1	1.3	29.4	85.4	35.8	0.0751		/	/	/
2#	Surficial	7.6	0.14	0.10	<0.01	50.9	2.6	70.6	283	44.1	0.0320		/	/	/
	Mid	7.4	0.14	0.08	0.03	48.3	3.6	46.8	245	39.8	0.0497		/	/	/
	Deep	7.5	0.20	0.03	0.01	41.0	3.6	56.2	228	39.8	0.0717		/	/	/
3#	Surficial	8.0	0.07	0.12	1.07	40.9	5.2	45.0	146	44.4	0.0039	0.0033	/	/	/
	Mid	8.2	0.09	0.07	0.74	43.5	5.2	41.3	154	45.5	0.0129	0.0134	/	/	/
	Deep	8.4	0.10	0.04	0.02	40.8	4.8	39.4	150	43.6	0.0137	0.0151	/	/	/
4#		/	0.291	0.260	12.1	61.3	32.0	/	176	32.2	/	/	0.03	0.183	26.2
5#		/	0.103	0.118	7.0	25.2	26.7	/	91.1	26.7	/	/	0.03	0.033	< 1.0

4.3.7 Ecological environment

1) Terrestrial ecology

The vegetation in Xiangshan is mainly of a hilly type which belongs in the north sub-zone of mid-subtropical evergreen broad-leaved forests. It has evolved into a secondary vegetation type owing to the extinction of a large area of primitive evergreen broad-leaved forests. Its actual vegetation can be divided into 15 vegetation types and 23 formations. Arboreal forests include coniferous forests consisting of masson pine, cypress and China fir, evergreen broad-leaved forests consisting of *nanmu*, Castanopsis sclerophylla and Schima superba, mixed forests consisting of secondary broad-leaved forests and coniferous forests mingled with deciduous broad-leaved forests as well as natural bamboo forests featuring with maobamboo. Shrubberies consist of white oak, white azalea and Eurya japonica. Thick growth of grasses consists of cogon, Themeda triandra and Arundinella anomala. Economic forests include citrus, red bayberry, loquat, tee, peach, plum, Chinese plum and pear tree.

2) Marine ecology

There are multiple eco-types in the surrounding waters of Xiangshan County according to the recent investigations and statistics from local authorities for fishery. More than 210 nektons have appeared including 124 fishes, 30 shrimps and 49 crabs. Major harvesting species are hair-tail, baby croaker, Acetes chinensis, mantis shrimp, Exopalaemon carinicauda and Muraenesox cinereous. Major economic fishes are large and small yellow croakers, hair-tail, silvery pomfret, mackerel and eel. Organisms in intertidal belts are also abundant with a common number of over 200 species, of which mollusks and crustaceans are in the majority. Littorina brevicula and hermit crabs are common in mudstone reef intertidal belts. Ruditapes philippinarum and coquina clams are common in intertidal sandflats. Mud snails and Ilyoplax tansuiensis are common in intertidal mud flats. About 70 species of benthos are common, mainly polychaetes, molluscs and crustaceans including Lumbriconeris heteropoda, scallop and stick insects.

3) Aquatic ecology

Historical data and field survey findings show: Most watercourses, such as the Nanda River, Xida River, Xinhua River, Xinkai River, Menqian River to be dredged are all man-

excavated canals. Most existing banks of them are retaining walls of block stones laid with grout or are hard embankments, neither of which is in the natural form. Moreover, in history, these watercourses were dredged and re-aligned for several times. Therefore, their existing ecological status is poor and artificial, where there are only such common fishes as crucian, chub and other fresh water fishes and a small amount of zooplankton and phytoplankton; and there are no such ecologically sensitive zones as natural habitats, spawning ground, feeding ground or migration passage of rare and valuable or important aquatic organisms.

5 Analysis of Environmental Impact during Construction Period

5.1 ANALYSIS OF CONSTRUCTIONAL WASTE GAS IMPACT

5.1.1 Pollution sources of waste gas

The pollution sources of waste gas during construction period include construction fugitive dust and construction vehicle tail gas.

Construction fugitive dust mainly comes from such processes as site leveling, fill soil transport and compaction, handling, stacking and transport of building materials, and foundation excavation; vehicles driving on unpaved roads and the site may also generate fugitive dust; and construction vehicles and mechanical operation process may also exhaust fuel oil waste gas. The ugitive dust arising from site leveling, foundation excavation and vehicle driving are the main factors of atmospheric environmental impact during the construction period.

5.1.2 Analysis of environmental impact

1)Fugitive dust of construction

According to the relevant literatures, during the construction process, the fugitive dust generated from driving vehicles accounts for over 60% of all the fugitive dust. That generated from driving vehicles can be calculated as per the following empirical formula under the complete dry circumstance.

$$Q = 0.123 \times \left(\frac{v}{5}\right)\left(\frac{W}{6.8}\right)^{0.85}\left(\frac{P}{0.5}\right)^{0.75}$$

In which: Q– fugitive dusts generating from driving vehicles, kg/km*vehicle(s);

v – Vehicle driving speed, km/h;

W– Load weight of vehicle, t;

P – Road surface dust capacity, kg/m^2.

Table 5.1-1 shows the quantities of fugitive dust generated under different road surface

cleanliness degrees and driving speeds when a 10t truck passes through the road of 1km long.

Table 5.1-1 Fugitive Dust of Vehicles under Different Driving Speed and Road Surface Cleanliness Degrees (Unit: kg/vehicle/km

Dust (kg/m^2) / Speed (km/h)	0.1	0.2	0.3	0.4	0.5	1
5	0.0511	0.0859	0.1164	0.1444	0.1707	0.2871
10	0.1021	0.1717	0.2328	0.2888	0.3414	0.5742
15	0.1532	0.2576	0.3491	0.4332	0.5121	0.8613
25	0.2553	0.4293	0.5819	0.722	0.8536	1.4355

As seen from Table 5.1-1, under the same road cleanliness degree, the faster the vehicle, the more the fugitive dust; at the same vehicle speed, the more the road dust, the more the fugitive dust.

Frequent watering on vehicle driving roads during the construction period (4~5 times/day) can reduce the output of fugitive dust by around 70% and offer good dust fall effect. The experimental results of dust suppression by watering on construction site are as shown in Table 5.1-2. When the watering frequency is 4～5 times/day, the TSP pollution distance caused by fugitive dust can be greatly shortened, nevertheless TSP concentration at the place 100 m away from the roadside is still above Grade II standard of the *Ambient Air Quality Standard* (AAQS) (GB3095-2012). Therefore, limiting vehicle running speed, regular watering and keeping road clean are the effective means to reduce fugitive dust.

Table5.1-2 Experimental Effect of Dust Fall with Watering Cart during Construction Period

Distance away from roadside (m)		5	20	50	100
TSP concentration (mg/m^3)	No watering	10.14	2.81	1.15	0.86
	Watering	2.01	1.4	0.68	0.6

Wind caused fugitive dust of open storage area and exposed site is another major factor of fugitive dust during construction process. Some building materials may need to be stacked temporarily due to construction demand, which may cause fugitive dust when the weather is dry and windy. The quantity of fugitive dust can be calculated as per the empirical formula for dust of storage area.

$$Q = 2.1(V_{50} - V_0)^3 e^{-1.023w}$$

In which: Q – Quantity of dust raised, kg/t*a;

V_{50}– Wind speed of field 50m above ground, m/s;

V_0– Speed of wind raising dust, m/s;

W– Moisture content of dust particle, %.

Speed of wind raising dust is associated with dust particle diameter and moisture content, so reducing the area of open storage yard and exposed ground, and ensuring certain moisture content are effective means for reducing dust raised by wind. The diffusion of dust in the air is association with the meteorological conditions such as wind speed and the dust settlement speed. The dust settlement speeds of dust of different particle diameters are shown in Table 5.1-3.

Table 5.1-3 Settlement Speeds of Dust of Different Particle Diameters

Dust particle diameter (μm)	10	20	30	40	50	60	70
Dust fall speed (m/s)	0.003	0.012	0.027	0.048	0.075	0.108	0.147
Dust particle diameter (μm)	80	90	100	150	200	250	350
Dust fall speed (m/s)	0.158	0.17	0.182	0.239	0.804	1.005	1.829

As seen from the above table that the dust settlement speed increases rapidly with the increase of dust particle diameter. When the dust particle diameter is greater than 250 μm, the major range of impact will be within a short distance of the downwind direction at the dust raising point, and dust with weeny particle diameter will offer greater impact to the ambience. Depending on the different climatic conditions of on-site construction seasons, the range of impact and direction will also be different. According to the analogic investigation, the fugitive dust within the range of 100~150 m of the downwind direction at the waste earth storage area goes beyond Grade II standard of the AAQS (GB3095-2012).

To sum up, following the construction activities such as civil construction, handling and transport, the fugitive dust arised therefrom will cause adverse impact on the ambience close to the construction site boundary, but its impact degree and range can be effectively controlled by taking measures such as dust suppression by watering, keeping road clean and controlling driving speed of construction vehicles. Hence, the development agencyagency and the contractor must put into practice the atmospheric pollution prevention and control measures proposed during the environmental assessment process, so as to mitigate the fugitive dust arising from construction and narrow the impact range as far as possible. The atmospheric environment impact during the construction period is temporary, which can be immediately

eliminated after the end of construction.

2)Tail gas of construction machines and transport vehicles

Construction machines and transport vehicles are generally driven by diesel, featuring in small exhaust gas emission, intermittent, short-term and mobility, which cause less impacts on surrounding environment.

3)Odor emitted from river dredging and sludge stack

River dredging operation and sludge stack process will both generate some smell. By comparing with similar works, we can know that, you may feel obvious smell beside river bank at the time of river dredging: the smell is light within the range of about 30 m, and little outside the range of about 50m. Because some river reaches involved in dredging under the Project are located within the main urban area, and there are too many residential points within the range of 50 m along both banks of the River, the dredging process will cause some impacts on their life.

Generally the sludge drying yard (SDY) will not be set within the main urban area at the time of river dredging under the Project. Sludge arising from river dredging will generally be dewatered by pressing the geotextile tubes full with sludge, which will be loaded into closed-tank trucks and transported to the sludge drying yard in suburb for drying; generally, SDY is far away from residential areas and the smell from which only has less impact on the residents.

5.2 ANALYSIS OF CONSTRUCTION WASTEWATER IMPACT

5.2.1 Pollution sources of wastewater

Construction wastewater mainly includes production wastewater such as construction machinery and vehicle washing wastewater, washing water of pipeline dredging, drilling caused slurry water, foundation excavation involved wastewater, and water drained for cofferdam, as well as domestic sewage of constructors;

1)Construction machinery and vehicle washing wastewater

Construction machines and vehicles such as excavators, bulldozers, loaders, and drilling machines need washing once per day, whose major pollutants are suspended sediments of high concentration and a small quantity of petroleum matters (according to the analogic result, SS

concentration is generally up to 3000 mg/L; petroleum matters are up to 20~100 mg/L).

2)Pipeline dredging involved washing wastewater

Pipeline dredging adopts mechanical device to inject high pressure water flow into pipeline for washing; SS concentration in washing wastewater is high, but most of suspended matters in it are settled in the sludge sediment well of the downstream pipeline, and the wastewater after sedimentation finally flows into the downstream watercourses .

3)Construction slurry water and foundation excavation wastewater

The foundation of pumping station adopts cast-in-place piles for pile foundation construction, which will generate drilling slurry water with extremely high SS concentration up to 10000~20000 mg/L; meanwhile, because the underground water surrounding the pumping station has a shallow burial depth, foundation pit wastewater with SS concentration up to 5000 mg/L will be generated at the time of foundation excavation.

4)Cofferdam water drainage

Cofferdams by segments are required to be set for some of the River dredging. Ponding in it is required to be pumped out or diverted to expose the Riverbed. The initial SS concentration for drainage of this part is relatively low, and rises during the later stage. In general, the SS concentration of drainage from cofferdam of watercourse dredging work is about 400~10000 mg/L.

