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Sichuan-Chongqing Cooperation: (Guang'an) Demonstration Area Infrastructure Development Project

Linshui Component

Environmental Impact Assessment

Linshui County People´s Government

China Railway Eryuan Engineering Group Co., Ltd.

October 2014 Chengdu

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1 Preface

1.1 Project Background

The Sichuan-Chongqing Cooperation: (Guang'an) Demonstration Area Infrastructure Development Project meets the need to realize the national economic development strategy. As required in the notice issued by the National Development and Reform Commission, the Ministry of Finance, the World Bank loan shall be actively applied to the infrastructure construction for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area. In the second half of 2011, Guang'an City launched the loan application for the Infrastructure Project for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area (including Qianfeng and Linshui Components) and in the early half of 2012, and the Infrastructure Project for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area was included in the World Bank Loan Funded National Plan for 2013-2015.

According to *China's Memorandum for Proposed Infrastructure Project for Sichuan-Chongqing Cooperation Demonstration Area* dated June 2013, the Infrastructure Project for Linshui Industrial Park of Guang'an is one of the components in the Infrastructure Project for World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area.

1.2 Necessity of Construction

1. Linshui County is important for the functional layout in the overall plan: the construction of electromechanical cooperation park in Linshui is the top priority in the functional layout for industrial cooperation. The Environmental Impact Assessment Report for the Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area
2. It is needed for adapting to the develop-the-west strategy and promoting local socio-economic development: for the Project, favorable opportunities are seized to implement relevant governmental policies, construct the infrastructure of Linshui Industrial Park, perfect urban infrastructure, enhance the function to provide urban services; improve people's living quality and adapt to the develop-the-west strategy for all-round progress of national socio-economic development and social undertakings.
3. It is the top priority of regional development: the Project is an inevitable choice of improving the opening-up image and investment attraction effect of the Demonstration Area. According to the existing construction and development of the Demonstration Area, efforts must be exerted to the tangible environment and the supporting infrastructures and public services of the Demonstration Area shall be upgraded to improve the opening-up image and increase the attraction to and enhance the confidence of the foreign investors.
4. It is needed for actively embracing the industrial transfer: the Project will better improve the infrastructure of Linshui Economic and Technological Development Zone (LETDZ) and is necessary to actively accept the industrial transfer, functional extension, element spillover and cultural radiation from the main urban area and Liangjiang New Area of Chongqing, create a half-hour traffic circle and an economic circle highly integrated with Chongqing with seamless communication and promote the industrialization and urbanization development.
5. It is needed for adapting to the continuously increasing traffic volume of the LETDZ: the traffic volume from Linshui to Chongqing will increase dramatically with the completion of expressway outlet, bringing an explosive growth of traffic volume in LETDZ. The Project will improve the traffic condition of Linshui County

and meet the increasing traffic demand.

6. It is needed for completing and improving the urban traffic network structure: the completion of road in the Project will greatly improve the urban traffic network structure, facilitate the residents along the line in daily travel and perfect the traffic organization of the whole road network.
7. It is urgently needed for improving the living environment of residents in the Linshui County and reducing environment pollution: the Project will greatly improve the living environment of residents in the Linshui County, reduce pollution to the environment and raise people's standard of living.

In conclusion, it is necessary and urgent to have the Project accomplished.

1.3 Targets and Contents

The development objective of the proposed project is *to support Linshui County and Qianfeng District of Guang'an Prefecture to improve transport, wastewater, skills and investment promotion services for current needs and projected growth.* For this purpose, the Project will support the following activities in Linshui County.

(a) Create a public transport corridor between low-income areas in the urban core and industrial areas and linking to the Guang'an-Chongqing highway; (b) construct storm water drainage, sewage interceptors, sewage pipelines and treated effluent pipelines for existing and new residents and industries; (c) increase wastewater treatment capacity; and (d) develop industry-linked skills training for low-income groups based on target industries.

With reference to the *Law of the People's Republic of China on Environmental Impact Assessment (EIA)*, the *Regulations on the Administration of Construction Project Environmental Protection*, the *Notice on Enhancing the Administration of Environmental Impact Assessment for International Financial Institutions (IFI) Financed Construction Projects,* the World Bank's Safeguard Policies, as well as the EIA procedures of China and World Bank, this exercise is to describe the positive environmental impacts of the project implementation, identify, screen and predictively analyze potential negative environmental impacts thereof and propose targeted and effective mitigation measures and an environmental management plan (EMP) for main unavoidable and negative impacts so as to provide the basis for both the independent project assessment by World Bank and the decision making and management by the administrative and environmental management departments of the government.

1.4 EIA Progress

In April 2014, China Railway Eryuan Engineering Group Co., Ltd. (hereinafter referred to as "China Railway Eryuan") was entrusted by the World Bank Load Funded Guang'an Project Department to undertake the EIA of the Project. After that, China Railway Eryuan established a project team, which collected, compiled and reviewed related materials, visited all the proposed project sites, looked at the surrounding environment of each site, monitored the environmental status and carried out preliminary analysis regarding the nature, content and size, main pollutants and potential environmental impacts of each component. Besides, the *EIA Report of the Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area* was prepared in accordance with domestic technical guidelines on EIA and the specific provisions on EIA in the Safeguard Policies and based on the *Feasibility Study Report of the Infrastructure Project for World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area*.

2 General

2.1 Preparation Basis

2.1.1 Laws and regulations on environmental protection

1. Environmental Protection Law of the People's Republic of China (December 26, 1989);
2. Law of the People's Republic of China on EIA (Order 77 of the President of the People's Republic of China, September 1, 2003);
3. Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution (September 1, 2000);
4. Law of the People’s Republic of China on Prevention and Control of Water Pollution (June 1, 2008);
5. Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise (March 1, 1997)
6. Law of the People’s Republic of China on Prevention and Control of Environmental Pollution by Solid Wastes (April 1, 2005);
7. Cleaner Production Promotion Law of the People's Republic of China (July 1, 2012);
8. Circular Economy Promotion Law of the People's Republic of China (August 29, 2008);
9. Law of the People's Republic of China on Protection of Cultural Relics (December 29, 2007);
10. Land Administration Law of the People's Republic of China (August 28, 2004);
11. Urban and Rural Planning Law of the People's Republic of China (January 1, 2008);
12. Law of the People's Republic of China on Water and Soil Conservation (March 1, 2011);
13. Law of the People's Republic of China on the Protection of Wildlife (August 28, 2004).

2.1.2 Ministerial Environmental Protection Regulations

1. Regulations on the Administration of Construction Project Environmental Protection (Order 253 of the State Council in 1998, November 29, 1998);
2. Regulations on the Implementation of the Land Administration Law of the People’s Republic of China (Order 256 of the State Council in 1999, January 1, 1999);
3. Regulations on the Implementation of the Law of the People’s Republic of China on Prevention and Control of Water Pollution (Order 284 of the State Council in 2000, March 20, 2000);
4. Regulations on the Implementation of the Law of the People’s Republic of China on Water and Soil Conservation (Order 120 of the State Council in 1993, August 1, 1993);
5. Regulation of River Administration of the People's Republic of China (Order 167 of the State Council in 1994, December 1, 1994);
6. Circular on Further Enhancing EIA Management and Preventing Environmental

Risks (HF [2012] No. 77);

7. Interim Measures for Public Participation in Environmental Impact Assessment (HF [2006] No. 28);
8. Catalogue for the Classified Administration of Environmental Impact Assessment for Construction Projects (Order of State Environmental Protection Administration, October 2008);
9. Decision of the State Council on Several Issues Concerning Environmental Protection (GF [1996] No. 31);
10. National Compendium on Eco-environmental Protection (November, 16, 2000);
11. Notice of State Development Planning Commission and State Environmental Protection Administration Regarding Issues on Regulating Charges for Environmental Impact Assessment (JJG [2002] No. 125);
12. Notice on the Implementation of Issues Concerning EIA System for Construction Projects (State Environmental Protection Administration, HF [1999] No. 107);
13. (22)Several Proposals of Enhancing Construction Project Environmental Protection in the Western Development (State Environmental Protection Administration, [2001] No.4);
14. Regulations on the Implementation of the Land Administration Law of the People's Republic of China (Order 256 of the State Council, January 1, 1999);
15. Notice on Effective Urban Fatigue Dust Control (State Environmental Protection Administration and Ministry of Construction, HF [2001] No. 56);
16. Administrative Provisions on the Prevention and Control of Source Water Protection Areas (July 1989);
17. Environmental Protection Regulations of Sichuan Province (September 24, 2004);
18. Measures of Sichuan Province for Implementation of the Water Law of the People's Republic of China (July 1, 2005);
19. Measures of Sichuan Province for Implementation of the Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution (September 1, 2002);
20. Notice of Sichuan Provincial People's Government on the Division of Key Prevention Area of Water and Soil Loss;
21. Provisions on the Administration of Urban Construction Garbage (Order 139 of Ministry of Construction in 2005);
22. Standard for Pollution Control on Storage and Disposal Site of General Industrial Waste (GB 18592-2001);
23. Measures for the Administration of Environmental Protection of Transport Construction Projects (Order 5 of the Minister of Communications, May 2003);
24. Notice on Enhancing the Administration of Environmental Impact Assessment for International Financial Institutions (IFI) Financed Construction Projects, HJ [1993] No. 324, 1993).

2.1.3 Technical guidelines and specifications for environmental impact assessment

1. Technical Guidelines for Environmental Impact Assessment - General Principles

(HJ2.1—-2011), September 1, 2011;

2. Technical Guidelines for Environmental Impact Assessment – Surface Water Environment (HJ/T2.3 -93), September 1993;
3. Technical Guidelines for Environment Impact Assessment - Atmospheric Environment (HJ2.2 - 2008), December 31, 2008;
4. Technical Guidelines for Environment Impact Assessment - Acoustic Environment (HJ2.4—-2009), December 23, 2009;
5. Technical Guidelines for Environment Impact Assessment - Ecological Environment (HJ19—-2011), April 8, 2011;
6. Technical Guidelines for Environmental Impact Assessment - Groundwater Environment (HJ610-2011), February 11, 2011;
7. Technical Guidelines for Environmental Risk Assessment on Projects (HJ/T169-2004), December 11, 2004;

2.1.4 Relevant planning and environmental function division documents

1. General Planning of Linshui County Downtown (2009-2030);
2. Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown (September 2013);
3. General Plan of Linshui Economic and Technological Development Zone (2008-2030);
4. Notice of the People's Government of Guang'an on the Issuance of Scheme for Regionalizing Ambient Air Quality Function in Guang'an (GAFB [2007] No. 93);
5. Notice of the People's Government of Guang'an on the Issuance of Scheme for Regionalizing Water Environment Function in Guang'an (GAFBH [2007] No. 102);
6. Approval of the People's Government of Guang'an on the City-wide Adjustment of Urban Ambient Noise Function Zones (GAFF [2010] No. 125);
7. Guang'an Eco-function Plan.

2.1.5 Relevant technical documents for construction projects

1. Letter of Authorization for Preparation of EIA Report;
2. Feasibility Study Report of the Infrastructure Project for World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area;
3. Notice of Environmental Protection Bureau of Guang'an on Executive Environmental Standards for the Infrastructure Project for Linshui Industrial Park (GSHF [2014] No. 129).

2.1.6 World Bank's Safeguard Policies

1. World Bank's ten safeguard policies and compliance

   There are ten operation policies on social and environmental safeguards of the World Bank. Based on the nature, the engineering layout, the scope of assessment as identified by the EIA and the field investigation, a review and screening was carried out to see whether those ten policies are triggered and the findings are shown in the table below:

Table 2.1.6-1 Bank's Safeguard Operation Policies Triggered by the Project

SN	Description	Triggered	Reasons for Screening

		by the Project (Yes/ No)	
1	OP/BP4.01 Environmental Assessment	Yes	Category A project; A full EIA and EMP are prepared; Two rounds of public consultation have been carried out as part of the EIA procedure.
2	OP/BP4.01 Natural Habitats	Yes	It is applicable to the policy. The construction and operation of the Project exerts potential negative effects on terrestrial and aquatic ecology in the Project area. The operation of wastewater interceptors and related wastewater treatment plants has positive impacts on the water quality and ecosystem of rivers in the project area.
3	OP/BP4.36 Forests	No	The Project would not finance any activity that may involve a major change or degradation of the important forest area or related major natural habitat.
4	OP/BP4.09 Pest Management	No	No pesticide would be procured under the Project, causing no increase in the use of pesticide. No activity is needed according to the policy.
5	OP/BP4.11 Physical Cultural Resources	Yes	The Project is close to Lingbaoshan carved stones and the ancient stone bridge without crossing the protection scope and controlled zone for construction. The construction will involve the relocation of tombs, the procedures and compensation methods about which have been specified in the resettlement action plan (RAP).
6	OP/BP4.37 Safety of Dams	No	The project does not involve any dam.
7	OP/BP4.10 Indigenous Peoples	No	No indigenous group lives in the project area or is affected by the Project.
8	OP/BP4.12 Involuntary Resettlement	Yes	Triggered and a RAP is prepared.
9	OP/BP7.50 Projects on International Waterways	No	There is no international waterway involved in the project area.
10	OP/BP7.60 Projects on Disputed Areas	No	There is no disputed region involved in the project area.

2. Compliance of the Project with World Bank Group Environmental, Health, and Safety Guidelines and relevant policies

The *World Bank Group Environmental, Health, and Safety Guidelines* (the General EHS Guidelines), section on wastewater treatment of the *Environmental, Health, and Safety Guidelines for Water and Health*, the *Environmental, Health, and Safety Guidelines for Toll Roads*, section on waste collection and transport of the *Environmental, Health, and Safety Guidelines for Waste Management Facilities* are also applicable to the Project. The mitigation measures included in the Project Environmental Management Plan (EMP) are fully consistent with the requirements of the above EHS Guidelines (especially the provisions on construction management). It is noteworthy that what the EHS Guidelines recommend is largely consistent with the China's laws, regulations, guidelines, and construction management rules.

Table 2.1.6-2 Compliance with World Bank Group EHS Guidelines

GeneralEHS Guidelines	Compliance of EIA/EMP
If the facility or project is close to an identified	Clean energy is used in the industrial park and can

ecologically sensitive area (such as a national park), it shall minimize the increase in pollution level whenever and wherever feasible. In addition, appropriate mitigation measures may also include the use of clean fuels or technologies, and application of comprehensive pollution control measures.	reduce the pollution level; there is no ecologically sensitive area inside the project area.
The most common pollutant involved in fugitive emissions is dust or particulate matter (PM).This is released during certain operations, such as transport and open storage of solid materials, and from exposed soil surfaces, including unpaved roads.	Dust-control methods, such as coverage, sprinkling for dust suppression or moderate wetting of the materials in open-air stack will be applied during the construction period. Sprinkling and suppression will be applied to the transport of materials on paved or unpaved roads.
Environmental, Health, and Safety Guidelines for Water and Sanitation	**Compliance of EIA/EMP**
No industrial wastewater, domestic wastewater, wastewater from operations of public works or storm water shall be discharged into a public or private wastewater treatment system unless it meets the pretreatment and monitoring requirements of such wastewater treatment system.	In LETDZ, the industrial wastewater is not allowed to enter the wastewater treatment plant (WWTP) unless it is subject to a pretreatment and meets the Level 3 discharge limits of the *Integrated Wastewater Discharge Standards* (GB8978-1996).
Storm water shall be separated from industrial wastewater and domestic wastewater in order to reduce the wastewater generation that needs treatment before emission.	Separate storm water and wastewater systems are applied in LETDZ, and separate storm sewers and wastewater pipes will be laid.
Noise prevention and control measures shall be applied if the predicted noise level at the most sensitive receiving point due to the operation of project facilities or operation activities will exceed the noise limits.	Low sound power level equipment will be selected; vibration isolation device will be installed for machinery and equipment; Running time of certain equipment or operation will be limited, particularly mobile noise sources that will travel through in a community.
Design, construct, operate, and maintain wastewater treatment facilities and achieve effluent water quality consistent with applicable national requirements or internationally accepted standards.	The Level 1-A standards of the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002) will be executed for wastewater discharge from the WWTP.
Odors from treatment facilities can also be a nuisance to workers and the surrounding community.Measures are recommended to prevent, minimize, and control air emissions and odors.	Odor emission units such as coarse screen and influent pumping station may be designed as enclosed chambers with covers at the top to constrain the odor diffusion space. For the sludge dewatering room that is of bigger space, odor will be collected for centralized biological treatment. An isolation zone consists of tall trees that are strongly pollution resistant and capable of absorbing harmful gases will be provided around the WWTP boundary to function as an absorptive barrier. Health protection distance will be specified. No residence, schools or other projects with relatively high population density shall be planned within the 100m scope surrounding the WWTP site, especially in areas at its downwind direction.
Sludge treatment and utilization. Following stabilization, the sludge can be dewatered and disposed of in a landfill or incinerator, or subject to further processing for beneficial uses.	Sludge will be dewatered by mechanical pressure filter and transferred to the Linshui sanitary landfill for disposal.
Environmental, Health, and Safety Guidelines for Toll Roads	**Compliance of EIA/EMP**

Siting roads and support facilities to avoid critical terrestrial and aquatic habitat (e.g. old-growth forests, wetlands, and fish spawning habitat) utilizing existing transport corridors whenever possible.	The area where the Project is located is not part of a critical terrestrial and/or aquatic habitat.
Minimizing removal of native plant species, and replanting of native plant species in disturbed areas.	A water and soil conservation plan has been specially prepared. Native plant species as appropriate will be planted according to the water and soil conservation plan.
Paving in dry weather to prevent runoff of asphalt or cement materials.	During the construction period, paving works are prohibited in windy weather and working sites will be laid out in a proper manner.
Where significant oil and grease is expected, using oil/water separators in the treatment activities.	Vessels of oily wastewater from construction machinery will be provided on the working sites for collecting the oily wastewater to be generated. The collected oily wastewater will be delivered to a facility with the treatment capacity for treatment. Direct discharge is prohibited.
Avoiding the generation of contaminated runoff from cleaning of asphalt equipment by substituting diesel with vegetable oil as a release and cleaning agent; containing cleaning products and contaminated asphalt residues; scraping before cleaning; and conducting cleaning activities away from surface water features or drainage structures.	The technical specifications of the Contractor will include special requirements on the storage of fuel, oil/grease, and other hazardous or toxic matter, and that all the fuel materials on the working sites are fenced for storage; the space for storage is 110% of volume of the fuel storage vessels. Fuel storage sites are not to be located near any source waters (i.e., within 100m from the source water).
Insulation of nearby building structures (typically consisting of window replacements); Use of road surfaces that generate less pavement/tire noise such as stone-matrix asphalt.	There shall be restricting provisions on the functions of the areas along the arterial roadways during the operation period of the roads. Roadside buildings shall be rationally planned and laid out with optimal acoustic design and installed with sound-proof windows as appropriate. Asphaltic pavement is designed for all the road of the Project.
Environmental, Health, and Safety Guidelines for Waste Management Facilities	**Compliance of EIA/EMP**
Waste Collection and Transport	**Handed over to local waste disposal plant for unified treatment.**
Encourage use of containers or bags for waste at the point of collection for each household and establishment; implement a regular collection schedule with sufficient frequency to avoid accumulation of garbage; cover collection and transfer vehicles along the entire route of transport to avoid windblown litter.	Wastes will be dumped at designated sites and Local health department will be operating the equipment and facilities to collect and transport the refuse to the Linshui Urban Domestic Waste Treatment Plant.
Establishing frequent waste collection schedules; Instituting a washing program for waste collection and transport vehicles and for company-owned waste collection and transfer containers; Promoting the use of bags to reduce the odors from soiling of waste collection and transport equipment.	
Optimize waste collection and transport routes to minimize distance traveled and overall fuel use and emissions; Implement transfer stations for small vehicles	

to consolidate waste into large vehicles for transport to a waste disposal plant.	