5)Domestic sewage of constructors

According to the data provided by the design institute for the project feasibility study), the duration for the drainage network improvement and reconstruction is about 10 months with about 10 constructors needed per day; the duration for the drainage network dredging work is about 10 months with about 30 constructors per day; the durations for the drainage network dredging and pumping station construction works are about 12 and 18 months respectively with about 30 constructor per day; the above works are basically implemented simultaneously, with the water consumption of constructors as calculated as 100L/d per capita . Hence, as seen from the calculation, the water consumption for the constructors of the above works during the construction period will be about 10 m^3/d; given that domestic sewage discharge coefficient is about 0.9, then the domestic sewage discharge amount will be about 9 m^3/d, and the domestic sewage discharge volume for the whole duration will be about 3510 m^3.

The domestic sewage quality is generally COD_{Cr} 300~400 mg/L, BOD_5 200~300 mg/L, 30~40 mg/L of ammonia nitrogen, and 50~100 mg/L of animal or vegetable oil.

5.2.2 Analysis of wastewater impact

Construction wastewater generally includes high concentration of SS and a little petroleum matters. If it is directly discharged into municipal pipes or watercourses s without treatment, it will cause pollution to surrounding surface water and shallow groundwater, and may affect normal operation of wastewater treatment plant and service life of equipment.

T River dredging and pumping station construction may both disturb sediments on river bottom, cause increase of suspended matter concentration in water of watercourses , and pollute the water quality of rivers in the construction operation areas and surrounding areas, but because the dredging and construction operations in watercourses s of the pumping station are temporary, the suspended matter pollution caused therefrom is not continuous; meanwhile, because of the water flow influence, the suspended matters will not settle within a narrow range, the quality of river water caused therefrom will not be severely impacted, and will be eliminated at the end of the construction.

5.3 ANALYSIS OF CONSTRUCTION NOISE IMPACT

The varieties of mechanical equipment used during construction period such as drilling machines, excavators, bulldozers, concrete mixers and transport vehicles are all the noise generating sources. In consideration of the complexity of construction noise and different affected areas and stages of construction noise impact, in the EA the noise impact ranges calculated of different varieties of construction equipment for different construction stages, so as to enable the contactor to adopt appropriate noise prevention and control measures during construction.

The noise sources of construction equipment shall be calculated on a point acoustic source basis, with the noise projecttion model as:

$$L_i = L_0 - 20\lg\frac{R_i}{R_0} - \Delta L$$

In which: L_i and L_0– are respectively the equipment noise levels at the locations of R_i and

R_0;

ΔL– is the additional attenuation amount generated by barrier, vegetation and air, etc.

According to the above projection method and model, the noise impact ranges of varieties of equipment during the construction process can be calculated and the projected results obtained as shown in Table 5.3-1.

Table 5.3-1 Impact Range Computation Table of Construction Equipment Noise

Serial No.	Mechanical equipment	Ranging (m)	Sound level (dB)	Sound level attenuation distance (m)				
				85dB	75dB	70dB	65dB	55dB
1	Hydraulic excavator	5	90	9	28	50	89	281
2	Wheel loader	5	91	10	32	56	100	315
3	Bulldozer	5	88	7	22	40	71	223
4	Generator	5	98	20	80	126	223	706
5	Road rollers	5	90	9	28	50	89	281
6	Air compressor	5	90	9	28	50	89	281
7	Pneumatic pick	5	92	11	35	63	112	354
8	Commodity concrete mixing vehicle	5	90	9	28	50	89	281
9	Resonant breaker	5	88	7	22	40	71	223
10	Drilling type cast-in-place pile	15	95	16	50	89	158	500
11	Vibrator	15	77	6	19	34	60	189
12	Self-discharging truck	5	90	9	28	50	89	281

In general, there are several construction machines of different types simultaneously operating on a construction site, whose radiation sound levels will be superposed. The increment is different depending on the factors of types, quantities, and distance of relative distribution, which is 1~8 dB more than that under operation of a single machine withof maximum sound level.

As seen from the comparison between the data of the above Table and the *Emission Standard of Environment Noise for Boundary of Construction Site* (GB12523-2011) (70 dBA for the daytime standard limit, and 50 dBA for the nighttime standard limit), besides mobile generators and drilling type cast-in-place piles, when no sound insulation and noise reduction measure is adopted, the conforming distance for noise of other construction machine is about

34~89 m for daytime, and about 189~354 m for nighttime.

Some works of the project locate in the core urban area, whose noises will inevitably impact on the surrounding environment. Therefore, the development agencyagency shall strictly put into place the noise prevention and control measures during the construction period proposed during environmental assessment to reduce or mitigate the impact.

5.4 ANALYSIS OF SOLID WASTE IMPACT DURING CONSTRUCTION PERIOD

5.4.1 Pollution sources of construction solid waste

The solid waste generated during the construction period includes construction waste and waste earthwork generated from various subprojects, sludge arising from pipeline and watercourse dredging, and domestic waste of constructors, etc.

1)Construction waste

The construction waste arising from engineering construction includes waste building stone, steel, reinforced concrete, timber, prefabricated parts, and woven bags, etc., whose quantity is associated with the management level, construction quality and personal qualities of workers during the construction process, and is hard to be quantitatively estimated.

2)Waste soil and stone

According to the estimation of the feasibility study, the waste earth generated from Huancheng Xilu and Baohai Lu works will be about 274 thousand m^3; the waste earth generated by pipeline improvement and reconstruction will be about 10 thousand m^3; and the waste earth generated by pumping station work will be about 16.2 thousand m^3.

3)Sludge

The sludge will mainly come from dredging of drainage pipeline and watercourses in the urban areas, of which, the former will generate 28 thousand m^3 of sludge, and the latter , 242.5m^3.

4)Domestic waste of constructors

During the construction period, the constructors will generate a certain amount of domestic waste.

If construction wasteand waste earth are stacked at will, they may not only disturb the

visual effect of landscape, but also infiltrate into soil or surrounding surface water, reducing the soil productivity and polluting the surface water environment; if is not suitably collected and disposed, the domestic waste of constructors may bring about impacts on the landscape and cause sanitation problems in the construction areas, and even cause epidemic diseases to constructors.

5.4.2 Impact analysis

1) Construction waste

According to the relevant provisions such as the *Construction wasteManagement Measures of Ningbo*, before the commencement of works, the construction unit shall prepare construction wastedisposal program and submit it to the local urban management bureau for filing; meanwhile, comprehensive disposal and recycling approaches shall be preferentially adopted to dispose of the solid waste generated during the construction process; as for the construction wastesuch as redundant building materials and wastes, considerations should be taken to utilize them in a comprehensive disposal and recycling manner for the greening basecourse earthing, foundation backfill, and abandoned hilly pond filling, etc. for the works under construction; as for those non-utilizable, the construction muck clearing qualification management shall be strictly implemented and the unit with construction wasteoperation and service enterprise qualification shall be entrusted for outward transport and disposal.

2) Waste earth and sludge

The waste earth and sludge of the project shall be uniformly transported to the "Foundation Treatment Works of Renyitu Zone in the Xiangshan Economic Development Park" for backfill and site leveling. The development agency of the works has agreed to use the waste earth of the project for site backfill. The waste earth disposal of the project conforms to the recycling utilization policy for solid waste disposal.

3) Domestic waste

As for the domestic waste generated by constructors, the environmental sanitation agency shall be entrusted for timely clearing; meanwhile, the environmental protection awareness education for constructors shall be enhanced to avoid littering of domestic waste and impacting on city appearance and landscapes.

4) Brief summary

Varieties of solid waste of the project can be properly disposed by classes. The solid waste generated during the construction period will cause less impact on the surrounding environment.

5.5 ANALYSIS OF IMPACT ON ECOLOGICAL ENVIRONMENT DURING CONSTRUCTION PERIOD

5.5.1 Dredging Impact on Ecosystem of Watercourse

1）Existing ecological status of watercourse

The 15 watercourses to be dredged under the Project are all located in the main urban area of Xiangshan, where the sew network is under-developed, the combined system can be seen commonly, wastewater is incompletely intercepted or simply not intercepted for the watercourses, there existing serious phenomena of discharging wastewater into them, which cause the water quality status quo is bad of the abovementioned watercourses, presenting their water quality worse than Category V; Historical data and field survey findings show: the overwhelming majority of the watercourses, such as the Nanda River, Xida River, Xinhua River, Xinkai River, Menqian River to be dredged are all man-excavated canals. Most existing banks of them are retaining walls of block stones laid with grout or are hard embankments, neither of which is in the natural form. Moreover, in history, these watercourses were dredged and re-aligned for several times. Therefore, their existing ecological status is bad of the watercourses to be dredged under the Project, where there are only such common fishes as crucian, chub and other fresh water fishes and a small number of zooplankton and phytoplankton; and there are no such ecologically sensitive zones as habitats, spawning ground, feeding ground or migration passage of rare and valuable or importantheater aquatic organisms.

The status quo photos of some watercourses are shown in Fig. 5.5-1.

	
An Outfall of Xinhua River	**Status of a Place of Xinkai River**
	
Nanda River section beside People's Square	**Junction of Menqian River and Nanda River**
	
Status of a Place of Xiangshan River	**Status of a Place of Xida River**

Fig. 5.5 1 Status Quo of Some River Sections Necessary to Be Dredged

2）Dredging impact

The construction process of dredging watercourse may stir up the sediments on riverbed and disturb the water body, making suspended matters increase to affect the water quality and then impact the habitats of aquatic organisms; furthermore, the noise of construction machines may bring some negative impacts on fishes and other aquatic life. Therefore, necessary safeguard measures need to be taken to minimize the impact to the aquatic ecosystem.

Nevertheless, the foregoing detrimental effects are temporary. After the construction being completed, various pollutants accumulated in the watercourse sediments will be reduced largely,

the flows of waters will be quickened to increase the oxygen content in the waters; in addition, after the watercourse being dredged, the self-purification capacity of the watercourse will be enhanced, the water will become clear, and the photopermeability bettered, which is advantageous to photosynthetic plankton's growth and aquatic organisms' subsistence and reproduction, consequently to make the whole aquatic ecosystem enhance its productivity and biological diversity.

5.5.2 Impact of waste earth disposal on marine ecological environment

The waste earth of the project is planned to be uniformly transported to Renyitu for site backfill to form a construction land use. As seen from the aforesaid analysis that the "Foundation Treatment Works of Renyitu Section" has been approved by the Ningbo Ocean & Fishery Bureau and Xiangshan Environmental Protection Bureau, etc. in respect of relevant environmental protection approval procedures. Because the construction of reclamation dike has cut off the water exchange between Renyitu and the open sea, Renyitu has lost its mudflat function. There are no mudflat aquaculture and seawater aquaculture areas in the section. The current landform of Renyitu is mainly wild grass ground.

The "Foundation Treatment Works of Renyitu Section" locates in Renyitu reclaimed area. The works construction involves no marine environment outside the dike. As seen from expert review opinions related to the marine environment impact and the replied conclusions of the Ningbo Ocean & Fishery Bureau that "the sea area proposed to be transferred in Xiangshan Renyitu section locates in Renyitu reclaimed project area, which basically has no impact on the marine ecosystem in the surrounding area. In consideration of the fact that the sea area proposed to be transferred locates in the reclamation area, it will cause no direct impact on the marine environment."

To sum up, the waste earthof the project will not cause new losses to marine ecological resources at the time of Renyitu backfill and utilization, nor impact on the surrounding marine environment of Renyitu (*tu means beach or mud flat*).

5.5.3 Impacts on vegetation and forest

The land occupation for construction may damage the original landform and aboveground

vegetation. According to the survey results, there is no rare wild plant and animal or old tree and famous wood species in the project area. Except that Huancheng Xilu construction involves hilly forest land, other subprojects mainly involve artificial vegetation.

The original landform on the temporary construction camp shall be timely recovered after the completion of the works; the vegetation and forest losses caused by permanent land occupation shall be compensated with re-vegetation measures. Hence, the vegetation and forest losses caused during the construction period will be recovered or compensated, the impact to the environment being less.

5.5.4 Impacts on animals and their habitats

Except the subproject of Huancheng Xilu, all the other subprojects locate in the core urban area and will not cause any impact to wild animals and their habitats.

Two hills (Huangtuling and Mulingdong) are beside Huancheng Xilu, which are small hills and locate in the core urban area. The west sides of the two hills have been separated with the other hills by the built Provincial Highway 71. According to the survey results, the wild animals in the hills include swallow, sparrow, hare, field mouse, frog, toad, and snake, etc., but no passageways of rare and endangered wild animals or large wide animals. To sum up, the project construction will cause less impact on the animals and their habitats.

5.6 ANALYSIS OF SOCIAL ENVIRONMENTAL IMPACT DURING CONSTRUCTION PERIOD

The social environment impacts during construction period are mainly negative ones, which are reflected in respect of land requisition,d residents resettlement as well as their trips.

Impacts of land requisition and resettlement: the permanent land requisition area of the project is about 210.21 mu or 14 ha.; the area of non-residence to be demolished is about 2764 m^2; the area of rural housing to be demolished is about 2000 m^2 (10 houses, all in Lixin Village on Baohai Lu). The economic incomes and livelihood modes of these affected households will all be impacted to different extents.

The project development agencys shall strictly put into place the land requisition work proposed by the social environment assessment and livelihood recovery of the affected population; all compensation amounts shall be reimbursed to the affected ones fully and timely,

without impacting on their long-term livelihood and residential conditions.

2) Tianan Lu is a primary north-south road of Xiangshan, and the key commercial corridor and residents' activity place of Xiangshan, which has large traffic flows and pedestrian flows. The overhaul of Tianan Lu and renovation of public space will cause some impacts on the traffic flows of vehicles and pedestrians. Before the construction period, the development agency and construction unit shall contact traffic police department, conduct traffic reconciliation scheme for the construction period. The traffic reconciliation scheme for the construction period shall be contained in the construction management plan.

3) The stores along Wenchang Jie and Tianan Lu are mainly owned by various merchants. The public space renovation may impact on the traffic conditions of pedestrians and vehicles, and further impact on the interests of merchants. The development agency shall adopt reasonable construction schemes, and reserve necessary sidewalks and merchant access ways to ensure that the merchants can operate normally.

4) Pollutions such as fugitive dusts, noise and construction wastegenerated during the construction period may impact on the daily life, traffic and teaching activities of residents and schools surrounding the construction areas. The development agency shall strictly put into place the environmental protection measures proposed by the environmental assessment, conduct publicity and education in terms of construction safety, relieve negative impacts and avoid disturbing residents as far as possible.

6 Projection and Assessment on Environmental Impacts during Operation Period

6.1 PROJECTION AND ASSESSMENT OF ACOUSTIC ENVIRONMENT IMPACT

According to the characteristics of each subproject, the assessment will focus on projections of the impacts of traffic noises on new constructed roads, noise at public transportation stops and terminals as well pumping stations on the surrounding environment and sensitive targets.

6.1.1 Traffic noises impacts of new roads

6.1.1.1 PROJECTON MODE

In the EA, German Cadna/A environmental noise simulation software system is adopted. This system is the noise simulation and control software based on ISO9613 standard methods with WINDOWS used as the operating platform. The system applies top projection, assessment, engineering design and control solution research of impacts on various noise sources such as industrial facilities, highways, railways and non-point sources.

Considering fact that on Huancheng Xilu traffic flows are large and vehicle driving speed high, and the sensitive object Lixin Village on Baohai Lu has been included in the resettlement plan of Xiangshan County. Huancheng Xilu is selected as the representative for the projection analysis of traffic noise impact.

6.1.1.2 PROJECTION HORIZON

According to the *Specifications for Environmental Impact Assessment of Highways (Trial)*, the projection years are divided into short-, mid- and long-term, for which the 1st year, the 7th year, and the 15th year are selected respectively after putting the completed highway into operation, so the projection years are respectively 2018, 2024 and 2032.

6.1.1.3 TRAFFIC FLOW

The projection results for the traffic flow of feasibility study design (see Table 2.2-1 for details) as converted to the projection years with interpolation method are respectively 2018, 2024 and 2032, which are shown in Table 6.1-1.

Table 6.1-1 Traffic Flow Conversion Results of Huancheng Xilu

Characteristic year	Full day (pcu/d)	Peak hour (pcu/h)
Short-term (2018)	13578	1290
Mid-term (2024)	17696	1681
Long-term (2032)	26486	2516

Considering that the traffic noise source intensity of the software is determined by inputting absolute vehicle flow, by converting pcu/d in the above Table into absolute vehicle flow, the conversion coefficient will be 1 pcu=1 small-sized vehicle, 1.5 pcu=1 medium-sized vehicle, and 3 pcu= 1 large-sized vehicle. According to the feasibility study findings, the vehicle type ratio of Huancheng Xilu is small-sized vehicle: medium-sized vehicle: large-sized vehicle= 5: 2: 3.

Meanwhile, for sake of noise projection, the daily average vehicle flow is divided into daytime and nighttime vehicle flows, in which, the daytime vehicle flow accounts for 80% of the total, calculated for 16 hours; the nighttime vehicle flow accounts for 20% of the total, for 8 hours. Thus, the short-, mid- and long-term daytime and nighttime absolute vehicle flows can be calculated as shown in Table 6.1-2.

Table 6.1-2 Absolute Traffic Volume Conversion Results of Huancheng Xilu (Unit: Vehicle/Hr)

Horizon	Time	Small-sized vehicle	Medium-sized vehicle	Large-sized vehicle	Total
Short-term (2018)	Daytime	200	80	120	400
	Nighttime	100	40	60	200
Mid-term (2024)	Daytime	261	104	156	521
	Nighttime	130	52	78	260
Long-term (2032)	Daytime	390	156	234	780
	Nighttime	195	78	117	390

6.1.1.4 PROJECTION SCHEME AND RESULTS

Projection scheme and results for “general” noise pollution level of the road segment

The subproject locates in Class 2 acoustic environment function area, in the projection for which such parameters areselected as daily average daytime and nighttime traffic volume of the road segment and average roadbed height of the road segment to calculate out the traffic noise

attenuation law of the road segment, and give the daytime and nighttime up-to-standard distances for Class 4a and Class 2 acoustic environment function zones along the line. At the time of projection, no influences s of landforms and buildings are taken into consideration.

See Table 6.1-3 for the short-, mid- and long-term up-to-standard distances in daytime and nighttime of Class 4a and Class 2 acoustic environment function zones along Huancheng Xilu.

Table6.1-3 Projection Results of "General" Noise Pollution Level of the Road Segment (Required Up-to-standard Distance)

	Projection year	Daytime noise value (dB)		Nighttime noise value (dB)	
		70	60	55	50
Up-to-standard distance away from central line of the road (m)	Short-term (2018)	/	40.0	27.5	103.1
	Mid-term (2024)	18.5	47.0	62.0	121.3
	Long-term (2032)	21.0	62.6	84.2	150.0

See Table 6.1-4 for the projection results of sensitive object.

Table6.1-4 Projection Results of Sensitive Object

Name of sensitive target	Projection year	Daytime contribution value (dB)	Nighttime contribution value (dB)
Sanchalu Village	Short-term (2018)	47.2	44.2
	Mid-term (2024)	48.3	45.3
	Long-term (2032)	50.1	46.9

As seen from the above Table, after Huancheng Xilu opens to communications, the short-, mid- and long-term daytime and nighttime noise contribution values to the sensitive object Sanchalu Cun (village) are lower than the standard values of Class 2 zone (60dB for daytime, and 50dB for nighttime).

6.1.2 Noise impact of Tashan Terminal Station

No facility in respect of vehicle repair and washing, etc. is set in the newly constructed Tashan Terminal Station under the Project, whose noise sources during operation period are mainly the public traffic vehicle access noise in the stations under the project. Because the vehicle speed in the station is low and so is the vehicle running noise, the major noise source is vehicle launching noise. According to the measured analogic data, the noise generated by public traffic vehicle under steady driving is 70~75 dBA, and the launching and braking noises are

78~86 dBA.

Because the vehicle speed of public traffic vehicle at the time of launching and braking is low, in the EAthe noise source is simplified as a point source of noise of a semi-free acoustic field. The distance attenuation projection mode of non-directional point acoustic source in a semi-free space is as followed (only distance attenuation will be considered).

$L_2=L_1-20lgr_2/r_1$。

In which: r_1 and r_2 are the distances away from the acoustic source (m);

L_1 and L_2 are the noise acoustic levels of the acoustic source within the distances of r_1 and r_2 (dBA).

The distance of access to the village, a sensitive object, closest to the project is about 50 m; as per the calculation, the noise contribution value is about 52.0 dB, which is lower than the standard value for daytime of Class 2 zone (60 dB).

According to the survey, the operation time of buses in Xiangshan County is no later than 22:00. That is to say, Tashan Terminal Station does not operate during nighttime. According to the projection result, the degree of impact of noise of Tashan Terminal Station on the sensitive object conforms to the standard requirements.

6.1.3 Noise impact of pumping stations

The boosting pumping stations operate in an intermittent manner. The pumping stations realize drainage function via automatic control of liquid level during the flood and rainy seasons. When the water level of watercourses is higher than the designed high water level, the water pumping units will start to run, and close when lower than the normal water level. According to the FSR, submersible axial-flow pumps will be adopted for all the three pumping stations under the project with buried design. According to the analogic survey data, the water pumps of such design generate less noise impact. On the basis of adopting EA-recommended vibration and noise reduction measures, it can be ensured that the station boundary noise satisfies Class 2 emission standard in the *Emission Standard for Industrial Enterprise Noise at Its Boundary* (GB12348-2008). Because the closest sensitive object around the pumping station is 35 m away, the pumping station operating noise will not cause any impact to the object after vibration and noise reduction and distance attenuation.

6.2 PROJECTION AND ASSESSMENT OF IMPACTS TO ATMOSPHERIC ENVIRONMENT

The atmospheric environmental impact source during the project operation period is mainly the impact of vehicle exhaust gas on the surrounding environment. The vehicle exhaust gas pollution source can be simulated as a continuously emitting linear pollution source. With Huancheng Xilu as example, the projection and analysis can be conducted as follows.

6.2.1 Source intensity of vehicle exhausted gas pollutants

According to the *Specifications for Environmental Impact Assessment of Highways (Trial)*, the gaseous pollutant emission source intensity of vehicle exhaust can be calculated as below:

$$Q_j = \sum_{i=1}^{k} 3600^{-1} A_i E_{ij}$$

In which:

I– refers to the vehicle classification by weight as large-sized (with self-weight over 12 tons), medium-sized (with self-weight of 3.5–12 tons), and small-sized (with self-weight lower than 3.5 tons);

A_i– refers to the hourly vehicle flow of Class i vehicle in the projection year, vehicle/h;

E_{ij}– refers to the single vehicle emission factor of Type j pollutant of Class i vehicle under highwaydedicated highway operation condition, mg/(vehicle*m), subject to the value recommended by the standardation;

Q_j– Type j gaseous pollutant emission source intensity, mg/(m*s).

See Table 6.1-2 for the vehicle ratio and traffic volume on Huancheng Xilu.

According to Article IV of the Notification on the Detailed Rules for Implementation of Zhejiang Vehicle Exhaust Pollution Control Endorsed by the General Bureau of the People's Government of Zhejiang: the motorized vehicle emission standards during stages III and IV(hereinafter referred to as "National-III and National-IV Emission Standards) shall be enforced simultaneously with the whole country for new vehicle registration in the province (the National-III standard for light-duty gasoline vehicles and diesel vehicle has been being implemented since July 2008 and National-IV, since July 2011) ; official business vehicles, public transit buses and commercial motorized vehicles of passenger transport shall take the

lead of meeting the environmental protection standard. According to the Notification on Implementing National Motor Vehicle Emission Standard of Stage IV (YongZhengGao [2012] No.1), as of February 1, 2012, light-duty gasoline vehicles, bi-fuel vehicles and single-gas fuel vehicles must conform to the provisions of National-IV standard.

To sum up, according to the *Composite Emission Factors of In-use Vehicles* published by the Motor Vehicle Exhaust Gas Monitoring Center of the Ministry of Environmental Protection, the short-term (2018) vehicle exhaust pollutant emission can basically satisfy National-IV standard, see Table 6.2-1 for details.