3. Compliance with Domestic Laws and Regulations

Preparation of the environmental assessment documents is in full accordance with the above laws, regulations and guidelines. Compliance with domestic laws and regulations associated with the Project are summarized in the table below.

Table 2.1.6-3 Compliance with China Laws and Regulations

China’s Laws and Regulations	Compliance of the Project
Law of the People's Republic of China on Environmental Impact Assessment	The full EIA report was prepared by a certified EIA consultant and the project implementation unit, and has been approved by the Sichuan Provincial Environmental Protection Department. Two rounds of public consultation have been carried out.
Notice on Enhancing the Administration of Environmental Impact Assessment for International Financial Institutions (IFI) Financed Construction Projects	The EIA report and EMP are in line with the Bank’s Safeguard Policies.
Land Administration Law of the People's Republic of China	The LETDZ meets the requirements on land use planning in *Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown*.
Law of the People’s Republic of China on Prevention and Control of Water Pollution	The LETDZ will be developed with such sewer networks as to enable centralized wastewater treatment. The WWTP outfall is not located in a surface water source reserve.
Law of the People's Republic of China on Water and Soil Conservation	A soil and water conservation plan is prepared, and submitted to the Sichuan Water Authority for approval. Water and soil loss prevention and control measures will be carried out in accordance with the approved soil and water conservation plan. The sand, stone, soil, etc. abandoned during the building activities will be stacked on the spoil ground as specified in the water and soil conservation plan, and measures will be taken to ensure that no new hazards occur. A water and soil loss monitoring program is prepared and the monitored results will be reported on a regular basis to Guang’an Water Authority.
Law of the People's Republic of China on Protection of Cultural Relics	Due to the location close to Lingbaoshan carved stones and the ancient stone bridge, and special attentions shall be paid to protection measures during the construction. During the construction of the Project, in case of any buried cultural relics discovered by the contractor, the construction shall be suspended with site protected and report of the same submitted to competent department in accordance with the *Law of the People’s Republic of China on Protection of Cultural Relics*.
Law of the People's Republic of China on the Protection of Wildlife	An awareness campaign about the law on wildlife protection is carried out for the contractors; constructors must observe the *Law of the People's Republic of China on the Protection of Wildlife* and no hunting of wild animals is allowed in the construction and surrounding areas.

2.2 Assessment Purposes

1. Know well the physical and social environment of assessed area, understand existing environmental quality and issues on regional environment protection in the area and set clear environmental protection targets of project through the analysis and investigation of project overview and environmental conditions.

2. Select proper forecasting methods to predict the degree and scope of proposed

project on the environment during the construction and operation and propose preventive measures.

3. Discuss the uniformity of economic, social and environmental benefits of the proposed project through analyzing the environmental and economic gains and losses. 4. Propose practical and feasible pollution prevention and control measures and discuss feasibility of environmental protection through actual assessment to provide basis for engineering and environmental management.

2.3 Assessment Principles

It is required to strictly implement the national and local regulations, decrees, standards and specifications on environmental protection and comply with requirements on Linshui urban development planning and environmental protection.

The Project is focused on the ecological impact assessment, acoustic environmental impact assessment, risk assessment and environmental protection measures and countermeasures during the construction, in the spirit that the ecological protection and pollution control should be well adapted to the regional ecological function and environmental protection targets.

The assessment shall be performed in accordance with the principle of scientificity, objectivity, fairness and practicability to ensure practical and realistic, objective and fair assessment.

2.4 Environmental Impacts, Assessment Factors and Criteria

2.4.1 Identification of environmental impacts

1. Identification of environmental impacts

For the proposed project is located in Linshui County of Guang’an City, the assessment includes the roads, wastewater interceptors and wastewater treatment; different impacts of engineering activities on the environmental aspects are mainly reflected on the ecological environment, acoustic environment, ambient air, social environment, surface water environment and groundwater environment. The process and results of identifying environmental impacts are shown in the table below.

Table 2.4.1-1 List of Identified Environmental Impacts

Environmental Resources \ Engineering Activities		Prior Period		Construction Period			Operation Period	
		Land acquisition	Demolition	Material transport	Mechanical operation	Main works	Daily life	Vehicle driving
Social environment	Land use	■						□
	Economy	●						□
	Agriculture	■						
	Travel			●	●		□	□
	Tourism							□
Ecological resources	Water quality					●	□	
	Water and soil conservation					●		
	Farmland and nursery	■						
Physical environment	Living environment		●				□	
	Acoustic environment		●	●	●	●		■

Engineering Activities / Environmental Resources		Prior Period		Construction Period			Operation Period	
		Land acquisition	Demolition	Material transport	Mechanical operation	Main works	Daily life	Vehicle driving
	Water environment (including ground water environment)				●	●	□	
	Ambient air		●	●	●			■
	Landscaping		●		●	●	□	

Note: “□/〇” indicates long-term/short-term impacts; the solid/hollow symbol indicates unfavorable/favorable impacts; and the blank indicates no mutual impact.

2. Major environmental issues

During the construction, all impacts but those of land acquisition are temporary, which are mainly on the ecological environment, water and soil loss, social environment, water environment, acoustic environment and air environment.

During the operation, environment impacts will last for a long term, which mainly include those on the acoustic environment, water environment, air environment and social environment.

2.4.2 Assessment contents and factor screening

1. Contents

The main contents of EIA are determined as below according to the engineering features and surrounding environmental features:

- Project overview and engineering analysis
- Environmental status investigation and assessment
- Environmental impact prediction and assessment
- Environmental protection measures
- Environmental risks
- Public consultation
- Conclusions

2. Assessment factors

Based on the survey along the proposed project and in combination with the engineering construction and operation features, regional environment functions of the project, importance of environmental factors and possible degree of impact, the environmental factors are identified and screened in all environmental aspects through the environmental impact analysis and the assessment factors are listed in the table below.

Table 2.4.1-2 List of Assessment Factors

Description	Environmental Factors	Assessment Factors
Road works	Ecological environment	Status quo: land use status, plants, animals, etc.; During construction: earth-rock, water and soil loss, plants, animals, etc.; During operation: impacts on plants, animals, landscape, etc.

Description	Environmental Factors	Assessment Factors
	Ambient air	Status quo: NO_2, SO_2 and PM_{10}; During construction: asphalt fume and fugitive dust; During operation: NO_2 and CO.
	Water environment	Assessment factors of existing water environment quality: pH, SS, BOD_5, CODcr, NH3-N, etc.; During construction: SS, CODcr, BOD_5, animal and vegetable oils; During operation: SS, BOD_5 and petroleum.
	Acoustic environment	Status quo: Leq; During construction: mainly include construction noise from construction machinery: During operation: noise of road service.
	Solid waste	During construction: domestic garbage of constructors and construction waste; During operation: street refuse.
Wastewater interceptor works	Ecological environment	Status quo: land use status, plants, animals, etc.; During construction: earth-rock, water and soil loss, plants, animals, etc.
	Ambient air	Status quo: NO_2, SO_2 and PM_{10}; During construction: fugitive dust; During operation: NO_2 and CO.
	Water environment	Assessment factors of existing water environment quality: pH, SS, BOD_5, CODcr, NH3-N, etc.; During construction: SS, CODcr, BOD_5, animal and vegetable oils;
	Acoustic environment	Status quo: Leq; During construction: mainly include construction noise from construction machinery; During operation: noise from pump station.
	Solid waste	During construction: domestic garbage of constructors and construction waste; During operation: street refuse.
WWTP	Ecological environment	Status quo: land use status, plants, animals, etc.; During construction: earth-rock, water and soil loss, plants, animals, etc.; During operation: impacts on plants, animals, landscape, etc.
	Ambient air	Status quo: NO_2, SO_2, PM10, H_2S and NH_3; During construction: fugitive dust; Predictive assessment factors: H_2S and NH_3.
	Water environment	Assessment factors of existing water environment quality: pH, SS, BOD_5, CODcr, NH3-N, etc.; During construction: SS, CODcr, BOD_5, animal and vegetable oils; Predictive assessment factors: NH3-N and COD.
	Acoustic environment	Status quo: Leq; During construction: mainly include construction noise from construction machinery; Predictive assessment factors: noise from WWTP equipment.
	Solid waste	During construction: domestic garbage of constructors and construction waste; During operation: street refuse and domestic garbage of WWTP staff.

2.5 Environment Function Division and Assessment Criteria

2.5.1 Environment function division

The environment function divisions in the project area are listed in the table below:

Table 2.5.1-1 List of Environment Function Divisions

SN	Description	Category of Assessed Area
1	Ecological function division	The project area is located in Xicao Eco-industrial Zone III1, an ecological tourism zone III orderly utilizing resources in eastern hilly and mountainous area.
2	Water and soil conservation "Three-zone" division	Provincial key rehabilitation region in Linshui County of Guang'an City
3	Noise function division	The noise function zoning has not been implemented in Linshui County in accordance with the *Approval of the People's Government of Guang'an on the City-wide Adjustment of Urban Ambient Noise Function Zones* (GAFF [2010] No. 125).
4	Water environment function division	Bajiao River is classified as category III water area function zone in accordance with the *Notice of General Office of the People's Government of Guang'an on the Issuance of Scheme for Regionalizing Water Environment Function in Guang'an (GAFBH [2007] No. 102)* and other water areas not classified.
5	Air environment function division	Linshui County is classified as Class II function zone in accordance with the *Notice of General Office of the People's Government of Guang'an on the Issuance of Scheme for Regionalizing Ambient Air Quality Function in Guang'an* (GAFB [2007] No. 93).
6	Nature reserve	Not involved
7	Scenic spot	Not involved
8	World cultural and natural heritage	Not involved
9	Source water protection area and water source	No approved centralized drinking water source protection area involved
10	Forest park	Not involved
11	Geopark	Not involved
12	Cultural relics protection unit	No cultural relics protection unit involved

2.5.2 Assessment criteria

The *Notice of Environmental Protection Bureau of Guang'an on Executive Environmental Standards for the Infrastructure Project for Linshui Industrial Park* (GSHF [2014] No. 129) is referred in this assessment.

1. Acoustic environment

(1) Acoustic environment quality standard

Class IVa standard in the *Environmental Quality Standard for Noise* (GB3096-2008) is executed in area within 30m right of way, Class III standard in the industrial park and Class II standard in other areas.

Table 2.5.1-1 Limits for Environmental Noise (unit: dB (A))

Location	Day (dB (A))	Night (dB (A))	Executive Standards
Residential area	60	50	GB3096-2008, Class II
Industrial park	65	55	GB3096-2008, Class III
On both sides of traffic artery	70	55	GB3096-2008, Class IVa

(2) Noise emission standard

The *Emission Standard of Environment Noise for Boundary of Construction Site* (GB12523-2011) is executed for noise during the construction period. See the table below for details.

Table 2.5.1-2 Limits for Noise at Construction Site (unit: dB (A))

Category	Day	Night	Executive Standards
Noise during the construction period	70	55	GB12523-2011

2. Ambient air

(1) Environment quality standard

Due to the location of the Project in Class II environment function zone, Class II standard in *Ambient Air Quality Standard* (GB3095-2012) is executed. See the table below for limits.

Table 2.5.2-3 Ambient Air Quality Standard

Assessment Criteria		SO_2	NO_2	PM_{10}
Ambient Air Quality Standard (GB3095-1996), Class II standard	Annual average	0.06	0.04	0.07
	Daily average	0.15	0.08	0.15
	Hourly average	0.50	0.2	/

(2) Pollutant emission standard

Due to the location of works in Class II zone as per in *Ambient Air Quality Standard* (GB3095-1996), Class II standard in *Comprehensive Emission Standard of Air Pollutants* (GB16297-1996) is executed for waste gas emission during the construction period. See the table below for maximum allowable emission concentration limits of waste gas.

Table 2.5.2-4 Limits for Air Pollutant Emission

Comprehensive Emission Standard of Air Pollutants (GB16297-1996), Class II standard		
Pollutant	NO_x	CO
Concentration limit of fugitive emission (mg/m^3)	0.12	/

The *Emission Standards for Odor Pollutants* (GB14554-93) and Class II standard in *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002) are executed for the WWTP odors.

Table 2.5.2-5 Limits for Air Pollutant Emission

Emission Standards for Odor Pollutants (GB14554-93), Class II standard on expansion and reconstruction				
Pollutant	H_2S	NH_3		Odor
Limits for odor pollutants at boundary (mg/m^3)	0.06	1.5		20
Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002), Class II standard				
Pollutant	H_2S	NH_3	Odor	CH_4
Unit	mg/m^3	mg/m^3	Dimensionless	Maximum volume concentration in plant (%)
Limit at boundary	0.06	1.5	20	1.0

3. Surface water environment

(1) Water environment quality standard

Due to the location of the Project in Linshui County of Guang’an City, water bodies such as Bajiao River and Shiba River are the main rivers in the assessed area and standards of category III water area in *Environmental Quality Standards for Surface Water* (GB3838-2002) are executed for the surface water environment quality. See the table below for details.

Table 2.5.2-6 Limits for Surface Water

Water Quality Factor	pH	COD_{Cr}	BOD_5	NH_3-N	TP	Fecal coliform
Concentration limit	6～9	20mg/L	4.0 mg/L	1.0 mg/L	0.2 mg/L	10000/L

(2) Wastewater discharge standard

Class I standard in *Integrated Wastewater Discharge Standard* (GB8978-1996) is executed for domestic sewage and production wastewater discharge during the construction period and Class IA standard in *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002) for the WWTP.

Table 2.5.2-7 Limits for Wastewater Discharge

Item	Unit	Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002), Class IA standard	Integrated Wastewater Discharge Standard (GB8978-1996), Class I standard
pH	Dimensionless	6-9	6-9
COD	mg/L	50	120
NH_3-N	mg/L	5(8)	25
Oil	mg/L	1	10
TN	mg/L	15	/
SS	mg/L	10	30
TP	mg/L	0.5	/

Note: for 5(8), the numerical value outside the parenthesis represents the controlling indicator at water temperature ＞12℃ while that inside represents the controlling indicator at water temperature ＜12℃.

4 Groundwater environment

Class III standard in *Quality Standard for Ground Water* (GB/T14848-93) is executed for groundwater environment. See the table below for details.

Table 2.5.2-8 Limits for Groundwater (unit: mg/LM, excluding pH)

Item		Class III standard
1	pH	6.5～8.5
2	Total hardness (in C_aCO_3)	≤450
3	Total dissolved solids	≤1000
4	Sulfate	≤250
5	Chloride	≤250
6	Fe	≤0.3
7	Nitrate	≤20
8	NH_4	≤0.2
9	Volatile phenol	≤0.002
10	Cyanide	≤0.05
11	Fluoride	≤0.1
12	Zn	≤1.0
13	As	≤0.05
14	Hg	≤0.001
15	Cr^{6+}	≤0.05
16	Cd	≤0.01
17	Pb	≤0.05
18	total coliform	≤3.0

5. Solid waste

Relevant requirements in *Standard for Pollution on the Storage and Disposal Site for General Industrial Solid Wastes* (GB18599-2001) apply to general industrial solid wastes, provisions in *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002) to WWTP sludge and *Standard for Pollution Control on Hazardous Waste Storage* (GB18597-2001) to hazardous wastes.

6 Prevention and control standards of water and soil loss

In accordance with the *Announcement of Sichuan Provincial People's Government on the Division of Key Prevention Area of Water and Soil Loss* and the *Prevention and Control Standards of Water and Soil Loss in the Development and Construction Projects*, Linshui County of Guang'an City along the Project is classified as a provincial key rehabilitation region and the prevention and control standards for construction projects apply to the Project.

Table 2.5.2-8 Prevention and Control Standards of Water and Soil Loss

Item	Standards and Specifications		Correction by the precipitation		Correction by soil erosion intensity		Correction by landform		Final value applied	
Period	Construction period	Trial operation	Construction period	Trial operation	Construction period	Trial operation	Construction period	Trial operation	Construction period	Trial operation
Treatment percentage of disturbed land (%)	*	95	*	0	*	*	*	*	*	95
Controlled percentage of erosion area (%)	*	85	*	+3	*	*	*	*	*	88
Controlled ratio of soil erosion modulus (%)	0.5	0.7	*	*	+3	+3	*	*	0.8	1
Percentage of dammed slag or ashes (%)	90	95	*	*	*	*	90	95	90	95
Recovery percentage of forestry and grass (%)	*	95	*	+3	*	*	*	*	*	98
Percentage of the forestry and grass coverage (%)	*	20	*	+3	*	*	*	*	*	23

2.6 Level and Criteria of Assessment

2.6.1 Level of Assessment

Table 2.6.1-1 Environmental Factors and Assessment Level

SN	Component	Environmental Factors and Assessment Level

		Air (1)	Surface water (2)	Groundwater (3)	Acoustic environment (4)	Ecological environment (5)
1	Road works	Level 2	Level 3	---	Level 1	Level 3
2	Wastewater interceptors	Level 3	Level 3	---	Level 3	Level 3
3	WWTP	Level 3	Level 3	Level 3	Level 3	Level 3

2.6.2 Assessment focus

According to the engineering features and surrounding environmental features of the proposed project, this assessment is focused on the air environment impact, surface water environment impact, acoustic environment impact, risks and the environmental protection measures and countermeasures during the construction period, with the impact analysis for public consultation and social environment taken into consideration.