Table 6.2-1 Composite Emission Factors of In-use Vehicles Conforming to National-IV Emission Standard (Unit: mg/m*vehicle(s))

Emission factor	Light-duty vehicle					Medium-duty vehicle				Heavy-duty vehicle			
	Gasoline vehicle				Diesel vehicle	Gasoline vehicle	Diesel vehicle	Public Transit Bus		Gasoline vehicle	Diesel vehicle	Public Transit	
	Mini car	Car	Other vehicle	Taxi				Gasoline	Diesel			Gasoline	Diesel
CO	0.12	0.2	0.22	0.29	0.31	0.92	0.87	0.92	0.87	3.96	2	3.96	2
NO_X	0.05	0.05	0.05	0.08	0.29	0.12	1.55	0.12	1.55	0.54	3.8	0.54	3.8

According to the short-, mid- and long-term hourly vehicle flows of the project and the vehicle exhaust emission factors, the CO and NOx exhaust emission source intensities of each characteristic year are as shown in Table 6.2-2.

Table6.2-2 Vehicle Exhaust Pollutant Source Intensity during Operation Period (Unit: mg/m*s)

Project name	Projection year	CO	NO_X
Huancheng Xilu	Short-term (2018)	0.0982	0.1321
	Mid-term (2024)	0.1277	0.1717
	Long-term (2032)	0.1915	0.2576

6.2.2 Projection methods and contents

By adopting Gaussian Line Source Diffusion Model to predict the impact of CO and NO_2 ground hourly concentrations within the assessment range on the surrounding atmospheric environment, which can be divided into short-, mid- and long terms, the specific projection contents are shown in the following Table 6.2-3.

Table 6.2-3 List of Projection Contents

Projection year	Projection factor	Projection contents (below stability degree D)
Operation in short, mid and long terms	CO, NO_2	When the wind direction is vertical to the linear source, the average wind speed and ground hourly average concentration distribution
		When the wind direction is parallel to the linear source, the annual average wind speed and ground hourly average concentration distribution

NOx includes compounds such as N_2O, NO, N_2O_3 and NO_2, among which NO and NO_2 are major ones; NO is relatively harmless, while NO_2 is somewhat harmful to human health. The ratio of NO and NO_2 concentrations in the air by both sides of the road is not a fixed value due to complicated influential factors. In general, NO_2 accounts for about 5%~40% of the total NOx. For this projection and assessment, 50% is taken in a conservative manner.

6.2.3 Parameter determination

1) The included angle between wind direction and road is selected as 90º (vertical) and 0º (parallel).

2) The annual average wind speed is 2.4 m/s.

3) In the calculation, the atmospheric stability category is Category D.

4) The average roadbed height plus 0.50 m is taken as the source height.

5) Other parameters are selected by main reference to the values in the *Specifications for Environmental Impact Assessment of Highways*.

6.2.4 Projection results and assessment

The projection results of the short-term (2018), mid-term (2024) and long-term (2032) vehicle exhaust pollutants CO and NO_2 of the project to be built in each characteristic year are shown in Tables 6.2-4 and 6.2-5.

Table 6.2-4 Ground Hourly Concentration of Pollutant by Two Sides of Road under Annual Average Wind Speed When Wind Direction is Vertical to Linear Source

Distance to road axis (m)	Pollutant concentration (mg/m^3)					
	CO			NO_2		
	2018	2024	2032	2018	2024	2032
20	0.0104	0.0136	0.0204	0.0070	0.0091	0.0137
40	0.0087	0.0114	0.0171	0.0059	0.0077	0.0115
60	0.0075	0.0098	0.0147	0.0051	0.0066	0.0099
80	0.0066	0.0086	0.0129	0.0044	0.0058	0.0087
120	0.0053	0.0069	0.0103	0.0036	0.0046	0.0069
160	0.0044	0.0057	0.0086	0.0030	0.0039	0.0058
200	0.0038	0.0049	0.0071	0.0025	0.0033	0.0050

Table 6.2-5 Ground Hourly Concentration of Pollutant by Two Sides of Road under Annual Average Wind Speed When Wind Direction is Parallel with Linear Source

Distance to road axis (m)	Pollutant concentration (mg/m^3)					
	CO			NO_2		
	2018	2024	2032	2018	2024	2032
20	0.0264	0.0343	0.0515	0.0177	0.0231	0.0346
40	0.0113	0.0147	0.0221	0.0076	0.0099	0.0149
60	0.0069	0.0090	0.0135	0.0046	0.0060	0.0091
80	0.0047	0.0044	0.0092	0.0032	0.0041	0.0062
120	0.0025	0.0032	0.0048	0.0016	0.0021	0.0032

As seen from the projection results that when the wind direction is parallel with the road, the contribution value of ground concentration of pollutant reaches the maximum level, and rapidly decreases with the increase of distance to the road axis. The maximum ground hourly concentrations of CO and NO_2 by the two sides of the road are respectively 0.0515 mg/m^3 and 0.0346 mg/m^3, amounting to 0.52% and 17.30% of the standard limits, which conform to Grade II standard of AAQS (GB3095-2012). Hence, the vehicle exhaust has less impact on the atmospheric environment along the road.

6.3 PROJECTION AND ASSESSMENT OF ENVIRONMENT IMPACT TO SURFACE WATER

1)Impact to water quality

The wastewater during the project operation period is mainly domestic sewage generated by Tashan Terminal Station. According to the design, the number of daily office work personnel of Tashan Terminal Station is about 30; when the water consumption quota per capita is calculated as per 150 L/d, the domestic sewage effluent volume will be 4.5 m^3/d. According to the analogic survey, the domestic sewage volume of entrance passengers is estimated to be about 10.0 m^3/d, then the total effluent volume of domestic sewage of Tashan Terminal Station during the operation period will be about 14.5 m^3/d; according to the empirical value, the concentration of domestic sewage is generally 350 mg/l for COD and 35 mg/l for ammonia nitrogen.

Tashan Terminal Station has good surrounding sewage discharge conditions. After being treated in septic tank, domestic sewage can be treated in WWTP in the core urban area of Xiangshan County via the municipal sewage pipe network, with less impact on environment.

After the implementation of urban drainage pipeline reconstruction and watercourses dredging subprojects, the eutrophication compositions such as nitrogen and phosphorus settled in urban river bed caused by residents' life and breeding industry can be greatly reduced, which increases the water storage and conservation and water environment capacity, enhances the self-cleaning capacity of river water, and can obviously improve the water quality in urban river, which plays an important part for realizing Class III water quality protection target of surface water in urban river network, and is beneficial to the existence and multiplication of aquatic organism of watercourses .

2)Hydrological regime impact

According to the calculation by means of the model adopted in the feasibility study, after the implementation of the River dredging works, when 5% frequency rainstorm occurs, the water level of river in the core urban area of Xiangshan will descend by about 20 cm; on the basis of this, after further implementation of pipeline network dredging works, the water level will descend by up to 23~30 cm; after the implementation of pumping station works, the maximum water level of upstream areas of Baishijing River, Nandahe Conduit and Xinhua River Pumping Station will continue to descend by 18~30 cm, and upraise the water level of initial segments of Dongda River and Xida River of the downstream by 4~6 cm, making the old urban area basically reach the drainage standard of 5% frequency.

Therefore, the implementation of the flood risk management component can effectively descend the water level of urban rivers during flood season, and increase its capacity of flood prevention and logged water drainage.

6.4 PROJECTION AND ASSESSMENT ON ENVIRONMENT IMPACT OF SOLID WASTE

The solid waste generated during operation period is mainly domestic waste generated by Tashan Terminal Station, for which the environmental sanitation authority is entrusted for regular collection, transport and disposal, having less environmental impact.

6.5 SOCIAL ENVIRONMENT IMPACT ANALYSIS

The social environment impact is mainly cited from the environmental assessment report of the project, of which the major conclusions are as followed.

6.5.1 Positive effects

1） The retrofitted public space will be helpful to improve the urban commercial environment and upgrade the conditions of public utilities.

2）The implementation of traffic corridor and transportation management Component will be beneficial to improving the safety of trip in the old urban area and enhancing the accessibility to it and strengthening the connection between the old and new urban areas as well as augmenting the safety of the slow trip system.

3）The implmentation of the road net improvement subproject will help improve the urban road network to mitigate traffic pressure in the urban areas.

4）The implementation of the Public Transportation Component will be favorable to elevate the level of urban public transportation infrastructures and improve the layout of public transit routes.

5）The implementation of the flood risk management Component will be conducive to exalting the capacity of drawing off floodwater and draining out logged water; furthermore, to ameliorating the environmental sanitation and water quality in the region.

6.5.2 Induced impacts

The Project aims at developing a humanized, sustainable, environment-friendly and safe systems of integrated transportation and flood risk management and constructing a safe, harmonious, pleasant, liveable, low carbon and environment-friendly urban infrastructure ambience, and then promoting the economic and social development in Xiangshan. The influences led in by the Project are mainly reflected in the aspects below.

1）The public space retrofit component will improve the urban commercial environment and public utilities and then enhance the liveability of city, exalt the attraction of city to the external and rural populations, which is helpful to activate the economic and social vitalities of city.

2）The construction of the traffic corridor and Transportation Management Component will, through such measures as optimization of signal setting, setup of road surface signs for pedestrians crossing roads, setting up barrier-free amenities for disabled's passage, raising the traffic efficiency of intersection, etc., improve the safety and accessibility for the resident, including vulnerable groups in the region.

3）The implemented road net improvement subproject will facilitate the residents dwelling along the roads to take trips for their routine work, attending school and consumption activities, saving trip time and cost and improving their living quality.

4）The public transportation improvement will facilitate poverty-strickened population, elderly group, women and other vulnerable groups to take trips for their attending school, going to work, going to hospital and other activities; in addition, the convenience of public transportation will be conducive to improving the trip modes of the nearby residents to relieve the traffic pressure and decrease automobile tail gas emission.

5）The implemented flood risk management component will be beneficial to raise the capacity of controlling flood and draining logged water in the region, further reducing the flood risk to the vulnerable groups, particularly the poverty-strickened population, and protecting the safety of people's lives and properties in the region to enhance the quality of life of the common people.

6）During the construction and operation periods, some non-technical jobs will be

generated. Such employment opportunities will be preferentially provided to women, poverty population and other vulnerable groups, thus promoting the vulnerable groups to obtain employments to lift their income level and life quality.

7 Public Participation

7.1 Purposes and Bases of Public Participation

The construction of the Project may bring about advantageous or disadvantageous influences to the surrounding ecological and social environments, which may directly or indirectly affect the social development and life of residents in the adjacent areas. Out of consideration of their self-interests or public interests, the masses may hold different viewpoints or opinions concerning the Project. The purpose of public participation survey is to learn about and get feed-back comments, demands and opinions of the public in the project area, and allow the public to participate in EIA, in order to have EIA more objective and comprehensive, and enable decision-makers to also consider the public's interests and demands when determing the construction of the Project and avoid one-sideness and blindness, so as to make the planning, design and formulated environmental measures for the Project meet the requirements of the economic development being coordinated with the ecological environment protection.

The public participation shall be carried out in accordance with the Tentative Provisions for Public Participation in Environmental Impact Assessment (HuanFa 2006 [No. 28], Zhejiang Environmental Protection Administrative Provisions for Construction Projects (Decree 288 of the Provincial Government), Enforcement Regulations (For Trial) for Public Participation and Government Information Disclosure in EIA (ZheHuanFa [2014] No. 28) and provisions and requirements in the Bank's EA Operative Policy (OP 4.01).

7.2 Ways, Scope and Participators of Public Participation

1)Ways of Public Participation

On the basis of the national and World Bank's requirements, such ways are adopted for the public involvement as information disclosure, common people symposium and questionnaire survey.

2)Scope and Participators of Public Participation

The implementation range of this PP maily covers the areas where the subprojects are situated, as well as affected peripheral areas and participators include citizens, and

representatives of legal persons, social organizations and other ones.

Individual information of two- round questionnaire surveys can be seen in Table 7.2-1.

Table 7.2-1 Individual Information of Two- Round Questionnaire Surveys

Age	18～35		36～60		＞60					
	Nr. (persons)	%	Nr. (persons)	%	Nr. (persons)	%				
	16	15.1	83	78.3	7	6.6				
Education Background	College or abover		Senior high school		Junior high school or below					
	Nr. (persons)	%	Nr. (persons)	%	Nr. (persons)	%				
	49	46.2	32	30	25	23.6				
Gender	Male			Female						
	Nr. (persons)	%		Nr. (persons)		%				
	62	58.5		44		41.5				
Vocation	Civil servants		Workers		Farmers		Individual laborers		Others	
	Nr. (persons)	%	Nr. (persons)	%	Nr. (persons)	%	Nr. (persons)	%	Nr. (persons)	%
	1	1.0	29	27.4	40	37.7	10	9.4	26	24.5

7.3 INFORMATION DISCLOSURE TO PUBLIC

7.3.1 First EA Information Disclosure

On September 11, 2015 the project development agency released the first round EA information via media (websites and newspapers), respectively in Xiangshan Today (newspaper), websites of NDRC, XDRC and NMRDIEP so as to allow the broad public to learn about and participate in this Project.

The released contents mainly cover: (i) project name and summary; (ii) name of project development agency and contact ways; (iii) name and contact ways of EA assessment institute assuming this EA; (iv) key work procedures and contents; (v) main items for which the public opinions and comments are requested. Photos disclosed in the newpapers and on the websites can be seen in Fig. 7.3-1.

During the first EA information disclosure, the project development agency and EA institute did not receive any feedback information.


今日象山

海纳百川 勇立潮头

拍卖公告

编号 XCQ2015018

"世行贷款宁波象山可持续城镇化示范项目(一期)"环境影响评价第一次公示

World Bank Funded

Ningbo Xiangshan Sustainable Urbanization Demonstration Project (Phase I)

First EA Information Disclosure

Xiangshan Today newspaper


宁波市发展和改革委员会

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World Bank Funded

Ningbo Xiangshan Sustainable Urbanization Demonstration Project (Phase I)

First EA Information Disclosure

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三、承担评价工作的环境影响评价机构的名称和联系方式

Fig.7.3-1 Photos for First Information Disclosure

7.3.2 Second EA Information Disclosure

On Nov. 6, 2015 the project development agency released the second round EA information via media (websites and newspapers), respectively in Xiangshan Today (newspaper), websites of NDRC, XDRC and NMRDIEP so as to allow the broad public to learn about and participate in this Project.

The main contents released include: (i) Brief description of the construction project; (ii) Summary of the potential impacts from the Project onto the environment; (iii) key points of measures and countermeasures of preventing or mitigating negative environmental impacts; (iv) Key points in the conclusions of EIAR; (v) ways for the public's assess to EIAR; (vi) the scope and main items of public opinions requested; and (vii) Contact ways, etc.

Photos disclosed in the newpapers and on the websites can be seen in Fig. 7.3-2 below.

Fig. 7.3-2 Photos of Second Information Disclosure

During the second EA information disclosure, the project development agency and EA institute did not receive any feedback information.

7.4 PUBLIC PARTICIPATION

7.4.1 Questionnaire Survey

In accordance with the Bank's requirements, after the first EA information disclosure, the development agency and EA institute carried out the first round public questionnaire survey in the urban area of Xiangshan where the project will be situated, totally 30 questionnaires were released, the findings of which are shown in Table 7.4-1.

Table 7.4-1 Statistical Results of First Round Questionaire Survey

No.	Item of Survey	Evaluation	Quantity	Ratio of Quantity to Total Surveyed
1	What do you think about the existing environmental quality of Xiangshan County?	Good	19	63.3
		Average	11	36.7
		Bad	0	0
2	Do you think that the present traffic travel conditions are convenient?	Yes	4	13.3
		Just so-so	22	73.4
		No	4	13.3
3	What do you think about Xiangshan County's existing capability of preventing flood?	Good	6	20.0
		Average	20	66.7
		Bad	4	13.3
4	Do you think that the construction plan is reasonable for the demonstration project?	Yes	23	76.7
		Average	4	13.3
		Not very	0	0
		Unknown	3	10.0
No.	Item of Survey	Evaluation	Quantity	Ratio of Quantity to Total Surveyed
5	What do you think the project will bring about influences after the project implemenation?	Advantageous	22	73.3
		Basically no influence	8	26.7
		Disadvantageous	0	0
8	If the environmental impacts are controlled within the range permissible by the state, what is your overall opinion and attitude?	Supportive	28	93.3
		Oppositive	0	0
		Doesn't matter	2	6.7

Based on the table above, the main findings can be summarized below:

1) the overwhelming majority of the public think that the existing traffic and trip conditions

are average or inconvenient in the county, the percentage amounting to 86.7%;

2) the overwhelming majority of the public think that the current flood control and drainage capabilities are just so so or weak, the percentage 80.0%;

3) the vast majority of the public think that the construction plan selected is reasonable for the demonstration project, 76.7%; and

4) the overwhelming majority support the project construction, 93.3%, while 6.7% do not care, and zero oppositive.

7.4.2 Second round questionnaire survey and symposium

In accordance with the requirements of the state and the Bank, the project development agency and EA institute carried out the second round questionnaire survey after the second information disclosure. Considering that the construction scopes of the subprojects had been basically identified during the survey, the questionnaires were distributed specially to the targeted residents/villagers in this round survey, such as those in Ruli Xincun, Sanchalu village, Jinxiujiayuan as well as business households in Wenchang Jie (street), Xiangshan Experiment School Elementary School and other social organizations, totally 86 questionnaires released to individuals and 29 to organizations. The findings can be seen in Tables 7.4-2 and 7.4-3.

Table 7.4-2 Statistical Findings of Second Round Individual Survey Questionaire

No.	Item of Survey	Evaluation	Number of Persons	Ratio of Number to Total Surveyed
1	To what extent do you know the Project?	Known	35	40.7
		Heard of	43	50
		Unknown	8	9.3
2	What do you think about the existing environmental quality of Xiangshan County	Good	43	50
		Average	41	47.7
		Bad	2	2.3
3	What are the problems that you mostly worry about?(multiply selectable)	Wastewater pollution	40	46.5
		Air pollution	33	38.4
		Noise	32	37.2
		Ecological destruction	9	10.5
		Solid waste	16	18.6
		Others	0	0
4	Do you think that the present traffic and travel conditions are convenient?	Yes	30	34.9
		Average	47	54.7
		No	9	10.4
5	What do you think about Xiangshan County's existing capability of preventing flood?	Good	21	24.4
		Average	44	51.2
		Bad	21	24.4
		Unclear	0	0
6	Do you think that after the project being implemented the residents' travel conditions and regional flood prevention capacity will be improved and raised?	Advantageous	71	82.5
		Basically no	12	14
		Disadvantageous	0	0
		Unclear	3	3.5
7	What influence do you think may be brought to your life and work after the project implementation?	Advantageous	65	75.6
		Basically no	19	22.1
		Disadvantageous	0	0
		Unclear	2	2.3

No.	Item of Survey	Evaluation	Number of Persons	Ratio of Number to Total Surveyed
8	If the environmental impacts are controlled within the range permissible by the state, what is your overall opinion and attitude?	Supportive	78	90.7
		Oppositive	0	0
		Doesn’t mater	8	9.3

Based on Table 7.4-2, the main findings of the second round Individual questionnaire are summarized below:

1) The overwhelming majority of individuals had known or heard of the Project, the percentage representing 90.7%;

2) The most worried environmental problems out of the project construction are, in order, wastewater pollution and atmospheric pollution, respectively 46.5 % and 38.4%;

3)the vast majority of individuals think that after the project implementation, the residents' travel conditions will be facilitated and the regional flood control ability raised, the percentage being 82.5%;

4)the overwhelming majority of individuals support the project construction, accounting for 90.7%, while 9.3% of the public have "no care" opinion, and no oppositive opinions.

Table 7.4-3 Statistical Findings of Second Round Questionaire Survey of Organizations

No.	Item of Survey	Evaluation	Quantity	Ratio of Qty to Total (%)
1	To what extent do you know the Project?	Known	19	65.5
		Heard of	10	34.5
		Unknown	0	0
2	What do you think about the existing environmental quality of Xiangshan County	Good	22	75.9
		Average	7	24.1
		Bad	0	0
3	What are the problems that you mostly worry about?(multiply selectable)	Wastewater pollution	5	17.2
		Air pollution	10	34.5
		Noise	16	55.2
		Ecological destruction	5	17.2
		Solid waste	6	20.7
		Others	0	0
4	Do you think that the present traffic and travel conditions are convenient?	Yes	11	37.9
		Average	17	58.6
		No	1	3.5
5	What do you think about Xiangshan County's existing capability of preventing flood?	Good	7	24.1
		Average	19	65.5
		Bad	3	10.4
		Unclear	0	0
6	Do you think that after the project being implemented the residents' travel conditions and regional flood prevention capacity will be improved and raised?	Advantageous	27	93.1
		Basically no	2	6.9
		Disadvantageous	0	0
		Unclear	0	0
7	What influence do you think may be brought to your life and work after the project implementation?	Advantageous	25	86.2
		Basically no	4	13.8
		Disadvantageous	0	0
		Unclear	0	0
8	If the environmental impacts are controlled within the range permissible by the state, what is your overall opinion and attitude?	Supportive	29	100
		Oppositive	0	0
		Doesn't mater	0	0

Based on Table 7.4-3 the main findings of the second round questionnaire survey of

organizations are summarized below:

1) All the organizations had known or heard of this Project;

2) The most worried environmental problems out of the project construction are, in order, noise pollution and atmospheric pollution, respectively 55.2% and 34.5%;

3) The overwhelming majority of organizations think that after the project implementation, the residents' travel conditions will be facilitated improved and the regional flood control ability raised, the percentage being 93.1%;

4) All the organizations support the project construction, spportive percentage being 100%.

7.4.3 Symposium

On the morning of Nov. 20, 2015, Ningbo PMO held a Public Participation Symposium for EA for this Project. The representatives of Ningbo PMO, Fenghua, Ninghai and Xiangshan PMOs as well as representatives of grass-root governments and residents attended this event. Please refer to Tables7.4-4 for detail.

Table7.4-4 Participators at Symposium

No.	Participators	Number
1	Ningbo PMO	3
2	Xiangshan PMO	1
3	Ninghai PMO	1
4	Fenghua PMO	1
5	Xikou Town Government	2
6	Xiwu Subdistrict	1
7	Changjie Town Government	1
8	Resident representatives of Xikou Town	3
9	Resident representatives of Ninghai County	3
10	Resident representatives of Xiwu Subdistrict	4
11	Resident representatives of Changjie Town	3
12	NMRDIEP (EA institute)	2
13	SMEDI (Design institute)	1
14	Huadong Engineering Corporation Limited	1

In the whole course of the meeting, the representatives of grassroot governments involved and residents conscientiously listened to the agencies concerned about the project background,

main construction coverage, main EA contents and concerned issues, who respectively expressed their comments and suggestions on the Project and EA, the key points of which are summarized below:

1) Representatives of Xikou Town and residents: (i) in the old town area, buildings are crowded, the width of road in some part is only one meter or so; furthermore, the town is a well-known tourist scenic spot, where it is very difficult for vehicles to run and park at ordinary times, the traffic will even suffer more serious paralysis in case of tourist seasons; (ii) because of unsound drainage facilities, water is serviously logged at Xilou Agroproduct Market, Paimen Lu and Wuling Middle School, etc.; (iii) urgently hope to improve regional traffic and drainage issues by reference of the Bank's advanced experience; (iv) due to the fact that there are a lot of cultural conservation units, close attention should be paid to the protection of them. In addition, the traffic flows are greatly different between tourist and non-tourist seasons, it is hoped that design of traffic management can be conducted in consideration of the regional characteristics.

2) Resident representatives of Ninghai County: Rest facilities are insufficient along main roads in the urban district, so they hope that these facilities can be improved through the Bank-funded project, especially the project of public spatial retrofit subproject can be implemented.

3) The representatives of Xiwu Sub-district and residents: (i) The Xiwu residents strongly support the urbanized reconstruction in the area, meanwhile hoping that in the reconstruction, the orginal historical style and features can be preserved; (ii) since there are a number of houses along streets in Xiwu, attention shall be paid to the safety of the old houses in the project implementation.