2.7 Assessment Scope and Environmentally Sensitive Area

2.7.1 Assessment scope

1. Assessment scope of each project component

According to the EIA guidelines, the assessment scope of each environmental factor in the Project is shown in the table below:

Table 2.7.1-1 Assessment Scope of Each Project Component

Environmental Factor	Assessment Scope	
Ecological environment	Road works	300m within both sides of the road central line
	Wastewater interceptor works	300m within both sides of the pipeline central line
	Wastewater treatment works	Within the WWTP boundary and within 300m outside the WWTP boundary
Acoustic environment	Road works	200m within both sides of the road central line
	WWTP	1m~200m outside the WWTP boundary
Surface water environment	WWTP	Water body from 500m upstream to 4.5km downstream of outfall
Groundwater environment	Wastewater interceptor works	All hydrogeological units where the works is located
	WWTP works	All hydrogeological units where the works is located
Air environment	Road works	200m within both sides of the road central line; within 300m outside the construction boundary
	WWTP	Square area with 5km side length centering on the proposed plant
Risk assessment	Wastewater interceptor works	From 100m upstream to 1,000m downstream of the proposed bridge
	WWTP works	Water body from 500m upstream to 4.5km downstream of outfall
Social environment	Throughout Linshui County	

According to the OP4.01: Environmental Assessment, the EIA shall cover the potential scope of project impact to include road and relevant facilities within 3.07km^2 southern area of the LETDZ, the traffic corridor connecting the southern area of the LETDZ to the central urban area of Linshui, the wastewater interceptors, No. 2 WWTP and No. 3 WWTP on both sides of Shiba River. Such assessment objects include activities to be or not to be funded by the World Bank loan. See Chapter 3 for specific analysis.

2. Induced and cumulative environmental impact assessment scope

The Project is located in Linshui County and the assessment will not only include the environmental impact of the Project, but also review the environmental impact of the constructed area of the LETDZ and predict the environmental impact of the current development activities.

See the figure below for the details of induced and cumulative impact assessment scope:

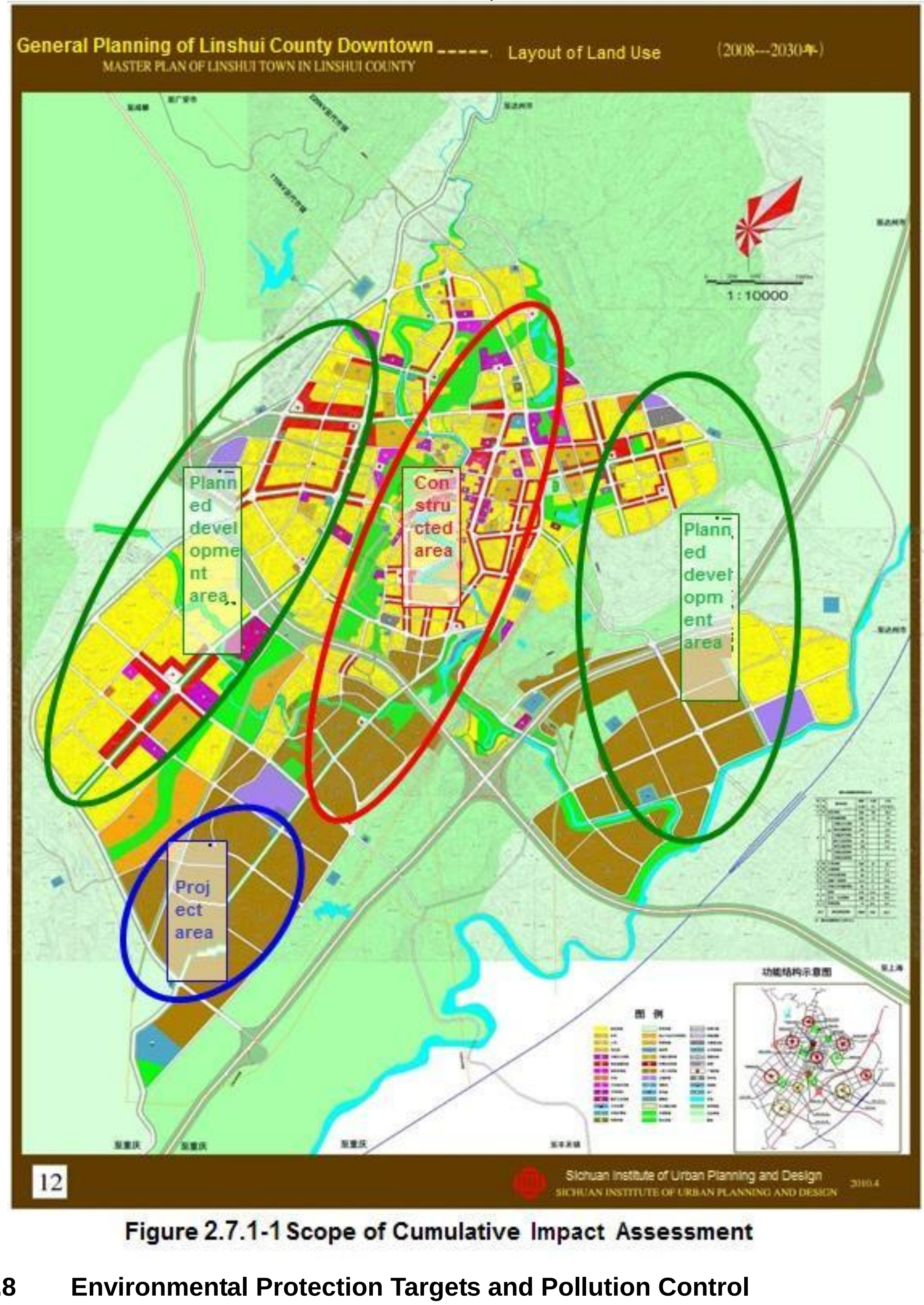


Figure 2.7.1-1 Scope of Cumulative Impact Assessment

2.8 Environmental Protection Targets and Pollution Control

2.8.1 Environmental protection targets

The environmental protection targets and distribution of this assessment are determined through field survey and investigation and by combining the environmental impact features of the Project and the distribution of sensitive areas in the scope of assessment. See the diagram of external environment relations for the distribution of targets.

1. Social environment protection targets

   The targets include the regional socio-economic development, land use, the living standard of land-acquired and relocated residents and the compliance of planning.

2. Ecological environment protection targets

   The targets include the cultivated land and the vegetation and water and soil conservation facilities. See the table below for details.

Table 2.8.1-1 Ecological Environment Protection Targets around the Project

SN	Sensitive targets	Location	Main Contents of Protection
1	Cultivated land	Land for permanent and temporary acquisition	Farmland, paddy field in particular
2	Natural vegetation	Land for permanent and temporary acquisition	Natural vegetation
3	Water and soil conservation	Land of surface excavation and temporary storage yard	Water and soil loss
4	Lingbaoshan cultural relics protection unit	Construction of wastewater interceptors	Cultural relics and historical sites such as ancient stone bridges and carved stones; wastewater interceptors are located 15m away from the construction controlled zone of the Lingbaoshan Relics Protection Department
5	Aquatic animals and plants	Construction of wastewater interceptors	Aquatic animals and plants of Shiba River within the scope of assessment; rare fishes and “three grounds ” for fishes not involved

3. Water environment protection objects

Table 2.8.1-2 Water Environment Protection Targets around the Project

Name of Sensitive Area	Locational Relation with the Project	Level and Type of Protection Target	Overview
Bajiao River	Receiving waters for tailwater from No. 2 WWTP and No.3 WWTP in Linshui County	Surface water, category III water area	Bajiao River flows from North to South on the east of LETDZ, waters to receive wastewater therefrom. With an average width of 50m and an average discharge of 31.3m^3/s over years, the river has an average discharge of 28.3m^3/s over years at the assessed segment; by analyzing hydrologic data in recent decade, the monthly average discharge should be 4.38 m^3/s at 90% guaranteed during dry season with 485m natural head and 9.19‰ average gradient. The highest ever-known discharge is 6466 m^3/s and highest water level is 198.88m.
Shiba River	Wastewater interceptors for Shiba River to be	Surface water, category III water area	Being a tributary of Xiaoxi River, Shiba River flows through Xitian Township, Chengnan Town and towns and townships

	built on both river sides		and flows into Xiaoxi River at Lingbao Mountain of Chengnan Town, with average discharge of 0.44m^3/s over years.
Danshuitan River	Linshui No. 3 WWTP is located near the bank of Danshuitan River	Surface water, category III water area	Danshuitan River is the primary branch of Bajiao River, originating in Huaying Mountain in the west of Linshui County. The watershed at source is about 1400m ASL. Danshuitan River runs southeastward through Xitian Township and flows into Bajiao River in Niulaojie of Moujia Town.

4. Acoustic and air environment protection targets

According to the FSR and site survey, the acoustic and air environment protection targets of the Project are shown as follows:

Table 2.8.1-3 Distribution of Acoustic Environment Sensitive Areas within the Assessment Scope of WWTP

SN	Name of Target	Function	Locational Relation with WWTP (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
			Location	Shortest Distance	Height Difference		
1	Group 3, Xinhe Village	Residence	On the north side of the Plant boundary	9	5	With 6 households, residing in the self-built housing with 1~3 floors, in masonry-concrete structures	Category 2 area
2	Group 3, Xinhe Village	Residence	On the west side of the Plant boundary	150	-7	With about 30 households, residing in the self-built housing with 1~3 floors, in masonry-concrete structures	Category 2 area

Table 2.8.1-4 Distribution of Acoustic Environment Sensitive Areas within the Assessment Scope of Road Works

Section	Name of Target	Function	Mileage	Locational Relation with Road (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
Road 1	Xujiawan	Residence	K0+460~+600	On the left side	38	1	With 15 households, residing in the self-built housing with 1~5 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 4a/2
	Dongguawan	Residence	K0+460~+600	On the right side	32	-3	With 21 households, residing in the self-built housing with 1~5 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 4a/2
	Xinwuzui	Residence	K0+860~+960	On the right side	45	-2	With 6 households, residing in the self-built housing with 1~3 floors in	Category 4a/2

Section	Name of Target	Function	Mileage	Locational Relation with Road (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
							adobe, masonry-timber, masonry-concrete or other structures	
	Wangjiawan	Residence	K1+020 ~+100	On the right side	25	-2	With 7 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 4a/2
	Xinfangzi	Residence	K1+480 ~+560	On the left side	23	-1	With 8 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 4a/2
	Group 6, Poshi Village	Residence	K2+200 ~+280	On the right side	32	1	With 18 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 4a/2
	Liujiawan	Residence	K3+360 ~+740	On both sides	24	-8	With over 50 households, residing in the self-built housing with 1~3 floors in adobe, brick masonry, masonry-concrete or other structures	Category 4a/2
	Hejiaya	Residence	K4+360 ~+740	On the left side	10	-7	With over 20 households, mainly residing in self-built housing with 1~3 floors, mainly in brick masonry and masonry-concrete structures	Category 4a/2
Road 2	Xujiawan	Residence	K0+180 ~+360	On both sides	11	1	With 24 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 3 area
	Xinfangzi in Lijiawan	Residence	K1+520 ~+680	On the right side	12	-2	With over 27 households, mainly residing in self-built housing with 1~3 floors, mainly in brick masonry and masonry-concrete structures	Category 3 area
Road 3	Yantangwan	Residence	K2+500 ~+700	On the right side	23	-3	With about 20 households, residing in the self-built housing with 1~4 floors, mainly in masonry-concrete structures	Category 3 area

Section	Name of Target	Function	Mileage	Locational Relation with Road (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
	Zhangjiawan	Residence	K0+420~+620	On the right side	8	-3	With about 20 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 3 area
	Zhangjiaxiawan	Residence	K1+180~+260	On the left side	16	2	With over 9 households, residing in the self-built housing with 1~2 floors in adobe, brick masonry, masonry-concrete or other structures	Category 3 area
Road 4	Liangzishang	Residence	K0+540~+660	On both sides	15	1	With about 10 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 3 area
Road 5	Lishuizui	Residence	K+000~+040	On the right side	60	-2	With 6 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 3 area
	Yantangwan	Residence	K+300~+500	On the right side	29	-2	With about 20 households, residing in the self-built housing with 1~4 floors, mainly in masonry-concrete structures	Category 3 area
	Yujiawan	Residence	K+620~+820	On the left side	36	-3	With about 20 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 3 area

Table 2.8.1-5 Distribution of Acoustic Environment Sensitive Areas within the Assessment Scope of Wastewater Interceptor

SN	Name of Target	Function	Mileage	Locational Relation with Pipeline (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
1	Heshuigou	Residence	K0+000~+150	On the left side	9	-3	With about 16 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 2 area

SN	Name of Target	Function	Mileage	Locational Relation with Pipeline (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
2	Daijiawan	Residence	K0+350~+500	On the left side	85	-5	With about 20 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 2 area
3	Liujiawan	Residence	K0+550~+850	On the right side	82	-5	With about 40 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 2 area
4	Zhongwan	Residence	K0+800~+950	On the left side	26	-5	With about 30 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 2 area
5	Wujiawan	Residence	K1+500~K2+150	On the right side	11	-5	With about 60 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures, in masonry-concrete structures, or in adobe houses	Category 2 area
6	Qinjiataizi	Residence	K2+500~K2+950	On the left side	22	-6	With about 50 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures, in masonry-concrete structures, or in adobe houses	Category 2 area
7	Xujiawan	Residence	K3+600~K3+750	On the left side	13	-6	With about 30 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures, in masonry-concrete structures, or in adobe houses	Category 2 area
8	Nursing House of Chengnan Town	Residence	K3+800~K3+550	On the right side	6	-6	With 6 housings with 2~4 floors, in ordinary brick masonry structures.	Category 2 area

SN	Name of Target	Function	Mileage	Locational Relation with Pipeline (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
9	Quanhewan	Residence	K5+600~K5+850	On the left side	31	-7	With about 20 households, residing in the self-built housing with 1~3 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 2 area

Table 2.8.1-6 Distribution of Air Environment Sensitive Areas for WWTP Project Component

Name of Target	Function	Locational Relation with WWTP (m)		Scale and Overview of Sensitive Area	Environment Function Divisions
		Location	Shortest Distance		
Group 3, Xinhe Village	Residence	On the north side of the Plant boundary	9	With 6 households, residing in the self-built housing with 1~2 floors	Category 2 area
Group 3, Xinhe Village	Residence	On the west side of the Plant boundary	150	With 30 households, residing in the self-built housing with 1 floor	Category 2 area
Ganbang	Residence	On the west side of the Plant boundary	1240	With 10 households, residing in the self-built housing with 1~2 floors	Category 2 area
Qianyanwan	Residence	On the west side of the Plant boundary	1790	With 9 households, residing in the self-built housing with 1~2 floors	Category 2 area
Shitai Village	Residence	On the south side of the Plant boundary	1670	With 7 households, residing in the self-built housing with 1~2 floors	Category 2 area
Xinwuwan	Residence	On the south side of the Plant boundary	2200	With 6 households, residing in the self-built housing with 1~2 floors	Category 2 area
Dapoliangzi	Residence	On the south side of the Plant boundary	2390	With 8 households, residing in the self-built housing with 1~2 floors	Category 2 area
Longdongzi	Residence	On the south side of the Plant boundary	2220	With 5 households, residing in the self-built housing with 1 floor	Category 2 area
Wanping	Residence	On the south side of the Plant boundary	220	With 4 households, residing in the self-built housing with 1 floor	Category 2 area
Xinhe Village	Residenc	On the east	870	With 4 households, residing in the	Category 2

Name of Target	Function	Locational Relation with WWTP (m)		Scale and Overview of Sensitive Area	Environment Function Divisions
		Location	Shortest Distance		
	e	side of the Plant boundary		self-built housing with 1~2 floors	area
Jinzhunao	Residence	On the east side of the Plant boundary	760	With 6 households, residing in the self-built housing with 1~2 floors	Category 2 area
Gaojiamiao	Residence	On the east side of the Plant boundary	2230	With 8 households, residing in the self-built housing with 1~2 floors	Category 2 area
Laojiawan	Residence	On the east side of the Plant boundary	2230	With 6 households, residing in the self-built housing with 1~2 floors	Category 2 area

Table 2.8.1-7 Distribution of Air Environment Sensitive Areas for Road Works Project Component

Section	Name of Target	Function	Mileage	Locational Relation with Road (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
Road 1	Xujiawan	Residence	K0+460~+600	On the left side	38	1	With 15 households, residing in the self-built housing with 1~5 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 2 area
	Dongguawan	Residence	K0+460~+600	On the right side	32	-3	With 21 households, residing in the self-built housing with 1~5 floors either in ordinary brick masonry structures or in masonry-concrete structures	Category 2 area
	Xinwuzui	Residence	K0+860~+960	On the right side	45	-2	With 6 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 2 area
	Wangjiawan	Residence	K1+020~+100	On the right side	25	-2	With 7 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 2 area
	Xinfangzi	Residence	K1+480~+560	On the left side	23	-1	With 8 households, residing in the self-built housing with 1~3 floors in	Category 2 area

Section	Name of Target	Function	Mileage	Locational Relation with Road (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
							adobe, masonry-timber, masonry-concrete or other structures	
	Group 6, Poshi Village	Residence	K2+200~+280	On the right side	32	1	With 18 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 2 area
	Liujiawan	Residence	K3+360~+740	On both sides	24	-8	With over 50 households, residing in the self-built housing with 1~3 floors in adobe, brick masonry, masonry-concrete or other Structures	Category 2 area
	Hejiaya	Residence	K4+360~+740	On the left side	10	-7	With over 20 households, mainly residing in self-built housing with 1~3 floors, mainly in brick masonry and masonry-concrete structures	Category 2 area
Road 2	Xujiawan	Residence	K0+180~+360	On both sides	11	1	With 24 households, residing in the self-built housing with 1~3 floors in adobe, masonry-timber, masonry-concrete or other structures	Category 2 area
	Xinfangzi in Lijiawan	Residence	K1+520~+680	On the right side	12	-2	With over 27 households, mainly residing in self-built housing with 1~3 floors, mainly in brick masonry and masonry-concrete structures	Category 2 area
Road 3	Yantangwan	Residence	K2+500~+700	On the right side	23	-3	With about 20 households, residing in the self-built housing with 1~4 floors, mainly in masonry-concrete structures	Category 2 area
	Zhangjiawan	Residence	K0+420~+620	On the right side	8	-3	With about 20 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 2 area
	Zhangjiaxiawan	Residence	K1+180~+260	On the left side	16	2	With over 9 households, residing in the self-built housing with 1~2 floors in adobe, brick masonry, masonry-concrete or other structures	Category 2 area

Section	Name of Target	Function	Mileage	Locational Relation with Road (m)			Scale and Overview of Sensitive Area	Environment Function Divisions
				Location	Shortest Distance	Height Difference		
Road 4	Liangzishang	Residence	K0+540~+660	On both sides	15	1	With about 10 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 2 area
Road 5	Lishuizui	Residence	K+000~+040	On the right side	60	-2	With 6 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 2 area
	Yantangwan	Residence	K+300~+500	On the right side	29	-2	With about 20 households, Residing in the self-built housing with 1~4 floors, mainly in masonry-concrete structures	Category 2 area
	Yujiawan	Residence	K+620~+820	On the left side	36	-3	With about 20 households, residing in the self-built housing with 1~3 floors, mainly in masonry-concrete structures	Category 2 area

2.8.2 Pollution control target

(1) Control and reduce water and soil loss and vegetation destruction by the land acquisition and protect the ecological environment;

(2) Properly handle the impact of project on the socio-economic environment and avoid compromising the environment quality;

(3) Strengthen the construction management to avoid pollution caused by fugitive dust to the regional air environment;

(4) Ensure the emission of up-to-standard pollutants and prevent noise nuisance. All means of pollutant treatment shall satisfy the requirements of urban planning and environmental management.