4) Representatives of Changjie Town Government and residents: (i) The town is surrounded by hills in three directions with serious problem of torrential flood, moreover, all the floodwater needs to pass through the town area to flow into sea, the town area is submerged twice or thrice every year; (ii) The roads are crowded in Changjie with a through-way across the town area, which brings about hidden danger to the safety of students and pedestrians, the representatives hope that a new through-way can be constructed outside the town area; (iii) urgently hope that the World Bank funded urbanization project can be implemented, under which the regional communications and drainage can be improved by reference of the Bank's

advanced experience; (iv) the facilities of collecting and transferring domestic solid waste are simple and crude, as a result, environmental contamination is serious in the course of collection and transfer, the government hopes that one modernized waste transfer station can be included in the the World Bank financed project; (v) the town belongs in a soft ground area, so attention shall be paid in EA to the rationality of construction management plan to prevent the building structures from being damaged.

5) Subconslusion: all the representatives of the grassroot governments and residents reflect that the capacities of urban traffic infrastructures and flood prevention are weak, hoping that they can participate into the implmentation scope of the World Bank financed demonstration project to improve regional traffic and flood control infrastructures with the help of the advanced idea and experience of the Bank so as to raise the regional urbanization level and liveability.

7.5 SUBCONCLUSIONS ON PUBLIC PARTICIPATION

Through twice EA information disclosure, most of the public have known the situation of the Project; the public participation symposium indicates that all the grassroot governments of the areas where the subprojects will be located hope that their areas can be involved into the implementation scope of the Bank funded demonstration project, all of them support the project construction; in addition, the findings of the two rounds questionaire surveys show that the overwhelming majority of the public support the project construction, no oppositive opinions.

8 Environmental Social Management Plan

The environmental social management plan (ESMP) is established to provide bases for environmental management in order to ensure that the development agencies can strictly follow the environmental protection laws and regulations during project design, construction and operation periods and put into practice the environmental protection measures set forth in environmental assessment report so as to reach the win-win purpose of project development coordinated with environmental protection

Schemes on environmental management at different stages of project implementation have been put forward in this report according to the features of the Project as well as the national, local and industrial laws and regulations related to project environmental protection and management.

8.1 Arrangements and Responsibilities of Project Environmental Management Organizations

Organizations for project environmental management include PMO for the World Bank financed project, construction contractors, construction supervisors, environmental monitoring agencies, relevant governmental departments, etc. Refer to Table 8.1-1 for arrangements and responsibilities of each party concerned.

Table 8.1-1 Arrangements and Responsibilities of Project Environmental Management Organizations

Phase	Party Concerned	Responsibilities	Staffing
Design and Prepara-tion	Ningbo PMO	Guidance, supervision and coordination, as well as overall organization works	1
	Xiangshan PMO	Responsible for preparation of environmental protection policies and objectives, putting EMP into bidding documents	1
	HECL, SMEDI	Responsible for the investigation and design of works, providing technical guarantee for environmental management	1
	NMRDIEP (EA Unit)	Preparing environmental management plan and environmental impact report	3
	XEPB		

Phase	Party Concerned	Responsibilities	Staffing
		Responsible for review and approval of environmental impact assessment documents	1
Construc-tion Period	Xiangshan PMO	①Responsible for the supervision on EMP implementation, inspecting the environmental management work of each subproject, periodically reporting EMP implementation progress to the superior project office and World Bank; ②Timely carrying out training programs and publicity works related to environmental management.	2
	Contractor	Responsible for taking mitigation measures during construction period according to EMP; ② Responsible for providing environmental protection training for construction personnel	1
	Construction and Environment Supervisors	Daily supervision to ensure the implementation of environmental protection measures during construction period ②Preparing periodic reports or special reports on environmental supervision works ③In monthly construction supervision report, presenting the implementation progress of environmental protection measures and existing problems, timely putting forward solutions and rectification schemes and putting the solutions and schemes into practice.	2
	Environment monitoring Unit	Responsible for the environmental and accident monitoring during construction period	2
	Xiangshan EPB	Examining the environmental management situation during construction period, giving guidance and supervision on the implementation progress of mitigation measures in EMP.	1
Opera-tion period	Xiangshan PMO	Responsible for the Three Simultaneities environmental protection acceptance after completion of the project; ②Responsible for giving guidance, supervision and coordination of other environmental protection works; ③ Responsible for reporting EMP implementation progress to the superior project	1

Phase	Party Concerned	Responsibilities	Staffing
		office and World Bank.	
	Operation Units of subprojects (Xiangshan HURDB, PTP, TPB, etc.)	Preparing regulations and standards on environmental management, responsible for the execution of mitigation measures at different operation periods according to EMP; ② Responsible for the organization and implementation works of environmental management training programs; ③ Responsible for the maintenance of environmental protection facilities.	1
	Environment monitoring Unit	Responsible for the operational and accidental monitoring works	1
	Xiangshan EPB	Three Simultaneities environmental protection acceptance after completion of the project as well as the environmental management inspection during operation period; ② Giving guidance and supervision on the implementation of EMP mitigation measures.	1
	TPB of Xiangshan County	Responsible for the vehicle inspection (on the exhaust emission situation) during operation period	1

8.2 ENVIRONMENTAL IMPACT MITIGATION MEASURES

Specific environmental impact mitigation measures for engineering design, project construction and operation have been proposed according to the negative impacts on environment stated in EIAR, and relevant national laws, regulations, codes and standards, guidelines of World bank including the *General EHS Guidelines*, *Water and Hygienic Conditions*, *Health and Safety Guidelines*, *Toll Road Environment, Health and Safety Guidelines*, etc. as well as the experience of carrying out similar projects recently within the project area or in our country. Refer to Table 8.2-1 for details.

In addition, social assessment report and resettlement plan of residents as well as social impact mitigation measures and advices at different periods have also been put into this management plan. Refer to Table 8.2-2 for details.

Table 8.2-1 Overview of Project Environmental Impact Mitigation Measures

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
Designing and Preparation	Procure-ment via bidding	/	Putting EMP into all bidding documents for civil works and construction supervision; 2) Putting EMP into the contracts with contractors and CSCs for implementation.	XPMO	NPMO	Not estimated separately
	Environmental Protection Training		Asking environmental experts to provide training on environmental impact controlling measures and exercising supervision on relevant personnel.	Ditto	XEPB	10.0
	Environmental Impacts Out of Project Scope Changes		If major changes occur, put forward environmental protection measures and incorporate these measures into construction drawing design. If any significant negative impact on environment exists after changes, the project development agency shall employ the environmental assessment unit once more for supplementary EA. EIAR after modification shall be submitted to the Environmental Protection Bureau of Xiangshan for review and approval, and meanwhile, to the World Bank.			5.0

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
	Information Disclosure and Public Participation		To minimize the negative impacts on residents' life and urban traffic, traffic relief work shall be well conducted during construction. To cooperate with traffic administrations to allow the public to know road traffic restriction information through mass media (TV, broadcast, newspaper and internet); 2) Information signboards containing the information like project profile, construction schedule, feedback comments, complaints hotline and the words hoping to get public's understanding shall be set on the construction site. 3) As large amounts of water and power are in need, construction units shall contact with relevant departments to connect pipelines/cables or temporary pipelines/cables in advance. For the areas lacking of water and power, water supply and power supply lines shall be installed in advance in case the water and power are suddenly out of supply, exerting negative impacts on the normal life and works of local residents, commercial and governmental organizations.	Contractors	XPMO	Not estimated separately
	Suggestions in Alternatives Comparison in EA		Suggestions have been put forward in EA that the functions of the multi-use building be optimized in FSR ---- the first floor of the building be transformed into a waiting hall with chairs, televisions and other amenities. In addition, public toilets shall be set in accordance with passenger number.	Contractors	Ditto	Not estimated separately
	Raise Dust, Exhaust of Construction Machines and Vehicles, Smell of	Negative Impacts on the Air Quality within the Construction Site as Well	Construction site shall be enclosed with solid, eye-pleasing barriers . The height of the barrier shall be no lower than 1.80 m. Fine-mesh safety net shall be mounted 100% for external scaffolds; 2) Building materials like cement, lime, etc. likely to cause raise dust in the construction site shall be stored in warehouses and pools with covers. The ground surface within 5 m from the entrance and exit of the construction site and main passages on the site shall be hardened; 3) Waste soil and stones and construction waste shall be timely collected and transported out. The soil and construction waste left behind on the construction site shall be stacked uniformly at	Contractors	CSCs, XEPB and XUMB	30

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
	Dredging Operation	as to the Life and Work of Nearby Residents	designated place. Solidification, coverage and greening measures shall be taken; 4) All vehicles going out of the construction site shall be cleaned and vehicles conveying construction soil and small particle materials shall be completely enclosed; 5) Commercial asphalt concrete shall be applied and no temporary mixing station is allowed to be set on the construction site; 6) Commercial concrete shall be applied where possible. Deduster shall be equipped for less on-site mixing operation ; 7) Dredging work shall be conducted in daytime. Sludge shall be timely transported to the designated disposal field. Drying field shall be set far away from residential area. If the River reach is near to the residential area, notification shall be sent to the residents in advance to acquire their understanding; 8) Lower sulfur contained gasoline (< 0.02%) and diesel (< 0.035%) shall be fueled to construction machines and vehicles and daily maintenance of them shall be enhanced to avoid excessive exhaust emission.			
	Construction Machinery, Vehicle Transportation, Road Pile Foundation Constructio	Noise Impacts on Nearby Residents, Schools, and other Sensitive Objects	Reinforce construction management and make reasonable arrangement on construction time and work. For the construction work needs to be conducted in nighttime, *Night Construction Permit* shall be handle as required and notification shall be sent to the residents nearby to acquire their understanding; 2) Optimize the construction schemes, advanced construction process and low-noise equipment shall be applied. High-noise construction machinery shall be arranged far away from residential areas and schools or isolated in sound insulation work shed to mitigate its impact; 3) Strengthen the regular maintenance on equipment and standardize the operation specifications to reduce abnormal equipment noise;	Contractors	Ditto	20

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
	n, Subgrade Compaction, etc.		4) Temporary noise-reducing construction barriers (like color steel plate and solid wall, etc.) in suitable heights shall be set near the sensitive objects; 5) Reinforced management system on transportation vehicles shall be carried out to reduce the number of vehicles in construction site and traffic density and vehicle honking forbidden. The entrance and exit of vehicles on the construction site shall be arranged far away from sensitive spots.			
	Washing of Construction Machines and Vehicles, Foundation Pit Excavation, Cofferdam Drainage	During construction activities, wastewater and pollutants enter into surface water bodies and municipal sewers	Washing area shall be set with hardened and anti-seepage ground, collecting gutter and oil separation tank shall be set around the washing area. Wastewater after oil separation and sedimentation disposal shall be sent back to the construction site for dust suppression; 2) Temporary septic tank and oil separator shall be set in constructors' living area. Domestic sewage cannot be discharged into municipal sewerage network before pretreatment. Where the sewer is not available, the sanitation agency shall be entrusted for regular suction; 3) When bored piles are under construction, a slurry circulation purification system shall be established. The drilling slurry shall be recycled for use after filtration. The final residual slurry and drilling debris shall be transported outside with closed vehicles by authorized slurry transportation enterprises which have been put in record by local UMB; 4) Sedimentation tanks shall be set up on site to purify the foundation pit wastewater. The wastewater after sedimentation shall be discharged into municipal sewers.	Contractors	CSCs, XEPB and XUMB	50
Construction Period	Subgrade Construction, Watercourses and	Impacts Caused by Solid Waste on Environment	According to the *Construction Waste Management Methods of Ningbo*, contractors shall prepare construction waste disposal schemes and send them to the urban administrative bureau for filling before commencement of works. Any construction waste shall be recycled first. Unusable waste shall be transported outside by the units with relevant operation and service qualifications; 2) Waste soil and stones produced during construction as well as dried slurry shall be transported	Contractors	CSC	80