2.9 Technical Method for Assessment

2.9.1 Technical method

Based on the nature of proposed project, the mode prediction method is applied for noise and ambient air in this assessment, while investigation and analogy analysis are applied for ecological environment, social environment and surface water environment.

2.9.2 Procedures of assessment

The procedures of this assessment are shown in the following figure:

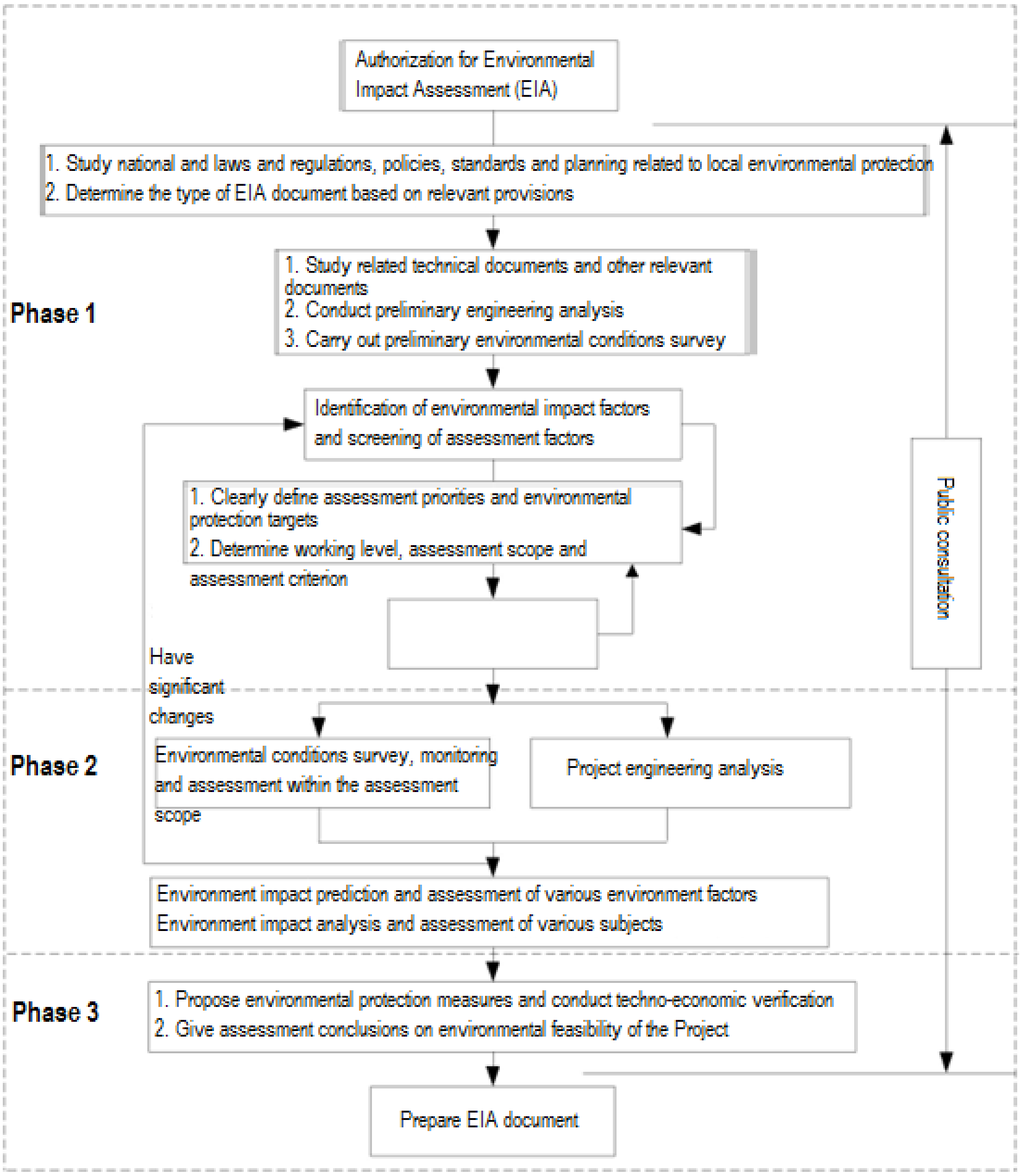


Figure 2.9.2-1 Diagram of Assessment Procedures

3 Project Overview and Engineering Analysis

3.1 Name, Nature and Location of the Project

Project name: Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area

Project nature: Municipal infrastructure projects

Type of Construction: New

Geographic Location: the Project is located in Linshui County, Guang’an City, see the geographical location map below for details.

Figure 3.1-1 Geographical Location of the Project

3.2 Project Components

Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area includes three components, namely, urban road, wastewater interceptors and wastewater treatment.

Items to be funded by the World Bank loan within the scope of assessment include:

(1) Five urban traffic roads, design of which includes water supply and drainage pipe network, lighting, electric power and communication pipe trench, bus stop, traffic safety and management facilities (signs and mark lines, barrier-free facilities of roads, and traffic lights).

(2) Two new wastewater interceptors along the banks of Shiba River will be built, with pipe length of 13,066m and diameter of DN400~DN1200.

(3) Wastewater Treatment Plant (WWTP) works, a new No. 3 WWTP will be built

with capacity 4,000 m^3 / d in the short term, and 8,000 m^3 /d in the long term.

Items not to be funded by the World Bank loan within the scope of assessment include:

(1) Thirteen urban traffic roads, see list of roads, in which, No. 1~No. 6 are roads which will be built during 2014 to 2015; Line A ~ Line F are roads which will be built during 2015 to 2016; the West Ring road is now in construction which is expected to complete in 2016, all these roads are funded by local finance.

(2) Wastewater Treatment Plant (WWTP) works, the No. 2 WWTP of Linshui County is planned to be built with a feasible design capacity of 30,000m^3/d.

3.2.1 Road Works Component

See Table 3.2.1-1 for the construction contents of road works component. See Figure 3.2.1-1 for the Project road network.

Table 3.2.1-1 List of Road Component

Component Category		Component and Nature
Road Works Component	Road Works	Roads to be funded by the World Bank loan within the scope of assessment include: 1. No. 1 road: from the planned road to the West Ring Road, about 4,760 in length; 2. No. 2 Road: from and to the planned road, about 3,124 in length; 3. No. 3 Road: from and to the planned road, about 1,845m in length; 4. No. 4 Road: from the planned road to the planned No. 3 Road, about 1,070m in length; 5. No. 5 Road: from the planned road to the planned No. 3 Road, about 839m in length; Roads to be funded by the World Bank within the scope of assessment include: 1. No. 1 Road, 1,607m in length and 40m in width; 2. No. 2 Road, 967.6m in length and 16m in width; 3. No. 3 Road, 977.33m in length and 40m in width; 4. No. 4 Road, 917.12m in length and 20m in width; 5. No. 5 Road, 790.31m in length and 24m in width; 6. No. 6 Road, 1,637.74m in length and 24m in width; 7. Line A, 1,148.23m in length and 30m in width; 8. Line B, 585.67m in length and 16m in width; 9. Line C, 496.42m in length and 20m in width; 10. Line D, 434.05m in length and 20m in width; 11. Line E, 740.06m in length and 24m in width; 12. Line F, 3,470.55m in length and 16m in width; 13. The West Ring Road, 3,000m in length and 40m in width;
	Bridge Works	Bridge of No. 1 Road crossing Shanghai-Chengdu Expressway shall be built by hoisting precast hollow slab beam in place, which is of two span arrangements with span distance of 2×20m, and the total length of bridge is 50.06m.
	Pipeline Works	Lay rainwater pipe network and sewage pipe network. Length of rainwater pipe is 25,233m (including rainwater branch pipe, gutter inlet connecting pipe), pipe diameter of d300~2,000x3,200mm; pipe length of 18,690m (including branch sewer), pipe diameter of d400~d800mm
	Landscaping works	For urban trunk roads, landscaping works mainly includes the 4m wide median separator and the 1.5m wide outer separator on both sides. For urban sub-trunk roads, landscaping works mainly includes the 2.5m wide sidewalks on both sides. For urban branch roads of Linshui County, landscaping works mainly includes the 2.5m wide sidewalks on both sides.
	Auxiliary	Including bus stations and barrier-free facilities, road traffic safety and

Component Category		Component and Nature
	works	management facilities, slow traffic design, lighting works

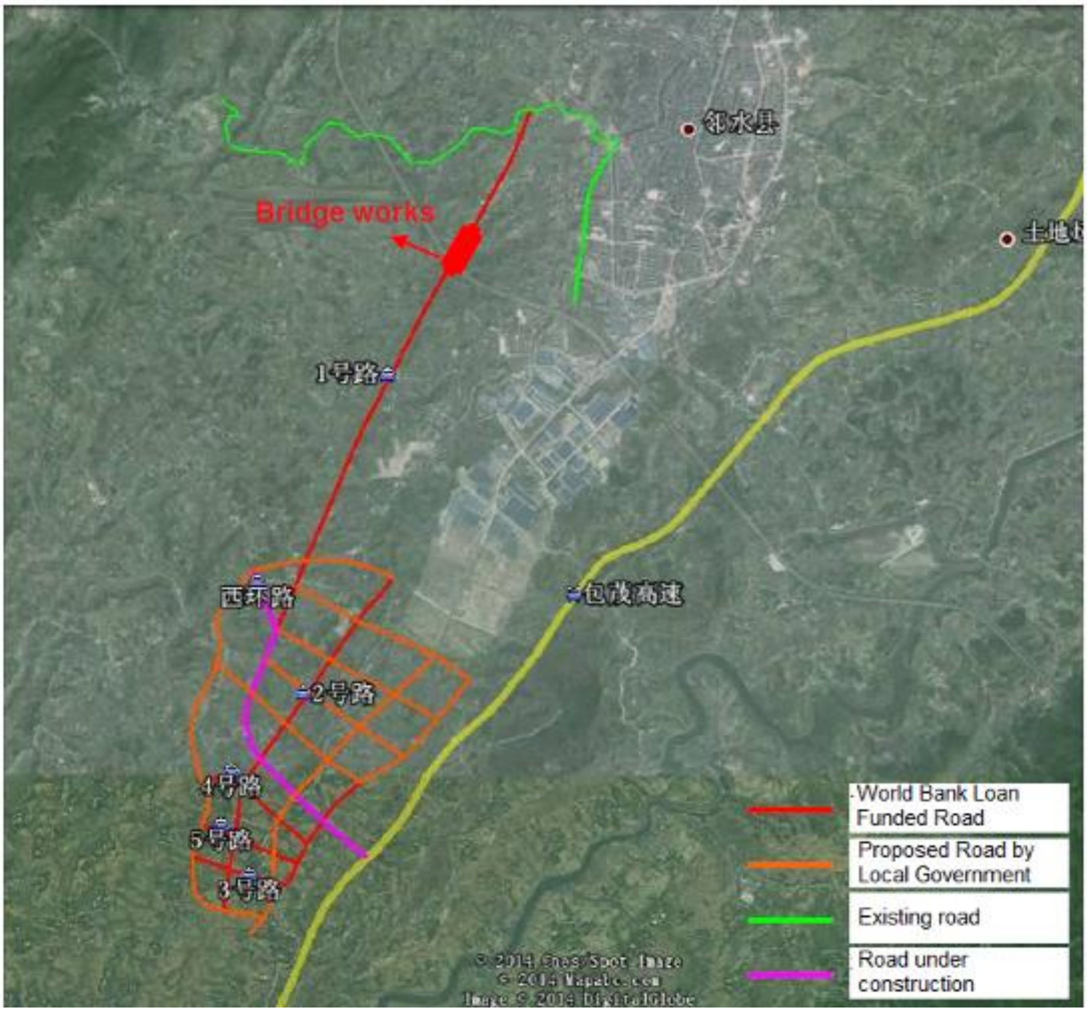


Figure 3.2.1-1 Relation Schema of Roads within the Construction Area

1. Road Works

Roads to be funded by the World Bank within the scope of construction include:

(1) Construction scale

This include 5 roads, they are No. 1 ~ No. 5 Roads respectively, with a total length of 11,640.9m. See Figure 3.2.1-2 for the general road plan layout.

No. 1 Road: it is an urban main road connecting LETDZ to the downtown area, which connects the existing township road in downtown (as indicated by the green line in Figure 3.2.1-1), with a total length of 4,760.34m; the right-of-way (ROW) of road is 40.0m with 2-way six lanes and a design speed of 60km/h.

No. 2 Road: it is an urban sub-trunk road with a length of 3,124.76m; the right-of-way (ROW) of road is 20.0m with 2-way four lanes and a design speed of 40km/h.

No. 3 Road: it is an urban branch road with a length of 1,845.48m; the right-of-way (ROW) of road is 16m with 3-way four lanes and a design speed of 30km/h.

No. 4 Road: it is an urban branch road with a length of 1,070.86m; the right-of-way (ROW) of road is 16m with 2-way four lanes and a design speed of 30km/h.

No. 5 Road: it is an urban branch road with a length of 839.46m; the right-of-way (ROW) of road is 16m with 2-way four lanes and a design speed of 30km/h.

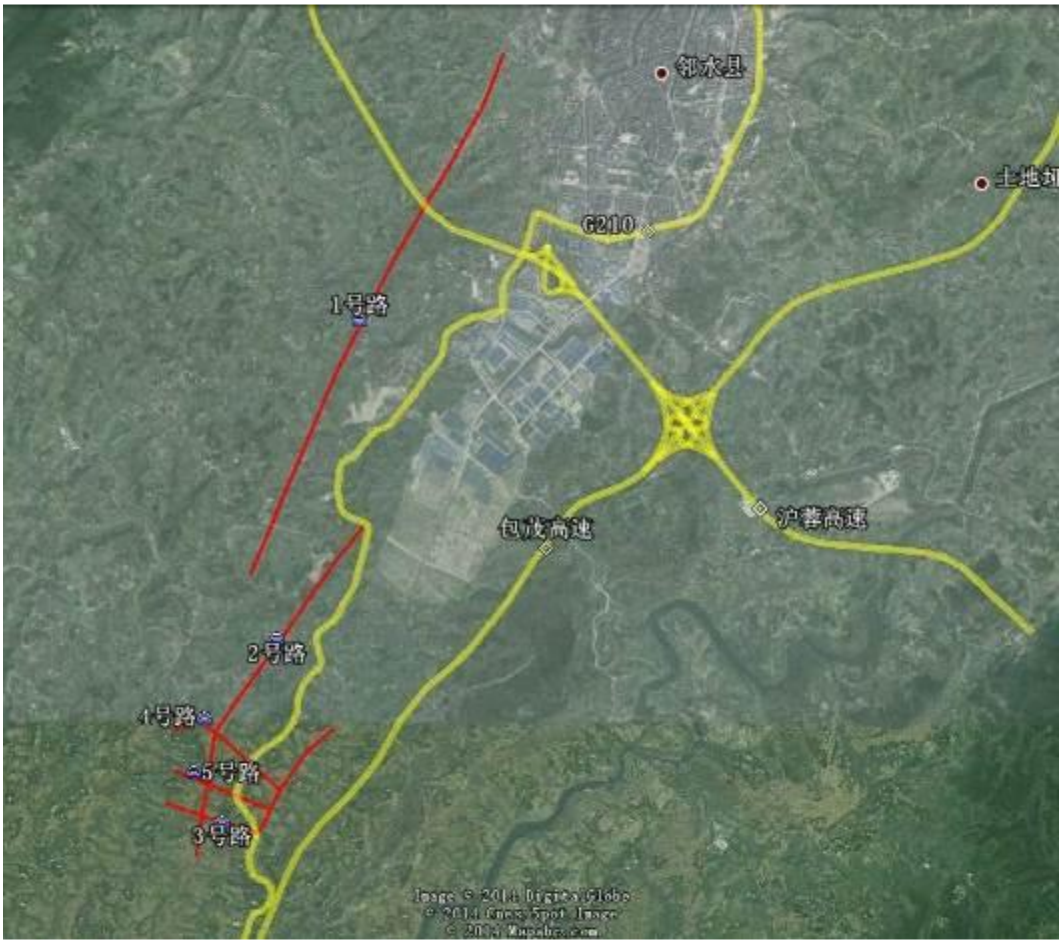


Figure 3.2.1-2 Location Plan of World Bank Loan Funded Road

(2) Technical standard for road works

According to design documents, technical standards for new roads are shown in the table below.

Table 3.2.1-2 List of Technical Standards for Road Works

SN	Description	Length (m)	Right-of-Way Width(m)	Road Grade	Design Speed(km/h)	Type of Pavement Structure
1	No. 1 Road	4760.34	40	Urban trunk road	50	Asphalt concrete
2	No. 2 Road	3124.76	20	Urban sub-trunk road	40	Asphalt concrete
3	No. 3 Road	1845.48	16	Urban branch road	30	Asphalt concrete
4	No. 4 Road	1070.86	16	Urban branch road	30	Asphalt concrete
5	No. 5 Road	839.46	16	Urban branch road	30	Asphalt concrete
Total		11640.9	/	/	/	/

(3) Road traffic volume prediction

According to FSR and by means of interpolation, traffic flows of each road in short term (2020), medium term (2026), and long term (2034) are calculated.

Table 3.2.1-3 Traffic Volume Schedule for Each Predicted Year

Characteristic Year	Year 2020 (Short Term)						Year 2026 (Medium Term)						Year 2034 (Long Term)					
Traffic Volume	Heavy truck		Midsize car		Car		Heavy truck		Midsize car		Car		Heavy truck		Midsize car		Car	
Time	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
No. 1 Road	207	46	248	55	310	69	231	51	277	62	346	77	268	60	320	71	400	89
No. 2 Road	40	9	48	11	60	13	45	10	54	12	67	15	52	12	62	14	78	17
No. 3 Road	12	3	15	3	18	4	14	3	16	4	20	5	16	4	19	4	24	5
No. 4 Road	4	1	4	1	5	1	4	1	5	1	6	1	5	1	5	1	7	2
No. 5 Road	3	1	3	1	4	1	3	1	3	1	4	1	3	1	4	1	5	1

(4) Cross-sectional Design

No. 1 Road (trunk road):

The proposed cross-section is 4m of sidewalk + 3m of NMV lane + 10.5m MV lanes + 0.5m of marginal strip + 4m of median separator + 0.5m of marginal strip + 10.5m MV lanes + 3m of NMV lane + 4m of sidewalk. The proposed cross-section is shown as follow:

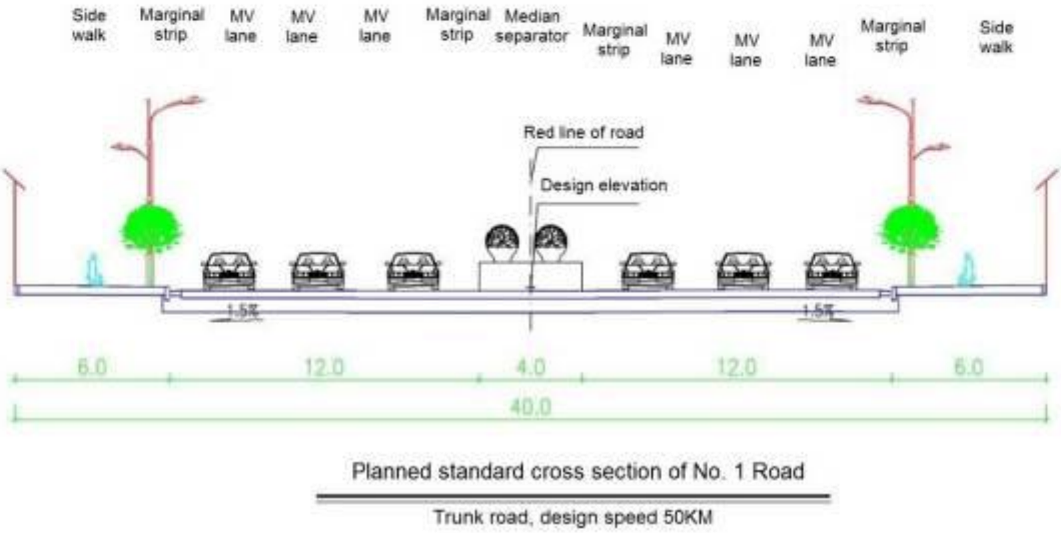


Figure 3.2.1-3 Cross Section of Urban Trunk Road

No. 2 Road (urban sub-trunk road):

The proposed cross-section is 2.5m of sidewalk+ 4m of MV and NMV mixed lane+ 3.25m MV lanes+ 0.5m of median separator + 3.25m MV lanes+ 4m of MV and NMV mixed lane+ 2.5m of sidewalk. The cross-section is shown as follow:

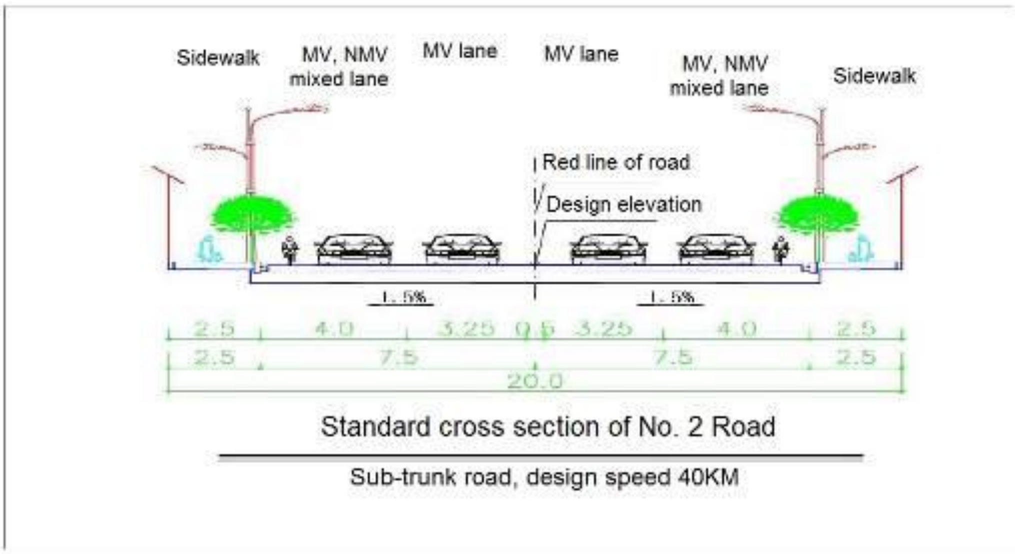


Figure 3.2.1-4 Cross Section of Urban Sub-Trunk Road

No. 3, 4, 5 Roads (urban branch road):

The cross-section is 2.5m of sidewalk + 0.25m of marginal strip + 2m of NMV lane + 6.5m MV lanes + 2m of NMV + 0.25m of marginal strip + 2.5m of sidewalk. The cross-section is shown as follow:

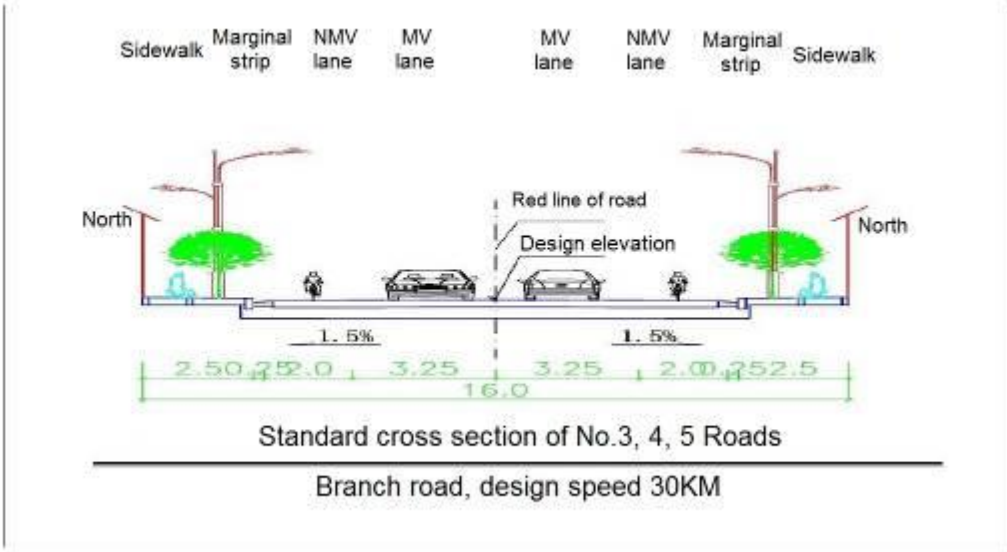


Figure 3.2.1-5 Cross Section of Urban Branch Road

(5) Subgrade works

1. Pavement structure of the MV lane of trunk road (No. 1 Road) is 4cm thick of fine grained type asphalt concrete (AC-13C) wearing course +5cm thick of medium grained type asphalt concrete (AC-16C) middle course +6cm thick of coarse grained type asphalt concrete (AC-25C) base course +1cm thick of emulsified bitumen slurry seal +20cm thick of 5% cement stabilized gravel +20cm thick of 4% cement stabilized gravel +20cm thick of graded gravel cushion, 76cm in total.
2. Pavement structure of the MV lane of sub-trunk road (No. 2 Road) is 5cm thick of fine grained type asphalt concrete (AC-13C) wearing course +7cm thick of coarse grained type asphalt concrete (AC-16C) base course +1cm thick of emulsified bitumen slurry seal +18cm thick of 5% cement stabilized gravel +18cm thick of 4% cement stabilized gravel +20cm thick of graded gravel cushion, 69cm in total.
3. Pavement structure of the MV lane of branch road (No.3, 4, 5 Roads) is 4cm thick of fine grained type asphalt concrete (AC-13C) wearing course +6cm thick of coarse grained type asphalt concrete (AC-16C) base course +1cm thick of emulsified bitumen slurry seal +18cm thick of 5% cement stabilized gravel +18cm thick of 4% cement stabilized gravel +20cm thick of graded gravel cushion, 67cm in total.

Pavement structure of sidewalk is 8cm thick of C25 color concrete brick pavement+ 2cm thick of cement mortar+ 10cm thick of 4% cement stabilized gravel, 17cm in total.

2. Bridge and culvert works

(1) **Bridge works overview**

The design width of No. 1 Road in Linshui County, Guang’an City is 40m, it intersects the Shanghai-Chengdu Expressway at about K3+345, with an intersecting angle of 72.5°. According to the characteristics of the expressway, three-dimensional transport must be adopted for intersection node. The intersection node between the Project and expressway is the flyover works crossing the Shanghai-Chengdu Expressway.

(2) General layout of bridge

The overall subgrade width of No. 1 Bridge is 40m, the median separator width is 3m; the bridge is divided into left and right roadway with both widths of 18.5m, the width of bridge floor and roadbed are equal. The composition of bridge floor road way is similar to that of roadbed.

Based on alternative analysis, precast hollow slab beam is adopted by the design to cross over the Shanghai-Chengdu Expressway. The pavement width of the Shanghai-Chengdu Expressway is about 25m; the Expressway intersects the No. 1 Bridge with an angle of 17.5°. The bridge adopts two span arrangements with span distance of 2×20m. Butt straps are provided after the bridge abutment to connect with the roadbed. The bridge is 50.06m length.

3. Pipeline Works

(1) Rainwater pipe network

Rain and sewage diversion system is adopted for drainage system within the assessment area. Proposed rainwater pipe network are all provided under the new roads. Pipe diameter is d300~ 2,000x3,200mm. Gravity flow tube is used for rainwater pipe network, and socket type reinforced concrete pipe with "O" type rubber ring flexible interface is used. Concrete circular well or rectangular well shall be used as rain manhole, manhole spacing is normally 50 ~ 120m.Reserved branch pipe spacing is 120~150m, the reserved branch pipe extends 2m beyond the right-of-way (ROW).

(2) Sewage pipe network

Rain and sewage diversion system is adopted for drainage system within the assessment area. The sewage pipe is laid along the new road. Pipe diameter is d400 ~d800mm, with total length of 18,690m (including branch sewer). Gravity flow tube is used for sewage pipe network, and socket type reinforced concrete pipe with "O" type rubber ring flexible interface is used. Concrete circular well or rectangular well shall be used as sewage manhole, manhole spacing is normally 40 ~ 100m.

4. Landscaping works

For urban trunk roads, landscaping works mainly includes the median separator and the outer separators on both sides. Landscaping mainly uses evergreen trees, together with multilayers of dungarunga and shrub. Between big evergreen trees and dungarunga there are layers of shrubs. The outer separators use trees as backdrop, combined with flowering small trees and with the ground covered with grass flower in order to add color; thus urban trunk roads characterized by many varieties and multi-function landscaping, four seasons evergreen, three seasons of flowering, bright and colorful, and thriving are presented.

For urban sub-trunk roads, landscaping works mainly includes the sidewalk on both sides. Landscaping mainly uses small trees and low shrubs together with lawn to produce pretty spacious visual spaces; moreover, urban road rainwater collection system is introduced to produce LID technological system.

For urban branch roads, landscaping works mainly includes the sidewalk on both sides. Landscaping mainly uses small trees and low shrubs together with lawn to produce pretty spacious visual spaces; moreover, urban road rainwater collection system is introduced to produce LID technological system.

5. Supporting works

(1) Bus stations and barrier-free facilities

According to the requirements of urban functional areas, the road design includes public transportation along the central trunk road (i.e., the No. 1 Road) connecting the western new city and the industrial park to form transit corridor, bus stations and station connection shall be well planned along the line.

Blind walk way for the eyesight disabled shall be provided on the sidewalk of the road to guide the eyesight disabled to walk by using the touch of sole of the foot. Blind walk way shall be continuous laid along the road segment; barrier-free facilities shall be laid 0.25~0.5m away from the green belt or the border tree pit. The blind walk way shall be 0.30m in width.

(2) Road traffic safety and management facilities

Design of traffic safety facilities mainly include: traffic signs, markings, channelized traffic guide of level crossing, etc. Traffic signs plane layout of the Project shall strictly conform to Road Traffic Signs and Markings (GB5768-2009) and relevant standards. Perfect safety facilities like traffic signs, markings, safety barriers, sight guide and anti-glare mesh shall be provided to ensure the normal road use and vehicle running safety, in short, following the principle of minimizing traffic accident.

(3) Road lighting works

Street lights shall be provided on both sides or one side of the road by following the principle of comfort, energy saving and beautiful.

(4) Slow-moving traffic

Slow-moving traffic, also known as non-motorized traffic, refers to means of transportation with travel speed no more than 15km/h, including walking and non-motor vehicle traffic.

Facilities and measures provided for slow-moving traffic in the Project include the following: pedestrian crossing, pedestrian crossing protection zone; design for the road traffic facility of slow-moving traffic system, namely, design of traffic markings, signs and traffic signals control facilities; and bench on roadsides.

Roads not funded by World Bank loan in the assessment scope:

Table 3.2.1-4 Roads Funded by World Bank Loan within the Assessment Scope

SN	Road		Length (m)	Width (m)	Estimate Cost (CNY 10,000)	Capital Source	Construction Duration
1	Proposed roads in 2014	Road 1	1607	40	6785.11	Local finance	2014-2015
2		Road 2	967.6	16	967.6	Local finance	2014-2015
3		Road 3	977.33	40	4104.66	Local finance	2014-2015
4		Road 4	917.12	20	1375.68	Local finance	2014-2015
6		Road 5	790.31	24	1422.56	Local finance	2014-2015
7		Road 6	1637.74	24	2947.32	Local finance	2014-2015
8	Proposed roads in 2015-2016	Line A	1148.23	30	2870.575	Local finance	2015-2016
9		Line B	585.67	16	585.67	Local finance	2015-2016

SN	Road		Length (m)	Width (m)	Estimate Cost (CNY 10,000)	Capital Source	Construction Duration
10		Line C	496.42	40	2084.964	Local finance	2015-2016
11		Line D	434.05	20	651.075	Local finance	2015-2016
12		Line E	740.06	24	1332.108	Local finance	2015-2016
13		Line F	3470.55	16	3470.55	Local finance	2015-2016
14		West ring road	11212.5	40	42800	Local finance	2015-2016
15		Chongqing-Linshui Expressway	300	40	5372.346	Local finance	2015-2016

3.2.2 Wastewater Interceptor Component

1. Service scope of wastewater interceptors

   Two new wastewater interceptors will be built along both sides of Shiba River. The terrain of Linshui County is that it is high in the middle and low on both sides. As it is divided into north area and south area, the sewage of Linshui County is discharged in different areas. The service scope of the new wastewater interceptors includes the north area of LETDZ, part of the old town of Linshui County, as shown in the following figure.

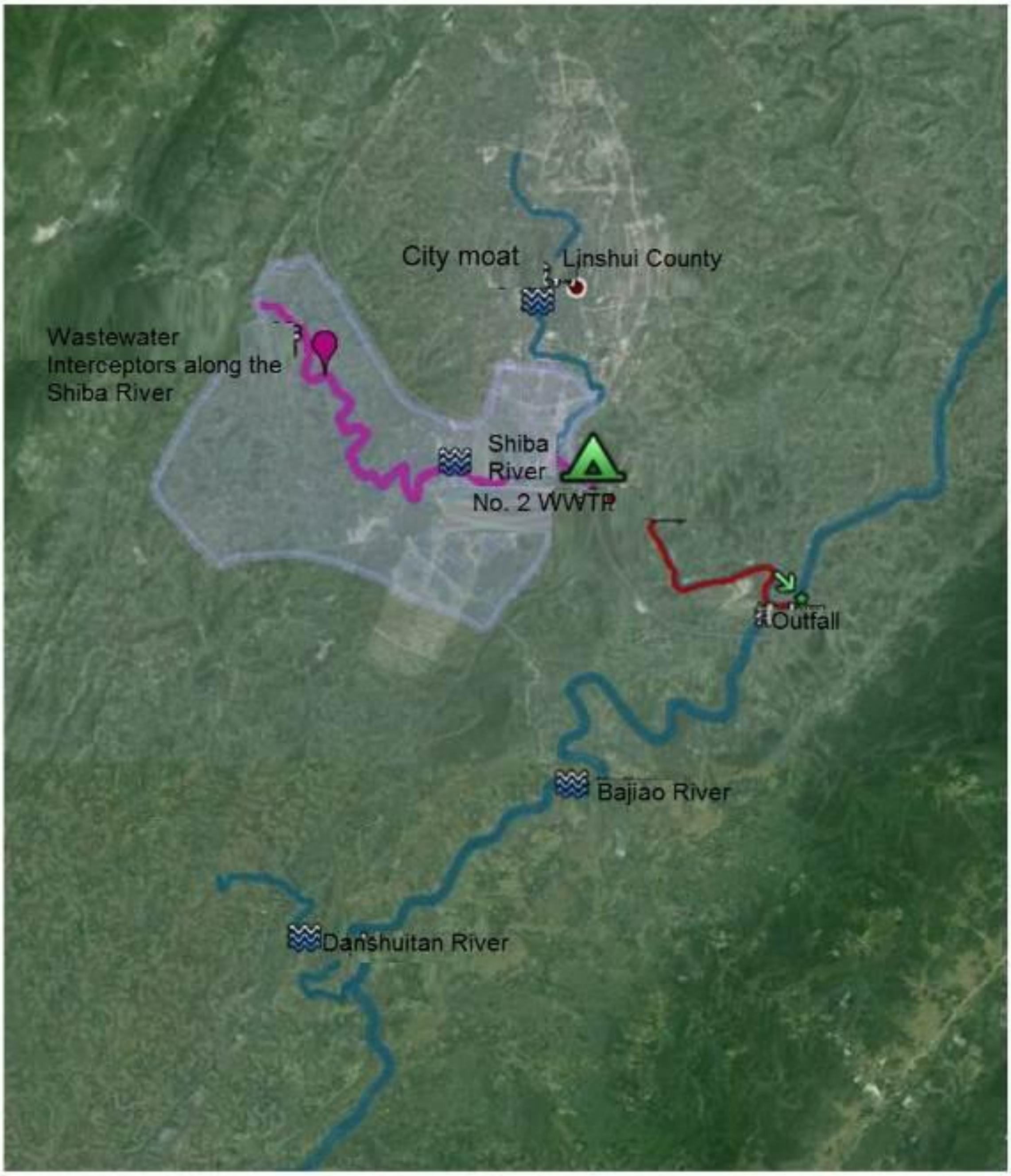


Figure 3.2.2-1 Service Scope of Wastewater Interceptors

2. Drainage system

Wastewater interceptors of the Project adopt rain sewage diversion system, which has two types, namely, “completely separate system reform” and “intercepting type separating system reform”.