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
	Sewer Dredging and Other Operations Producing Solid Waste		to Renyitu zone in Xiangshan Economic Development Park for backfilling and absorption; 3) Local sanitation agency shall be entrusted to timely collect and transport domestic garbage.			
	Constructional Earth Work Activities	Impacts on Ecological Landscape and Vegetations	Strictly controll the space occupied for construction, construction processes with less land occupation shall be adopted to reduce the occupation area of hilly area and forest land; 2) Construction excavation volume shall be reduced, and reasonable allocation made in excavation and filling and protective measures taken in temporary stacking yard to avoid water and soil losses caused by rainwater; 3) During construction, mentions shall be taken on the vegetation protection. Trees and bushes in the adjacent areas shall be transplanted to safe areas elsewhere if possible. After completing the construction, the temporary occupied land shall be timely restored to the original state. Vegetation losses caused by permanent occupation shall be compensated with new greenbelts.	Contractors	CSCs,Xiangshan Agriculture and Forestry Bureau	300
	Watercourse dredging	Impacts on fishes and other aquatic organism	1） To strengthen publicity on ecological protection during construction period and prohibit constructors' such activities of catching fish as fishing, trolling, electric shock, etc. 2） Low noise operation equipment shall be employed in dredging during construction to minimize the noise impact on aquatic organisms; to choose dry seasons as far as possible to conduct the cleanout operations to prevent the sediments from being dredged out in the period (genrally Apr. –Jun.) for fish's egg reproduction and that for fish fry's food intake for fattening to ensure that they can reproduce and grow normally; 3） To strictly prohibit construction waste (that with oil contained in particular) to be dumped into watercourse to avoid damages to aquatic organisms.	Contractors	CSCs, XOFB and XUMB	Not estimated separately

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
	Road Works	Impacts on Cultivated Land and Agricultural Production	During construction, the surface soil layer (plough layer) of occupied arable land shall be separately, and carefully stored with water and soil losses prevention measures. After construction, the occupied arable land shall be recovered with the plough soil; 2) When construction is conducted near farm land, construction scope shall be strictly controlled. Existing old road shall be used firstly as construction passage and temporary occupation land so as to reduce occupation of farm land.	Contractors	Ditto	20.0
	Vehicle Emission	Impacts on Sensitive Objects beside Road	Inspection and maintenance on in-use vehicles shall be enhanced and motor vehicles which emit excessive exhaust shall be forbidden to pass through; 2) The traffic signal indicating system shall be optimized to keep traffic moving and reduce the emission of exhaust gas; 3) The greening shall be enhanced on both sides of the road to purify the exhaust of vehicle; 4) Cleaner fuel should be recommended for use.	County PTC and TPB	Xiangshan PMO, TPB	Not estimated separately
	Traffic Noises		Rational planning of land uses on both sides of road shall be worked out to control the distance between sensitive buildings and noise sources. Buildings for commercial and industrial uses shall be arranged in the first row along the road. If the residential buildings are set at the first row, their use functions shall be optimized by setting kitchen, toilet and other subsidiary rooms on the side facing the road; 2) Low-noise pavement shall be applied and regular maintenance on the pavement shall be well conducted; 3) In sensitive sections, vehicle noise control shall be intensified by limiting the speed, forbidding vehicle honking, etc.	XPB, XHURDB, TPB and Transportation Bureau	Xiangshan PMO and EPB	Not estimated separately

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
	Operation Noises of Terminal Station at Tashan and Boosting Pumping Station	Impacts on Vulnerable Objectives Around the Road	Management shall be strengthened with signs indicating No Tooting set up in the station. When coming in and out of the terminal station, drivers of public vehicles shall be forbidden to honk. Timely shut down the engine after stop; 2) Entrance and exit of vehicles shall be laid out reasonably, far away from sensitive objects; 3) Except the north station boundary close to Tashan Lu, it is suggested that solid walls be built along other boundaries of the station for sound insulation; 4) Pumping units shall be designed to be buried under ground; low-noise units selected. Vibration-absorbing foundation shall be set at the bottom and soft joints shall be employed at the pipe junction of pumping unit; 5) Maintenance and overhaul on equipment in pumping station shall be strengthened to avoid abnormal operation noise.	XHURDB, PTC	Ditto	Not estimated separately
Operation period	Domestic Sewage Discharge Within the Station Field	Its Impacts on Environment	Before the domestic sewage of workers in the station is discharged into municipal sewer, pretreatment via oil separation and septic tank shall be conducted. After that, the sewage shall be sent to the wastewater treatment plant in the core urban district of Xiangshan for treatment and discharge after the effluent water quality meets the standard.	XPTC	XEPB	2.0
	Solid Waste Discharge	Its Impacts on Environment	During operation period, most of the domestic garbage in the terminal station at Tashan is solid waste. Local sanitation agency shall be trusted for regular collection, transportation and disposal.	Ditto	XUMB	5.0
	Ecological Protection Measures		Greenbelts are set on both sides of road. It is suggested that sculptures and landscaping mini-works be set at crossings, unoccupied land between street and buildings if applicable, which can not only improve the urban environment, beautify the road landscape but also raise the quality of city and strengthen the affinity of the city;	County HURDB and PTC	XEPM	10.0

Phase	Main Activities	Major Negative Impacts on Environment	Mitigation Measures	Implementing Agency	Supervised by	Expenses (RMB 10,000)
			Greening of the terminal station at Tashanand the pumping station shall be enhanced, regular spraying and maintenance shall be carried out.			
	Environmental Acceptance for Facilities Completion -		Project implementation agency shall entrust a relevant qualified unit to prepare the investigation/monitoring report on the environmental acceptance for the completion of the Project within three months prior to the official operation of the Project.	XPMO	Ditto	30.0

Table 8.2-2 Plan of Social Impact Mitigation Measures

Phase	Main Activities	Principal Negative Impacts	Mitigation Measures	Implementing Agency	Supervisor	Expenses (RMB 10,000)
Designand Preparation prior to Construction	Project Planning	Impact on socioeconomy and vulnerable groups	Taking more considerations of the impacts of project construction on socio-economy and vulnerable groups and making it a key factor in optimizing comparisons between alternatives.	The design unit and XPMO	NPMO	Not estimated separately
	Design of road routes	Impact on hill bodies, arable land and sensitive objects along routes	1) Road routes shall avoid or reduce their occupation of land to the maximum, reduce excavation of hill and occupation of forests and arable land; 2) Road routes shall keep off natural reserves, scenic spots, forest parks, drinking-water source protection areas, cultural protection units and other sensitive objects; it shall avoid villages, schools and other sensitive spots and reduce or avoid demolition; 3) Soil borrowand spoil grounds, construction roads and other temporary works shall be designed not to occupy or occupy less arable land.	The design unit	XPMO	Not estimated separately
	Public space retrofit and public transportation development, etc.	No enough considerations are taken of ideas of vulnerable groups and residents involved	1) To encourage vulnerable groups (including senior citizens ,women etc.) to attend public participation symposium in the project preparation stage, and pay more attention to their thoughts and demands; 2) In design of public space retrofit, the comments shall be incorporated of the shops along streets and residents nearby as well as parents of students and school teachers.	The design unit and social assessment unit	XPMO	5.0

Phase	Main Activities	Principal Negative Impacts	Mitigation Measures	Implementing Agency	Supervisor	Expenses (RMB 10,000)
	Requisition of land, demolition, etc.	Avoiding social impacts by implementing relevant policies	1) In design of construction scheme, land requisition and resettlement shall be avoided or reduced as much as possible ; 2) All kinds of preparation shall be sufficient before construction. Detailed investigations shall be carried out on land requisition and resettlement involved in the project as well as pipe network related to road construction. Cooperation shall be conducted in advance with the agencies concerned to decide the resettlement plan and route adjustment, ; preparatory works shall be got ready to meet emergencies thus to assure normal status of social life; 3) To work out feasible resettlement plan according to the project and local actual conditions to ensure the project-affected people not to suffer losses from its construction.	The design unit and XPMO	NPMO	Not estimated separately
Construction Period	Requisition of land, and resettlement, etc.	Impact on the life and income of social groups involved	1) Full compensations shall be provided to the affected people ; 2) Income and livelihood recovery measures shall be adopted to ensure that the affected people to participate in detailed design of the project and resettlement influences be minimized; resettlement activities shall be carried out in combination with technical and skill training and other development activities sponsored by the local government; 3) Compensation shall be paid for permanently acquired land according to the national laws and regulations, and policies of governments at different levels.	Relevant sub-district offices and headquarters	XPMO	Not estimated separately
	Road construction, public space retrofit	*Constructional impacts on traffic, efficiency and safety*	*1) Reasonable construction plans shall be adopted; construction shall be implemented by section. During construction, necessary pedestrian passageways, access ways for merchants and enterprises shall be reserved, residents living, normal operation of enterprises and public institutions as well as ordinary merchants shall be ensured;*	*The construction unit*	*CSCs, TPB and Transportatio*	*10.0*

Phase	Main Activities	Principal Negative Impacts	Mitigation Measures	Implementing Agency	Supervisor	Expenses (RMB 10,000)
Construction Period	*and, bus station construction, etc.*	*of residents' trips, cargo transportation for enterprises, merchants' operation, etc.*	*2) Road traffic management program during construction period shall be formulated. The inform shall be released via the media of traffic control, routes, time and location of detour in the mean time, warnings and notifications be published on construction site;* *3) The contractors shall strengthen contacts with departments of public security, transport and communications to make traffic dispersion, reasonably control traffic flows and directions at construction sections; for sections near schools, safety warning signboards shall be erected and temporary parking lot for vehicles picking up students shall be set;* *4) Providing that underground cultural relics are found during construction, construction shall be suspended immediately for preserving the field. The contractor shall notify the local cultural conservation bureau to dispatch its staff for field disposal.*		*n Bureau of Xiangshan County*	
	Measures for guaranteeing construction personnel's health and safety	Property loss and personal injury to construction personnel	1) A good system for site clearing shall be performed, for example, classifying scattered building materials and dismantled objects and putting them in areas away from passageways; 2) Construction waste and leaked liquid shall be cleared at regular intervals to ensure construction passageways unimpeded; 3) Particular methods and safety appliances shall be adopted when such operations are conducted as material cutting, polishing, chiseling, hoisting and carrying; 4) Proper personal safety appliances shall be worn (such as safety glasses, safety helmets, safety shoes and face guards); 5) Areas for mechanical operation, vehicle run and personnel walk shall be planned and divided to control construction vehicle traffic and prescribe speed limits; 6) Constructors shall wear marked vests to increase their visibility when they are operating or walking in heavy machinery operating area;	Contractors	CSC, XPMO	20.0

Phase	Main Activities	Principal Negative Impacts	Mitigation Measures	Implementing Agency	Supervisor	Expenses (RMB 10,000)
			7) Strengthening maintenance of construction equipment; 8) Cleaning the construction site frequently and making household garbage clearance in time. 9) Construction safety management shall be incorporated into construction contract management. Publicity and education of safety awareness to construction personnel shall be strengthened.			

8.3 ENVIRONMENTAL MONITORING PLAN

In order to make sure that various bad environmental impacts caused by the project are effectively controlled and mitigated, strict and scientific tracking shall be done in the overall process of the project, standard environmental management and monitoring shall be conducted as well.

See Table 8.3-1 for details of environmental monitoring plans of the project.