Complete separating system reform includes the separating system reform of urban road drainage network and the community drainage network; one major reform task is to add another new drainage system, allowing rainwater and sewage to discharge into different drainage system. Complete separating system reform involves a range of issues like road reconstruction, housing demolition, pipeline relocation, traffic organization, departmental coordination, etc. it is really a complex and difficult task.

While maintaining the combined system pipeline of the built up areas, the intercepting type separating system reform is to lay on either side of the Shiba

River a wastewater interceptor from the downstream outlet of the combined system pipeline (the upstream pipeline on either side is still wastewater interceptor), and to set up catchpit to collect the wastewaters from the combined system pipeline of the built up areas before they flow into the downstream wastewater interceptor and transport them to Linshui No. 2 WWTP for disposal.

According to the locations of the Shiba River wastewater interceptors, complete separating system design shall be adopted for collecting the wastewater of the upstream and midstream section of Shiba River (the planned area), while intercepting type combined system design shall be adopted for collecting the wastewater of the downstream section of Shiba River (built up area).

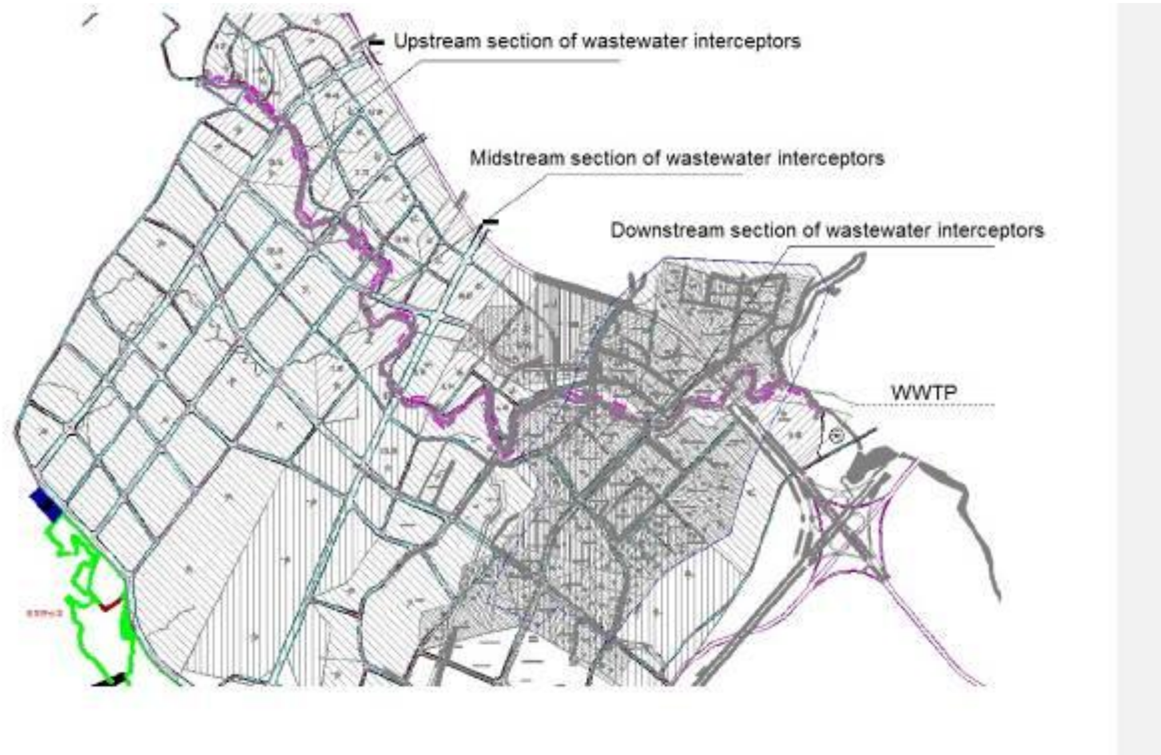


Figure 3.2.2-2 Drainage System in the North Area of Linshui Industrial Park

3. Technical standard

Pipe roughness coefficient: reinforced concrete pipe: n = 0.014, steel pipe: n = 0.010;

Design fullness: sewage pipe shall be calculated as slack flow, and maximum design fullness shall refer to the Table below:

Table 3.2.2-1 Maximum Design Fullness for pipes

Pipe diameter	Maximum Design Fullness
d200～d300	0.6
d400～d500	0.65
d600～d1000	0.75
d1200～d1800	0.8

Minimum and maximum design flow rate: in order to ensure that solid waste can be washed away by wastewaters, the design of the pipeline slope shall ensure that the minimum flow rate of wastewaters is no less than 0.65m/s below the maximum fullness of pipeline and the maximum flow rate for non-metal pipeline is 5.0m/s.

Minimum overburden soil depth and maximum buried depth: buried depth of pipeline shall safeguard it from the current and future possible harm to pipeline facilities; generally, the minimum overburden soil depth above the top of pipe under MV lane shall be no less than 0.7m. Moreover, it is not proper for burying pipe too deep, or it not only results in too high a construction cost, but pretty high operation and maintenance costs. Generally buried depth of pipe shall be within 8~9m.

Manhole arrangement: manholes shall be provided at pipe junction, pipe bends and where pipe diameter or pipe slope changes, where there is water fall, and at regular interval along straight pipe section (for sewage pipe the maximum interval shall be 40~100m, and 50~120m for combined pipe).

Determination of specific discharge: specific discharge of sewage surface is 0.40 L / S·ha.

4. Plant layout of wastewater interceptors

The wastewater interceptors are laid along the north and south side of Shiba River respectively. The north side wastewater interceptor crosses the Shiba River to converge with the south one at Node 35, eventually the wastewaters flow into the No. 2 WWTP in Linshui County. The total length of wastewater interceptors is 13.066km, with pipe diameter of DN400~DN1200.

In the midstream and upstream sections of the wastewater interceptors (length on one side is about 4km), where it is yet to be developed, complete separating system is adopted and the rainwater is discharged into water bodies nearby and wastewater is collected by the wastewater interceptors in these sections.

In downstream section of the wastewater interceptors (length on one side is about 2km), where it is the built area of LETDZ, intercepting type combined system is adopted. Wastewater from the combined pipeline is collected by the wastewater interceptors through catchpit, while rainwater is discharged into the Shiba River.

Table 3.2.2-2 Bill of Quantities for Wastewater Interceptors

SN	Name	Specification	Unit	Qty.	Remarks
1	Steel belt reinforced HDPE pipe	dn400	m	2458	Slope excavation
2	Steel belt reinforced HDPE pipe	dn800	m	4419	Slope excavation
3	Steel belt reinforced HDPE pipe	dn800	m	1119	Fully contracted river bank section
4	Reinforced concrete jacking pipe	dn800	m	85	Pipe jacking H = 14 m
5	Steel Pipe	dn800	m	85	Overhead (10 m)
6	Steel belt reinforced HDPE pipe	dn1000	m	764	Slope excavation
7	Reinforced concrete jacking pipe	dn1000	m	450	Pipe jacking H = 14 m
8	Steel belt reinforced HDPE pipe	dn1000	m	2868	Fully contracted river bank section
9	Steel Pipe	dn1000	m	85	Overhead (10 m)
10	Steel belt reinforced HDPE pipe	dn1200	m	240	Excavation
11	Reinforced concrete jacking pipe	dn1200	m	420	Pipe jacking H = 8 m
12	Steel Pipe	DN1000	m	28	River crossing via inverted siphon
13	Steel Pipe	DN1200	m	45	River crossing via inverted siphon

4. Drainage destination of wastewater interceptors

Wastewater interceptors are laid along the north and south side of Shiba River. The wastewater interceptors on the north side along Shiba River cross the Shiba River to converge with those on the south side at Node 35, ultimately into the No. 2 WWTP in Linshui County.

3.2.3 WWTP Component

Two WWTPs will be built in the assessment area, namely, the No. 2 and No. 3 WWTP.

- World Bank loan funded WWTP: No. 3 WWTP of Linshui County
- Non-World Bank loan funded WWTP: No. 2 WWTP of Linshui County

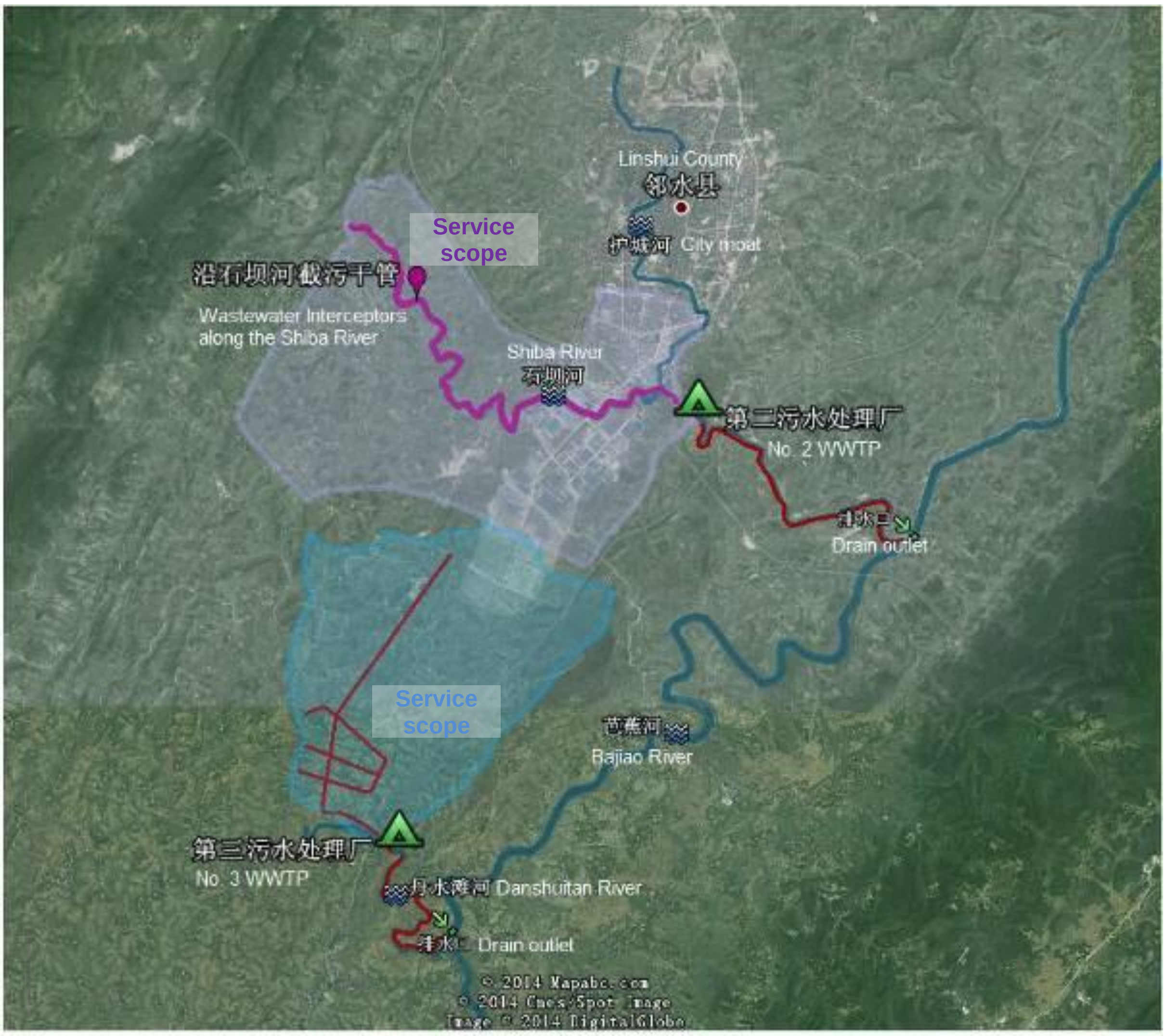


Figure 3.2.3-1 Location Sketch Map of WWTP

- **Overview of Linshui No. 3 WWTP:**

1. **Location of WWTP**

   The No. 3 WWTP is located at Group 3 of Xinhe Village south of Linshui County Downtown, east of Baotou-Maoming Expressway and state road 210, with convenient traffic conditions; the place now consists partially of farmland and wasteland. The 20 year flood elevation at the plant site is 294.83m.

2. **Service scope of WWTP**

   According to the *Regulatory Plan of City-production Integration*

Demonstration Zone in Southern Linshui County Downtown, the service scope of Linshui County No. 3 WWTP is the south area of industrial park; calculated based on the service area chart, the service scope of No. 3 WWTP is about 324.87hm^2 industrial area.

3. WWTP inflow and drainage scheme

The inflow pipe of No. 3 WWTP starts from the sewage pipe of the No. 2 Road planned in the Project; it runs along the planned road and natural terrain into the lift pump station of No. 3 WWTP, with a total length of 1,800m and diameter of d800.

The tail water discharge pipes of No. 3 WWTP are laid along the Danshuitan River, ultimately into the Bajiao River, with pipe length of 2,650m and pipe diameter of DN600.

3. Wastewater treatment capacity

According to the prediction of sewage quantity in the south area of LETDZ by the *General Planning of Linshui County Downtown*, the *Urban Drainage Special Planning of Linshui County*, and the *Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown*, it is decided in the Project feasibility study that the short term (2020) capacity of No. 3 WWTP is 4,000 m^3/d, and long term (2030) capacity is 8,000 m^3/d. Considering that it will take time for the settling and construction of industrial enterprises, and according to the capital arrangement, the No. 3 WWTP will be constructed in two stages.

4. Inflow and effluent quality

According to Project FSR, the Linshui No. 3 WWTP mainly disposes the industrial wastewater and sewage in the south area of LETDZ, where the enterprises induced are mainly of machining, textile, food, packaging, electronics, and so on.

The analogy in feasible study report is performed for the inflow water quality of Linshui No.1 WWTP through the investigation on existing enterprises in LETDZ and in combination with the *Code for Design of Outdoor Sewerage Engineering*; in consideration of the allowance for treating future inflow water of WWTP, it is determined in the final feasibility study that the inflow water quality indicators of WWTP satisfy the requirements as follows:

Table 3.2.3-1 Predictions on Designed Inflow and Effluent Quality

Water quality index		pH	CODcr (mg/l)	BOD_5 (mg/l)	NH_3-N (mg/l)	TN (mg/l)	SS (mg/l)	TP (mg/l)
Inflow quality	Domestic Wastewater	6.5-8.5	300	165	200	26	4.4	36.5
	Production wastewater	6.5-8.5	189	97	164	20	2.3	25
Effluent quality		6-9	≤50	≤10	≤5 (8)	≤15	≤10	≤0.5

5. Process and scale

(1) Process and scale

Combined process of "coarse grid + fine grid + grit chamber + regulating tank + hydrolysis acidification tank + amended oxidation ditch + rotary filter tank" is adopted as the wastewater treatment process; sludge treatment process of "sludge storage pool + Plate-and-frame filter press + lime" is adopted for sludge dewatering, and "ultraviolet disinfection" process is adopted for disinfection. Component scale: 0.4×10^{4}m^3/d for short term, and 0.8×10^{4}m^3/d for long term. See Attached diagram 14 for process flow chart.

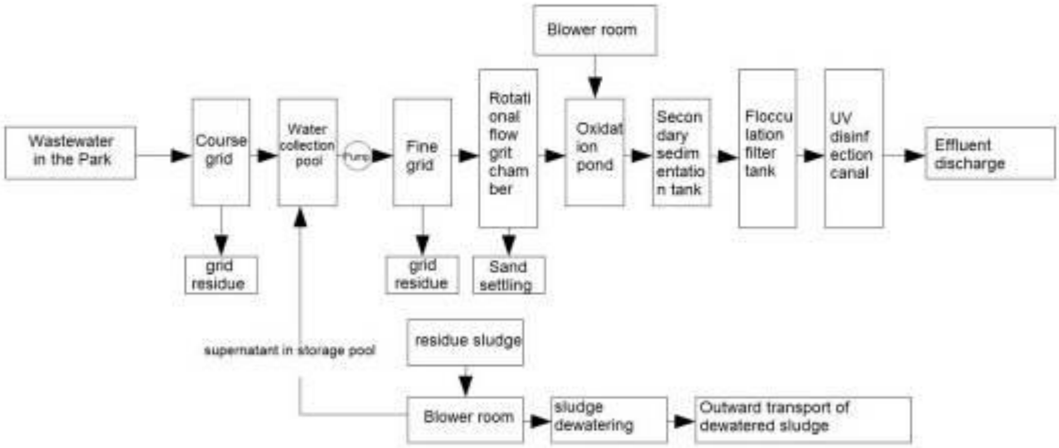


Figure 3.2.3-2 Wastewater Treatment Process Flow Chart

(2) Process instructions

ndustrial park wastewater is collected by wastewater pipe network and flows into WWTP. First it flows through the coarse grid and into the lifting pump room where the big suspended solids and floating objects are intercepted by the coarse grid; lifted by the lifting pump, it then flows through the fine grid and into the grit chamber where grit with big specific gravity is removed from the wastewater, effluent from the grit chamber then flows into the regulating tank for quality and quantity adjustment, and then into hydrolysis acidification tank where decomposition of macromolecular substances and degradation of toxic and harmful substances are carried out in hydrolysis section tank to improve the biodegradability of wastewater; it then flows into the oxidation ditch upon hydrolysis, passing anaerobic zone, anoxic zone and aerobic zone successively, where the pollutants in wastewater are removed by microorganisms; the effluent whereof now flows into sedimentation tank for sludge and water separation, the supernatant flows into the filter tank and, after disinfection and metering, is discharged up-to-standard.

Sludge separated in the sedimentation basin of oxidation ditch is entered into sludge back well where it is pumped back to the oxidation ditch and hydrolysis acidification pool; the remaining sludge is pumped to the sludge sump. Sludge produced in the flocculation filter tank is also pumped to the sludge sump where it is again pumped to sludge dewatering system, after the sludge moisture content is reduced to lower than 60%, the sludge is transported outward for disposal. Wastewater discharged from the sludge dewatering system flows to the coarse grid and lifting pump room through the plant drainage pipe for further treatment.

6. WWTP general layout design

(1) General Layout

The WWTP is divided into three function areas, namely, work and living area, production area and auxiliary production area. The work and living area consists of worker’s canteen, warehouse and the guard room; the production area consists of sewage treatment, dosing and disinfection room, blower room, power distribution control station; and the auxiliary production area consists of structure area for sludge handling. Different areas are separated by plant roads.

1) Work and living area: it is located on the west side of the plant. Close to the door, main structures consist of complex building (including workers' canteen) and the guard room. It is convenient for access and management.

2) Production area: it is located in the middle of the plant. Main structures consist of the coarse grid room and lifting pump station, fine grid room, bell type grit chamber, oxidation ditch, secondary sedimentation tank, rotary filter tank, transformer and distribution room and blower room. This area is the core area for water processing with many pipelines; in addition to reserving enough pipeline corridors around, special attention shall be paid to surrounding landscaping.

3) Auxiliary production area: it is located on the east side of the plant, consists of sludge storage pool, sludge dewatering room, dosing room, machine repair shop.

The perennial dominant wind direction is north wind; the sludge treatment system is located in the downwind direction of the dominant wind. See plan layout for the specific arrangement of structures.

Various functional areas of the plant are divided by plant roads and separated by green belt, they are independent from each other, however, connect closely. Pipelines between different workshop sections are short and convenient and smooth traffic in between is available.

The plant gate is located on the east side.

General technical and economic indicators and main quantities are shown in Table below:

Table 3.2.3-2 General Technical and Economic Indicators of No. 3 WWTP

SN	Indicators	Unit	Qty.	Remarks
1	Plant floor area	Ha	0.88 (13.3mu	
2	Floor area of buildings and structures	m^2	2408	
3	Floor area of storage yard and outdoor operation field	m^2	300	
4	Building coefficient	%	31.0	Short term
5	Floor area of road and square	m^2	2251	
6	Usage factor	%	55.5	
7	Greening area	Ha	0.35	
8	Softening coefficient	%	40	Short term

Table 3.2.3-3 Main Work Quantity

SON	Indicators	Unit	Qty.
1	Excavation in plant	m^2	38700
2	Backfilling in plant	m^3	38000
3	Brick and concrete rubble wall	m	425
4	Greening area	m^2	3546m^2
5	Electric flex door	Piece	1
6	Road and storage yard	m^2	2251
7	Slope protection and retaining wall	m	400

(2) Vertical design and flood control and drainage

The plant is located on a mountain ridge with plant surface elevation of 305.5m, where the 20 year flood elevation of the Danshuitan River is 294.83m, thus there is no need for flood control.

The whole plant area inclines southward (to the Danshuitan River) at a slope of 3‰, in favor of surface rainwater drainage. Rainwater drainage mode: rainwater drainage tubes are mainly used in the plant, rainwater channels are provided around buildings as necessary; rainwater is ultimately discharged out of the plant after being collected.

(3) Plant road and transport

Access to the plant is via the original rural road which leads to the east side of the plant. New plant road is in ring shape, for which, according to the vehicle running frequency of each section and the staff movement condition, 4m width of cement concrete pavement is adopted. No MV traffic workshop channels and footways are made of precast color concrete sidewalk slab.

The plant transportation consists mainly of mud cake and sludge out and consumptive drugs in, of which, aluminum polychlorid is a liquid delivered to plant site by the supplier.

Table 3.2.3-4 Summary of Plant Transportation Volume

SN	Item Name	Unit	Transportation Volume	Remarks
1	Mud cake, sludge, sand	m^3/d	1.4	Out of the plant by truck
1	PAM	t/a	0.5	Into the plant by truck

Table 3.2.3-5 Vehicle Allocation

SN	Name	Specification	Num.	Remarks
1	Cargo-bus	0.5t	1	/
2	Small car	/	1	/

(4) Plant greening

The plant covers an area of 14.8mu. Targeted at the practical needs and development prospect of WWTP, two leading design concepts, namely, “humanized scale” and “ecological atmosphere” are proposed for the WWTP landscaping design; based on these two concepts, the design shall be conducted in proper scale and close to people as much as possible by analyzing the human behavior in the plant and various flow relationship, and by implementing the design goal of “ecologization combining dynamic and static”, in order to realize an reasonable and high quality landscaping effect no matter in terms of function layout, greening area, hard ground and so on. A comprehensive greening principle integrating dot, line and surface greening shall be adopted in the organization of greening system, together with small square, waters, hard ground, ultimately creating an ecological and landscaping plant environment.

Landscaping at the plant door shall mainly use pot flowers. Bench shall be provided at proper place in small parks; and small garden ornaments shall be used to perfect greening. Landscaping of the front of other buildings shall combine flowers and plants to form high and low layers of greening. Landscaping of road sides and the surrounding of plant walls shall mainly use trees which are suitable for the local climate and soil, and different tree species shall be planted in collocation considering the season changes.

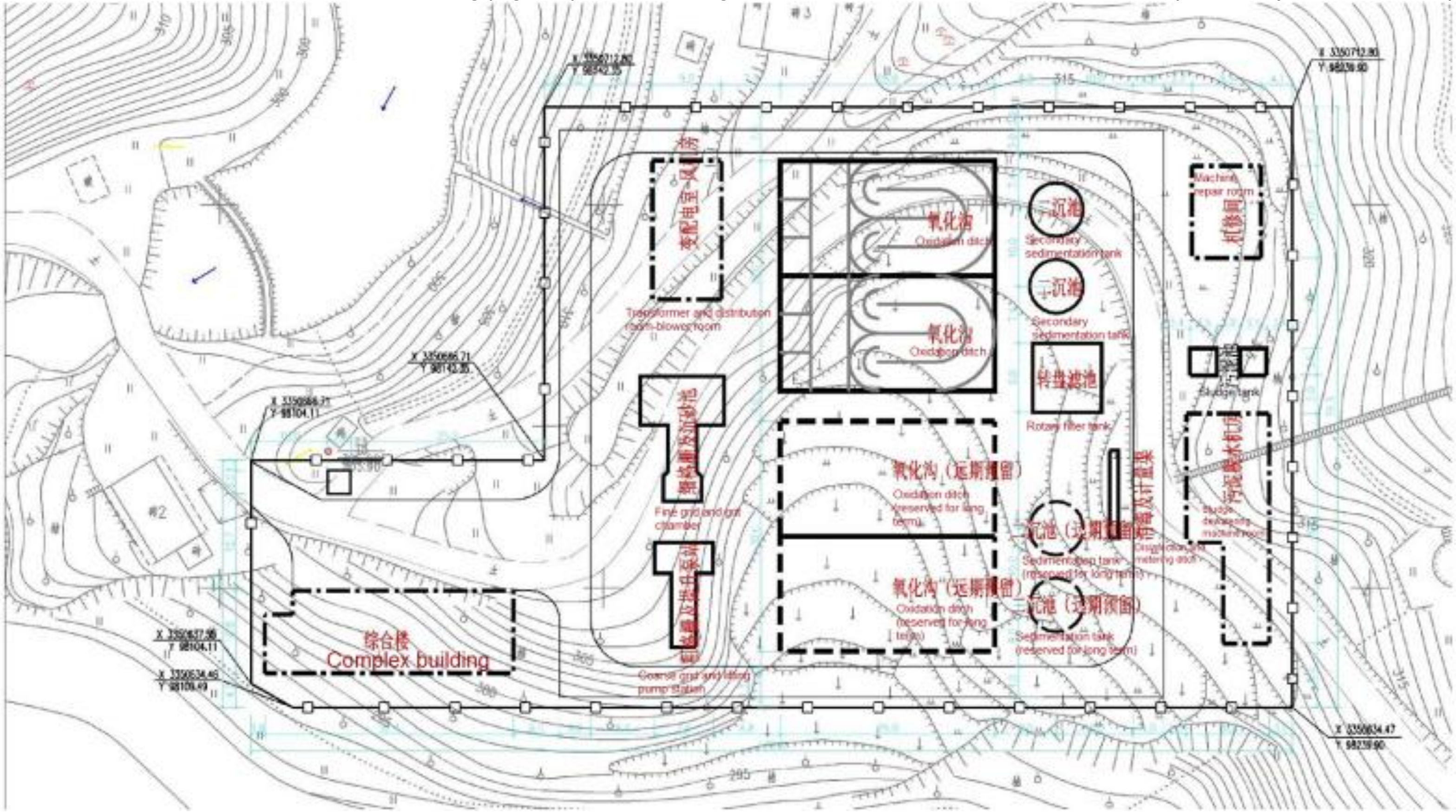


Figure 3.2.3-3 WWTP General Layout

- **Overview for Linshui No. 2 WWTP:**

1. WWTP site

Hongdian Village in Chengnan Town, Linshui County is preliminarily selected as the site for Linshui No. 2 WWTP according to the design.

2. Scope of WWTP services

Linshui No. 2 WWTP receives wastewater collected by the wastewater interceptors along Shiba River, with scope of service consistent with that of the wastewater interceptors along Shiba River, i.e., north area of the LETDZ and part of Linshui Western New City.

3. WWTP inflow and drainage scheme

The wastewater interceptors on the north side along Shiba River cross the Shiba River to converge with those on the south side at Node 35, eventually into Linshui No. 2 WWTP, of which the tail water drainage pipes are laid along the Danshuitan River, ultimately into the Bajiao River.

4. Wastewater treatment capacity

According to the documents provided by the Housing and Urban-Rural Construction Bureau of Linshui County, the proposed capacity of the Linshui No. 2 WWTP is 20,000m^3/d. However, the capacity predicted in the feasibility study report is 30,000m^3/d and that mentioned in *Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown* is also 30,000m^3/d. Therefore, we suggest the Owner to conduct a detailed argument on No. 2 WWTP in the next stage.

5. Inflow and effluent quality

The wastewater disposed by Linshui No. 2 WWTP mainly includes industrial wastewater and domestic sewage. The enterprises introduced in LETDZ are mainly mechanical processing enterprises and electronic enterprises. The following table shows inflow and effluent quality index of wastewater treatment plants by reference to Linshui No. 3 WWTP:

Table 3.2.3-6 Predictions on Designed Inflow and Effluent Quality

Water quality indicator		pH	CODcr (mg/l)	BOD_5 (mg/l)	NH_3-N (mg/l)	TN (mg/l)	SS (mg/l)	TP (mg/l)
Inflow quality	Domestic sewage	6.5-8.5	300	165	200	26	4.4	36.5
	Production wastewater	6.5-8.5	189	97	164	20	2.3	25
Effluent quality		6-9	≤50	≤10	≤5 (8)	≤15	≤10	≤0.5

6. Process and scale

Linshui No. 2 WWTP applies CASS (Cyclic Activated Sludge System, CASS for short) technology. CASS system is a batch reactor as well as an activated sludge method for "water inflow and drainage", which is newly developed on the basis of SBR technology through constant evolution and improvement.

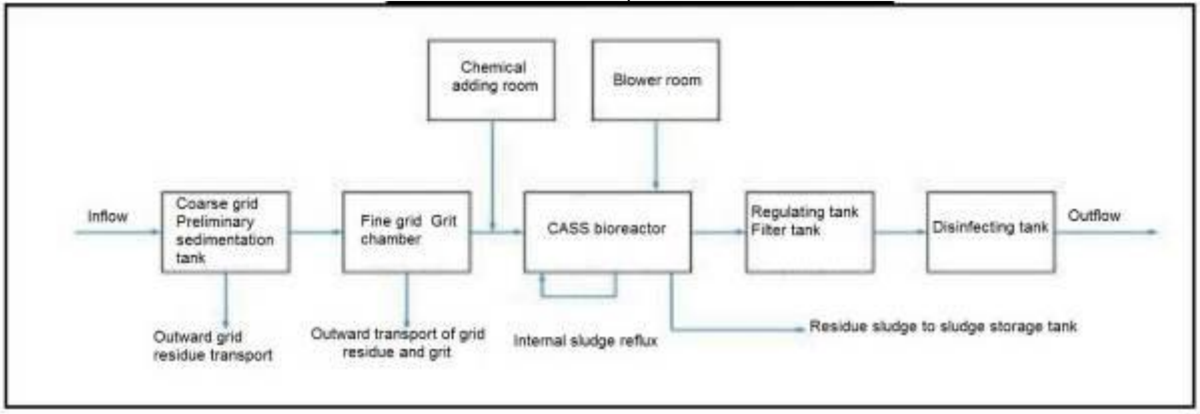


Figure 3.2.3-4 CASS Process Flow Chart

7. WWTP status quo

Linshui No. 2 WWTP is proposed to be built from 2014 to 2016. At present, project design is underway, preliminary work like project feasibility study, environmental assessment and project approval is expected to be completed in 2014, and infrastructure construction is planned to be started at the beginning of 2015. Project constructor will be determined by bidding process, while Sichuan Linshui Aizhong Environmental Protection Co., Ltd. serves as the operator.

3.2.4 Linshui Public Training Center Project Component

To improve the employment or re-employment adaptability of land-lost farmers, demobilized military personnel as well as laid-off and unemployed personnel from Linshui County and the districts and counties around, and give skills training to new labor forces, the Linshui Public Training Center is established.

As strategic cooperation is carried out between Linshui Public Training Center and Linshui Vocational School, Linshui Public Training Center will be established in the original Linshui Vocational School, and no new teaching buildings or other infrastructures will be built. By doing this, the existing infrastructures of the School can be fully used, realizing the sharing of resources and facilities and avoiding repeated construction and adverse impact incurred on the construction period.

The Project is merely intended to give financial support to the establishment of Linshui Public Training Center for training materials and teaching equipment procurement, school administrators and teachers training, Linshui enterprise employment investigation and future organization and management.

As strategic cooperation is carried out between Linshui Public Training Center and Linshui Vocational School, Linshui Public Training Center will be established in the original Linshui Vocational School, and no new teaching buildings or other infrastructures will be built, without civil works. During the construction, no environmental impact will occur.

3.3 Project Occupied Area and Earthworks/Stoneworks

1. Project occupied area

The construction area covers 307hm^2 in total, mainly involving paddy field, dry land, forest land, grassland, rural homestead, highway land, pond and hydraulic construction land.

2. Quantities of Earth and Stone

Based on the regional planning and design documents, construction excavation covers about 59,940,000m^3, without abandonment, all for filling. There is large elevation difference in Linshui County downtown and the earth within the county may be temporarily transferred, so borrow area and spoil ground are not required.

3.4 Construction Organization

3.4.1 Main raw and auxiliary material consumption

1. Sand and gravel

The project area and its vicinity are rich in local road-building materials, of which the quality and quantity may meet design requirements.

(1) Sand, gravel and pebbles: qualified earth and stone in subgrade excavation are mainly utilized as subgrade filling.

Fine sand may be purchased from Guang’an and medium-coarse sand from a nearby sand and gravel company.

(2) Rubble and block stone: material goods of rubble and block stone required by the embankment slope, cutting slope protection, drainage ditch and retaining walls of the Project are purchased from the stockyard with production license by car.

(3) Pavement and subgrade fillings: subgrade filling of the Project may apply the excavated subgrade nearby. The gravel for the base course of pavement may be purchased from a sand and gravel company in Guang'an: the gravel for the subbase course may be purchased nearby.

(4) Cement: the cement may be purchased from the cement plants in Huaying, Qujiang and Xikou, lime from Huaying Tianchi and Guang'an Guixing, and coal ash from Guang'an Thermal Power Plant, Luodu Thermal Power Plant and Lvshuidong Thermal Power Plant. Such resources are abundant which may meet engineering needs and the transport condition is good.

Most of the road-building materials required for the Project are purchased from elsewhere, and the stockyard owner is responsible for liability subject of environmental protection and water protection.

2. Steel and timber

The steel required for the Project may be purchased from Guang’an, Chengdu or other places, while timer may be purchased nearby.

3. Water and electricity for construction

There are four main rivers, Bajiao River, Danshuitan, Xiaoxi River and Shiba River respectively, from north to south in Linshui County, which belong to Changjiang River system, while the others are hill streams feeding into such three rivers. Due to non-corrosion to the concrete, the nearby small rivers and streams, small reservoir, stream ditch and well may be applied as water for construction. Before use, approval shall be obtained upon with negotiation with the Contractor or property Owner. In some area, water supply pipes may be directly connected to the project area. In addition, environmental protection work shall be conducted during the construction period to strictly prevent the domestic water along the project from pollution.

There are a lot of towns and villages along the project and power supply is sufficient, so it may be considered to access to the electricity for construction from the civil power grid along the project, but contact with local power administrative department shall be made to get usage license. Key works such as bridge works and crossing works shall be each provided with a generator for itself to deal with temporary power failure, so as to ensure the smooth construction.