Table 8.3-1 Summary Sheet of Environmental Monitoring Plans for the Project

Phase		Monitoring Objects (Factors)	Point Location	Monitoring Method	Monitoring Frequency	Expenses Estimated (RMB 10,000)
Construction Period	Construction of roads and foundations of stations, dredging of sewers and watercourses s	Dust (TSP)	Construction site	Visual or sensuous inspection. When complaints occur, the monitoring agency will be entrusted to monitor according to the *Monitoring Standard for Ambient Air Quality (Trail)*	To be entrusted to monitor once after receiving complaints	3.0
		Wastewater on construction site (pH, COD_{Cr}, SS, petroleum and derivatives)	Watercourses s involved in dredging	Relevant provisions in the *Environmental Quality Standard for Surface Water* (GB 3838-2002) shall be followed	Once per quarter fortwo days during the construction period	3.0
		Noise (L_Aeq)	Shangjin village, Tashan Garden	Relevant provisions in the *Environmental Quality Standard for Noise* (GB 3096-2008) shall be followed	Monitoring at sensitive points, once everyday in daytime (when in construction or operation, that in nighttime shall also be conducted if there is construction)	1.0/time
			Jinxiu Jiayuan, Lixin village			
			Huifengyuan, Xiguyuan, Ximen village, Penglai Residential Area, Fengmaoyuan and Rongxinyuan Residential Areas			

Phase	Monitoring Objects (Factors)	Point Location	Monitoring Method	Monitoring Frequency	Expenses Estimated (RMB 10,000)
		Xiajia village, Lanyuan Residential Area, Jiangjia village, Hengtang'ou village, Yangxin village, Xiabanhe village, Haiyu Guandi Residential Area, Linghetou village, Shangwu village, Xiaoting village, Lujia village, Xiaodongyang village, Hujiaqi village, Qiujiashan village, etc.			
Operation period	Vehicle exhaust (CO, NOx, PM_{10})	Zhushuixicun, Jinxiu Jiayuan, Lixincun	The *Monitoring Standard for Ambient Air Quality (Trail)* shall be followed	Once for two days after road operation reaches its peak flow,	4.0
		Shangjincun, Tashan Garden, Xiangshan Middle School		Once every year for two days after the operation of the terminal station	4.0
	Noise (L_Aeq)	Pumping stations, boundary of terminal station of Tashan	Relevant provisions in the *Emission Standard for Noise at Boundaries* of *Industrial Enterprises* (GB 12348-2008) shall be followed	Once during operation of pumping stations, and after operation of the terminal station. In addition, once monitoring after receiving complaints	2.0
		Zhushuixicun, Jinxiu Jiayuan, Lixincun	Relevant provisions in the *Environmental*	Once after road operation reaches its peak flow, one	1.0

Phase	Monitoring Objects (Factors)	Point Location	Monitoring Method	Monitoring Frequency	Expenses Estimated (RMB 10,000)
			Quality Standard for Noise (GB 3096-2008) shall be followed	time in both daytime and nighttime	
	Domestic sewage from terminal bus station of Tashan (pH, COD_{Cr}, BOD_5, SS, NH_3-N, TP)	Discharge outlet for domestic sewage	Relevant provisions in the *Integrated Wastewater Discharge Standard* (GB 8978-1996) and *Wastewater Quality Standard for Discharge to Municipal Sewers* (CJ 343-2010) shall be followed	Once per a half year for two days, one time both in the morning and afternoon	3.0

8.4 ENVIRONMENTAL TRAINING PROGRAMS

The purpose of environmental training is to ensure a smooth and effective environmental management implementation and make sure that all related personnel can get familiar with the contents and procedures of environmental management so as to improve their management ability and make certain the effective enforcement of each environmental protection measure.

The main objects of environmental management capacity building are environmental managers and supervisors, the training to whom is a part of technical support to the project. Contractors and their workers shall also attend training courses during the project implementation. Before the construction, all contractors and their personnel, workers of operation units and their construction supervisors shall take part in the compulsory HSE training courses.

See Table 8.4-1 for details of environmental training programs for relevant personnel during construction and operation periods of the project.

Table 8.4-1 List of Environmental Training Programs

Trainees	Training Contents	Number	Duration (Day)	Expenses Estimated (RMB 10,000)
Preparation and construction period				
The Contractor and on-site environmental protection technicians and team leaders	1) Mitigation measures during the construction period in EMP, and environmental training will be combined with on-the-job safety training; 2) Introduction on environmentally sensitive areas surrounding the construction site, its neighborhood and list of objects under protection; 3) Simple monitoring/selfdetection methods and control measures against noise and raise dust caused by construction; 4) Emergency handling of environmental pollution accidents; 5) Disposal measures with cultural relics found during the construction period.	2 persons in each work section	2	6.0
Supervision engineers	1) Mitigation measures and requirements concerning the construction period in EMP; 2) National and local laws and regulations, construction plan and supervisory rules concerning environmental protection, civilized construction and safety production; 3) Simple monitoring/self-detection methods and control measures against noise and raise dust caused by construction; 4) Emergency handling of environmental pollution accidents; 5) Requirements of daily records and reports about conditions of environmental protection, civilized construction and safety production during the construction.	1 or 2 persons in each work section	2	8.0
XPMO, operation units and their environmental management personnel	All of the aforementioned contents	1 or 2 persons in each unit	2	8.0
Operation period				

XPMO, operation units and their environmental management personnel	1) Mitigation measures in EMP during the operation period; 2) Monitoring requirements in EMP during the operation period; 3) Related discharge standards for pollutants and operating regulations; 4) Maintenance of environmental protection facilities.	1 or 2 persons in each unit	2	8.0
Total				30.0

8.5 REPORTING AND COMPLAINTS MECHANISM

According to the Chinese environmental laws and regulations concerning construction projects, World Bank operative policy requirements, the Borrowers (the Owner at subproject level) shall be responsible for preparing the *Monitoring and Evaluation Report on EEMP Implementation* (usually twice a year) to ensure the implementation of requirements and measures in all approved EMPs, discover problems timely for analysis and summary so as to control adverse impacts on the environment in the follow-up activities of the project.

Arrangements for environmental monitoring and reporting are as follows:

1) Construction supervision engineers of the project shall be responsible for routine supervision on the implementation of the measures set forth in EMP, keeping detailed records into their logs and monthly reports, and submit them to the PMO for the World Bank Financed Project;

2) Xiangshan PMO shall make regular and irregular site supervision on the implementation of EMPs and have the records to be incorporated into semi-annual reports;

3) The external environmental monitoring unit shall supervise implementation of mitigation measures as soon as accepting entrusted tasks, regularly monitor quantitative indicators, prepare external monitoring reports according to the requirements of this section and the Contract and submit them to the Xiangshan PMO;

4) If any environmental complaint occurs, external environmental monitoring unit and Xiangshan PMO shall notify local EPBs and submit it to the superiors if necessary.

5) Xiangshan PMO shall work out schedules for EMP on the basis of materials and reports stipulated in the four items above and with the help of external environmental

monitoring unit or experts, which shall be incorporated into semi-annual reports of project implementation progress and submitted to the World Bank in time.

Main contents shall be included in implementation of EMP:

1) Implementation of EMP: main contents of this construction stage, what training on environmental management has been conducted during this stage, problems in existence, implementation of mitigation measures, problems and causes as well as next rectification measures;

2) Environmental monitoring results: brief explanation to data, its existing problems and phenomena not up to standard, their causes analysis and rectification measures suggested; residents' complaints and solutions shall be included if necessary;

3) Overall evaluation and conclusions to EMP implementation of this stage, and suggestions and plans for next half year work.

9 Environmental Management Frame

For the subprojects (Phase II) to be identified and environmentally assessed in the course of implementing this Project, an Environmental management Frame is hereby worked out to guide PMO to identify and manage environmental impacts of the subprojects and to provide an action plan for environmental management and control of the follow-up subprojects.

9.1 SUBPROJECTS SELECTION CRITERIA

1)The projects shall be within the scope of municipal infrastructure category, flood risk management and integrated transportation system category, such as road construction, river realignment, municipal pipe network construction etc. Furthermore, no projects with large environmental impacts, to which the public is sensitive (for example, domestic solid waste landfill and incineration projects and solid waste centralized disposal projects etc.), will be implemented.

2)The Environmental and social impacts of the subprojects shall not exceed the scope and category of the safeguard policies of the World Bank to which Phase I subprojects are involved.

9.2 SUBPROJECTS SITING CRITERIA

1) No subprojects shall be located within such special protected areas and other environmentally sensitive areas according to the national stipulations and planning, or approval by the people's government at county level or above as drinking-water source protection area, natural reserve, scenic spot, ecological function protection zone, basic farmland protection zone, main area of preventing water loss and soil erosion, forest park, geologic park, world heritage place etc.;

2) The project siting shall be in conformity with the related Regional Master Planning, Industrial Development Planning, Function Zone Planning for ecological environment, and other planning;

3)After the public participation and consultation being conducted according to the requirements concerned, the peripheral affected residents can accept the implementation of the Project.

9.3 Preparatory Work for Environmental Assessment

1)National Preparatory Work for Environmental Assessment

After the subprojects being identified, the first is to process the national environmental requirements and procedures. Namely, we need to ask the national environmental protection agency for advice about the administrative requirements on EA. If EIA report (EIAR) is necessary, the project development agency needs to entrust a qualified EIA institute to prepare the national EIA and other materials concerned, and ascertain, according to the List of Classified Administration Construction Projects, which is needed among EIAR, Report Table and Registration Table.

2)World Bank EA Requirements

On the basis of the national Environmental Assessment and with the Bank's EA for Phase I as model, EIAR/EMP will be prepared and submitted to the Bank so as to meet the provisions of the Bank at the same time. EIAR/EMP submitted to the national authorities and the Bank shall be consistent in such key contents as subprojects' construction scope, environmental impact analysis, mitigation measures, monitoring requirements etc.

3)Preparation of EMP

For environmental assessment of subprojects, EMP shall be prepared for each in accordance with the Bank's requirements. EMP shall mainly cover the requirements of related environmental impact mitigation measures for construction and operation periods and those on the responsible units and other necessary contents; furthermore, relevant monitoring plans and staff training programs, etc. need to be provided.

The final EIARs/EMPs of both Chinese and English versions shall be delivered to the Bank.

9.4 Public Participation

The task of public involvement needs to be completed in line with the requirements of the national authorities and the Bank. It is required by the national authorities that during EA period the information be disclosed twice and the public consultation be conducted once; while by the Bank that the more the better.

1) Information disclosure requirement

As required by the Bank, the information disclosure should cover the whole EA process, and the information be disclosed for at least two weeks and then the public consultation conducted so as to ensure that the affected people may have sufficient time to learn about the Project and to feed back their opinions, and avoid just going through the motions. The information disclosed mainly includes main information, concise version and complete version of EA. The ways of disclosure include public disclosure in local main media (newspaper, broadcast, TV, and website on internet), and the public should be informed of disclosure time, location, and ways for access to the concise and complete EA documents (generally the reports will be avalible in public places where the public are easy to look up) and how they can provide their feedback.

2)Public consultation

Multiple methods should be adopted to conduct public consultation, i.e., symposium, individual interview and questionnaire survey. Most of recipients should be affected people other than local officials, and the more the number of recipients the better. Their concerns should be reflected in revisions of EIAR and EMP. EIAR should detail records of the dates, locations, discussion topics, ways and number of participators, their professions and main concerns, as well as how EA and project design address these issues and suggestions raised by the public.

9.5 Review and Approval

1)After EAs are completed for the subprojects, EIAR will be submitted to the local EPB for evaluation. At the same time, it will be delivered to the Bank for pre-appraisal of EA and EMP.

2)The local EPB with the authority of review and approval will organize experts to evaluate EIAR and provide evalution comments. Also, the Bank will give written comments on EA.

3) The EA institute will modify and improve EIAR incorporating the national EA evaluation comments and the Bank's pre-appraisal comments and submit the final version to the EPB for review and approval, and at the same time, to the Bank.

9.6 IMPLEMENTATION

1)Each Subproject PMO shall contain the funds nessary for EMP implementation in the estimated costs for project implementation in order to ensure that EMP can be implemented practically.

2)Project implementation agencies, project development agencies and operation units shall, according to EIAR and EMP, put into effect the environmental impact mitigation measures, personnel training programs and environmental monitoring plans.

10 Conclusions

The World Bank financed Ningbo Sustainable Urbanization Demonstration Project (Phase I) will be located in Xiangshan County, Ningbo municipality, the construction of which meets the requirements of the Xiangshan Urban Master Planning, Integrated Transportation Planning, Integrated Drainage and Flood Prevention Planning, and also conforms to the national and local industrial policies. The main construction contents are municipal services and infrastructures. The construction of the Project will play an important role of raising the capacity of drainage and flood prevention, enhancing the comprehensive urban transport capability and improving the overall image of the county seat. Although certain impacts may be brought to the environment during the construciton and operation periods, the pollution/pollutants generated in the course of construction and operation can be effectively treated and controlled and the regional environmental impacts will be in the extent acceptable, the project will bring about good economic and social benefits and overwhelming majority of the public support the construction of the Project, as the specialized environmental impact assessments indicate, if only the project development agency put into effect the environment protective measures proposed in EIR.

Therefore, from the environmental angle, the implementation of this Project is feasible.