3.4.2 Construction process and methods

(1) New road works

Construction preparation work is necessary for the successful implementation and timely completion of main works. Before the commencement, "Water and Electricity Supplying, Road Connecting and Construction Site Leveling" shall be completed; and the construction preparation shall be done before the construction of subgrade works. The construction processes of subgrade works include:

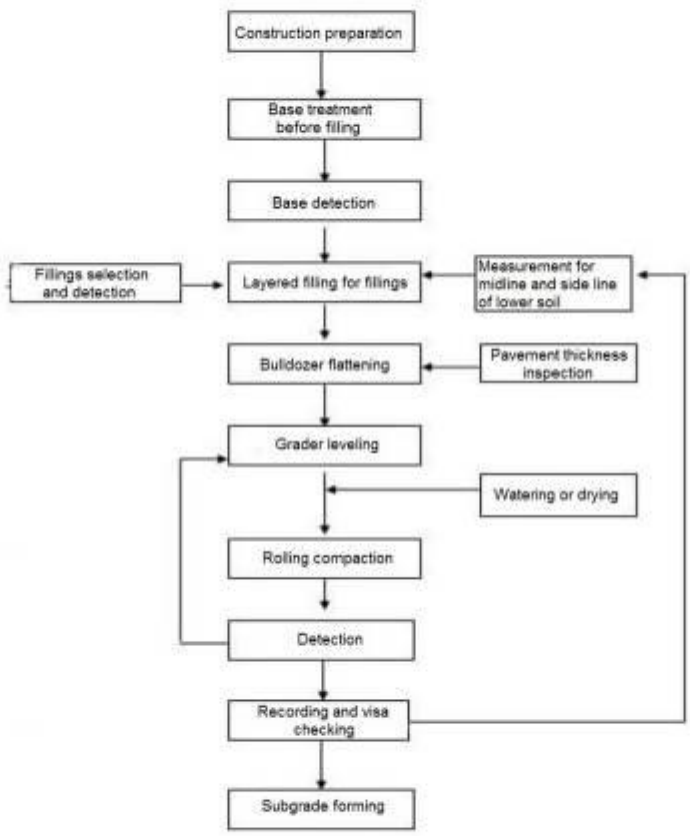


Figure 3.4.2-1 Subgrade Construction Process of Road Works

The construction of storm water and wastewater pipe networks under the road is synchronized with the construction of road works, including: pipe trench construction → pipe construction (welding, joint coating, defect repairing and anticorrosion)

The pavement works mainly including paving asphalt concrete after the pipeline works and subgrade construction. The pavement process is as follows: clean the base → distribute asphalt oil layer → transport qualified concrete → push against the back wheel of dumper to roll the paver → the paver moves forward while unloading → pave and compact for shaving and tamping, and iron the plate as per thickness and camber requirements → compact with roller and finally perform the landscaping and the installation of ancillary works.

The construction process of bridge works in road works component includes: cleaning construction site →setting up working platform and construction of cast-in-place pile →closure of bridge structure→ bridge deck pavement.

(2) Wastewater interceptors and other pipe network works

Wastewater interceptors are laid along both sides of Shiba River for the Project.

Rain and wastewater pipe network, laid along Road 1 to Road 5, is constructed at the same time with road works. The construction method for pipe network laying is as follows:

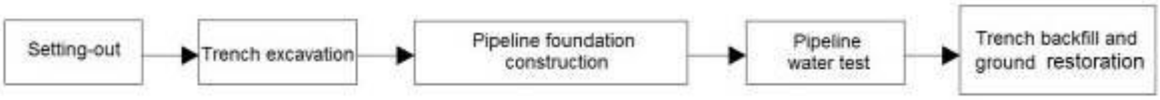


Figure 3.4.2-2 Pipe Network Construction Process

(3) WWTP component

This component is proposed to build new Linshui No. 3 WWTP in Group 3, Xinhe Village, Chengnan Town, Linshui County and new Linshui No. 2 WWTP in Hongdian Village, Chengnan Town, Linshui County. The construction method for WWTP is as follows:

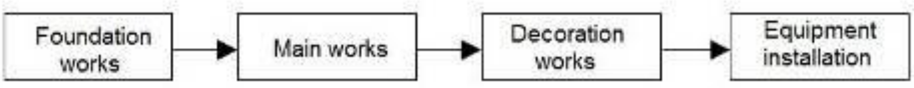


Figure 3.4.2-3 WWTP Construction Process

3.4.3 Temporary works

1. Camps on construction site

Because of the dense population along this works, renting a house from nearby residents for work and accommodation by the construction unit is preferred to avoid new water and soil loss caused by camp building.

Taking into account the impact from the most unfavorable condition during the construction period, road works area will still be included in construction camp area. Based on similar engineering experience and field survey, the proposed construction camp of road works area covers an area of 0.50hm^2. Nearby residential houses are rented for wastewater interceptor works area and Linshui No. 3 WWTP construction camp.

This road works of the Project area is mainly constructed at one prefabrication site and three mixing stations.

2. Construction access road

WWTP works may apply the existing G210 and township road as the construction access road, and new construction access road is not acquired. The traffic in the road works area is convenient and only few new access roads are required to be built at some section to connect the existing road and construction site. The new construction access road of the road works covers 2,900.0m long and 4.0m wide, with an area of 1.16hm^2; while that of the wastewater interceptor works covers 4150.0m long and 4.0m wide, with an area of 1.66hm^2.

Figure 3.4.3-1 Status Quo of Construction Access Road

3.4.4 Construction period and schedule

Construction of the Project is planned to be started in July 2015 and completed in June 2019, with a total duration of 48 months. The construction schedule of the Project is as follows:

Table 3.4.2-1 Implementation Schedule of the Project

SN	Construction Contents		Year 2015				Year 2016						Year 2017						Year 2018						Year 2019		
			7	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6
1	Road works	Construction preparation																									
2		Subgrade works																									
3		Pavement works																									
4		Bridge works																									
5		Landscaping works																									
6	Wastewater interceptor works	Construction preparation																									
7		Pipeline works																									
8	WWTP	Construction preparation																									
9		In-plant works																									
10		Off-site works																									

3.5 Engineering Analysis

3.5.1 Major environmental impacts during the construction period

1. Analysis on pollution production link during the construction period

Adverse environmental impact of the Project is mainly reflected in the construction process, and the EIA of the Project focuses on environmental impact link analysis for different kinds of constructions.

(1) Road works component

Road works and its ancillary works are constructed over the same period in an orderly manner, with construction process as follows: route determination, land acquisition, demolition and relocation → construction site development, materials (earth/stone) transport and mechanical operations → subgrade and trench construction (subgrade, trench excavation and other earthworks/stoneworks) → pavement works construction → pipeline construction (welding, repairing, patching , interface corrosion resistance, etc.) → subgrade and trench overburden backfill → traffic engineering (landscaping works and construction of related facilities). The analysis on the pollution production link of road works is as follows:

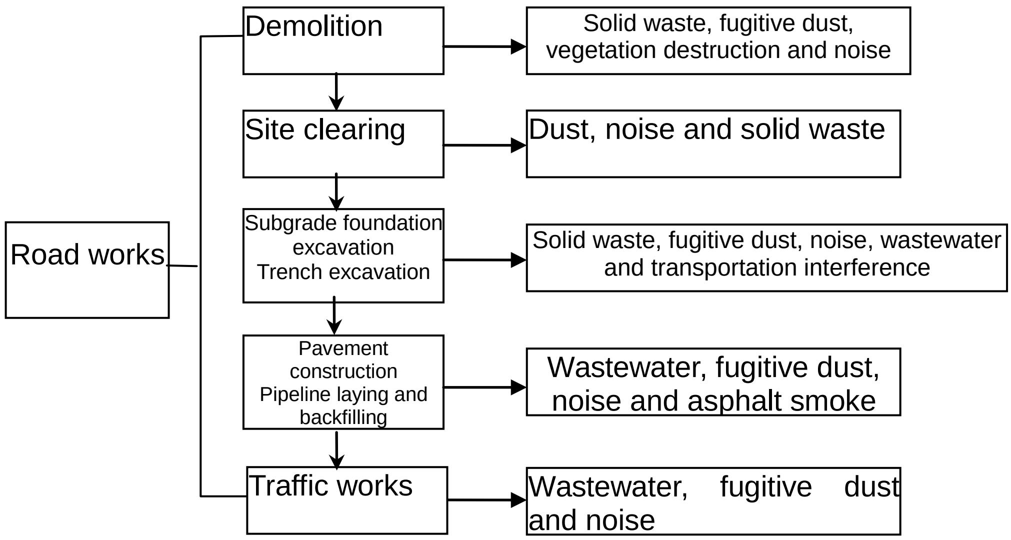


Figure 3.5.1-1 Pollution Production Link during the Construction Period of Road Works

(2) Wastewater interceptor component

In general, the construction process of wastewater interceptors is as follows: construction preparation → survey and setting-out → trench excavation → side trimming and bottom clearing → wastewater and rainwater pipe foundation concrete casting → wastewater and rainwater pipe installation → pipe socket pouring and junction protective band plastering→ closed water test for wastewater well and sampled closed water test for rainwater inspection well → upper trench backfilling → manhole, well cover and well grate installation → ending. The analysis on the pollution production link of wastewater interceptor works is as follows:

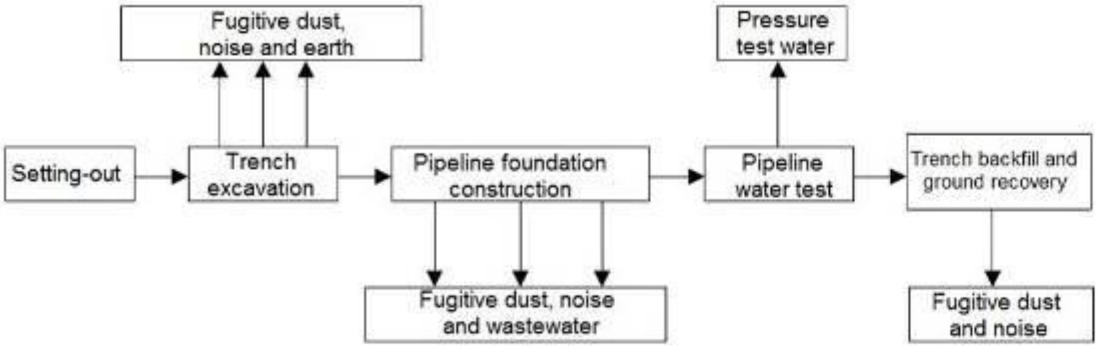


Figure 3.5.1-2 Pollution Production Link during the Construction Period of Wastewater Interceptor Works

(3) WWTP component

The project implementation process includes construction stage (earthworks/stoneworks stage and foundation stage, main works stage, building decoration and ancillary works stage), final acceptance stage and operation phase. The analysis on the pollution production link of WWTP is as follows:

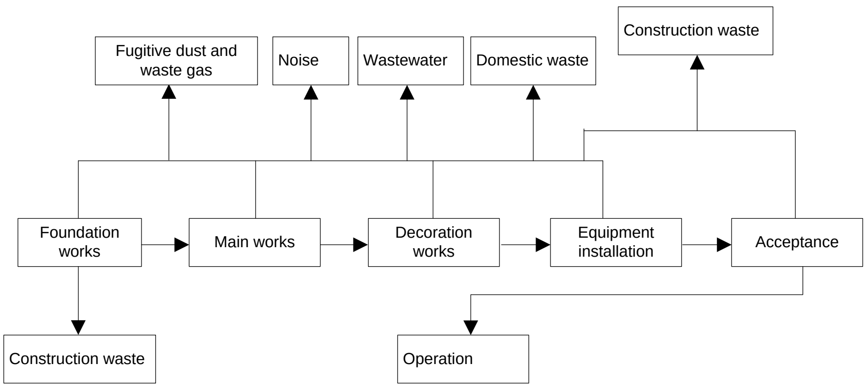


Figure 3.5.1-3 Pollution Production Link during the Construction Period of WWTP Works

2. Analysis on pollution sources during the construction period

See the table below for major environmental impacts during the construction period:

Table 3.5.1-1 Summary of Environmental Impact of the Project during the Construction Period

Environmental Factor	Item Type	**Impact Property**	Environmental Impact
Ecological environment	All items	Short-term, reversible and unfavorable	Permanently and temporarily occupied land for the project impacts nearby cultivated land, forest land, grassland, etc.; Surface vegetation is easy to be damaged in the process of excavation, filling and

Environmental Factor		Item Type	Impact Property	Environmental Impact
				borrowing during project construction, which will increase regional water and soil loss; Construction activities such as excavation destroy the ecological environment of animal habitats, and various construction behaviors disturb wild animals and forced them to leave their original habitats. Wastewater interceptors of the Project are close to “Lingbaoshan Heritage”, so please pay attention to the preservation of cultural relics during construction.
Acoustic environment		All items	Short-term, reversible and unfavorable	Construction machinery and construction vehicles are the main noise sources. The noise generated by construction machinery during construction impacts the surrounding acoustic environment. The noise at the earthworks stage is mainly from the loader and transport vehicles.
Air environment		Fugitive dust during the construction period	Short-term, reversible and unfavorable	Fugitive dust is produced due to soil cement mixing, concrete mixing and vehicle transport during construction.
		Asphalt smoke	Short-term, reversible and unfavorable	Asphalt smoke is produced as a result of pavement.
Water environment	Surface water	All items	Short-term, reversible and unfavorable	Flushing wastewater in the construction area is the main wastewater pollution source during the construction period. Construction personnel produce domestic sewage during construction. Pigging and pressure test discharge wastewater upon pipeline installation.
	Groundwater	All items	Short-term, reversible and unfavorable	Bridge and wastewater interceptors construction exert slight impact on groundwater level. Groundwater quality is impacted by surface water quality.
Solid waste		Demolition waste	Short-term, reversible and unfavorable	Solid waste generated by demolition mainly includes abandoned buildings slag, waste wood, plastic, metal, domestic waste, etc.
		Domestic waste	Short-term, reversible and unfavorable	It mainly relates to the small amount of domestic waste produced by the construction team.
		Road spoil	Short-term, reversible and unfavorable	Excavation will generate spoils. If stored improperly, it may result in water and soil loss, blockage of drainage channels or landscape destruction due to rainwater leaching, thereby impacting the environmental health in the project area.

(1) Analysis on the characteristic of ecological impact

Ecological impact during the construction period is mainly reflected in project area, vegetation destruction, water and soil loss, etc. The land occupied during the construction period is mainly used for construction machinery, temporary construction site and sediment storage yard. The construction of wastewater interceptors, roads and the whole industrial park will destroy the existing vegetation and farmland system, cause damage to the vegetation and reduce crop production, which may have a certain impact on the local residents' income. In addition, because of the project area of road works with large terrain variation and large earthworks/stoneworks, construction will produce water and soil loss, which may aggravate regional water and soil loss.

(2) Analysis on the characteristic of impact on acoustic environment

Various types of machinery, including loader, excavator, bulldozer, concrete mixer, vibrators and heavy crane, will be used for road excavation, pipeline construction, bridge laying and WWTP construction on the construction site. Such machinery is the main source of construction noise. Besides, a large number of transport vehicles will be used for earth allocation and equipment and material transportation during construction. These transport vehicles, especially heavy trucks, feature high noise radiation intensity, so their frequent drive will produce greater interference on the construction site, construction access road and the surrounding environment of existing roads. Please see the table below for noise source intensity and distance attenuation of commonly used construction machinery based on the existing monitoring statistics.

Table 3.5.1-2 Source Intensity of Commonly Used Construction Machinery

Machinery Type	Model	Distance from the Test Point to Construction Machinery (m)	Maximum Sound Level Lmax (dB)
Wheel loader	ZL40	5	90
Wheel loader	ZL50	5	90
Grader	PY160A	5	90
Vibratory roller	YZJ10B	5	86
Dual wheel vibratory roller	CC21	5	81
Three-wheel roller	/	5	81
Tire roller	ZL16	5	76
Bulldozer	T140	5	86
Hydraulic wheel excavator	W4-60C	5	84
Paver (England)	fifond311 ABG CO	5	82
Paver (German)	VOGELE	5	87
Generating unit (2 sets)	FKV-75	1	98
Impact drill machine	22	1	87

(3) Analysis on the characteristic of impact on air environment

The pollution to ambient air during the construction period of the Project is mainly from: a. fugitive dust produced by soil cement mixing, concrete mixing and vehicle transport during construction; and b. asphalt smoke produced by asphalt-concrete mixing process and pavement.

(4) Analysis on the characteristic of impact on surface water environment

The impact is mainly reflected as evaporating, emitting, dripping or leaking waste oil from the construction machinery and a small amount of oily wastewater produced after the outdoor construction machinery being washed by rainwater in the construction area, as well as the impact on water quality by the domestic sewage and domestic waste produced in the residential area of site construction personnel, for example, being discharged into the surface waters by rainwater.

Domestic sewage is mainly from the daily life of construction personnel, and the main pollutants include CODcr, BOD5, etc.

Pigging and pressure test discharge wastewater upon wastewater interceptors and other pipeline installation, and slurry and wastewater are produced during the construction of crossing works.

(5) Analysis on the characteristic of impact on groundwater environment

Construction wastewater and domestic sewage may impact the groundwater during the construction period. If untreated and discharge at will, it will have an impact on the surface water quality, which in turn may impact the groundwater quality. New bridge works is involved in the Project. In addition, earth excavation impacts the groundwater during bridge pier construction, and wastewater interceptor construction precipitation impacts the groundwater as well.

(6) Analysis on the characteristic of impact on solid waste

The Project involves demolition of buildings and structures within the engineering land acquisition range, with a demolition area of 96,807m^2. The solid waste during the construction period mainly includes construction waste (including the waste produced by demolition) on the construction site and a small amount of domestic waste produced by the construction team. Demolition of the Project will generate 6.58 × $10^4 m^3$ of solid wastes, which mainly contain abandoned buildings slag, waste wood, plastic, metal, domestic waste, etc.

In addition, excavation will generate spoils, which may be temporarily stored in the construction site. If stored improperly, it may result in water and soil loss, blockage of drainage channels, landscape destruction or secondary fugitive dust pollution under the action of wind due to rainwater leaching, thereby impacting the environmental health in the project area.

3.5.2 Major environmental impact factors during the operation period

1. Analysis on pollution production link during the operation period

The unfavorable environmental impacts during the operation period mainly occur in road works and wastewater treatment works; the wastewater interceptor works will bring positive effect on the environment. Therefore, the EIA of the Project is focused on the environmental impact analysis on the component of road works and the wastewater treatment plant.

(1) Road transport component

The environmental impact during the operation period mainly includes traffic noise, automobile exhaust impact and the impact of road rainfall runoff on water environment. The following figure describes the main environmental impact link and its environmental impact characteristics during the operation period of the Project:

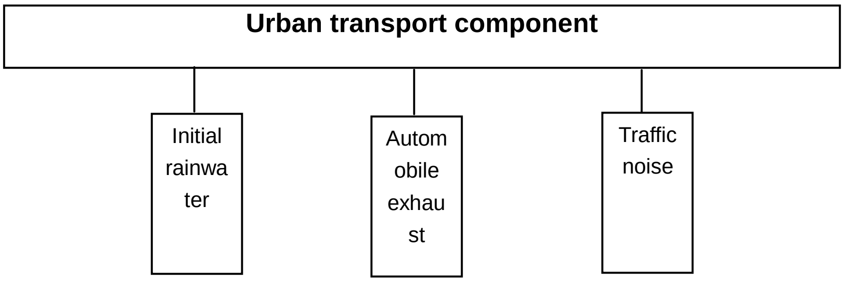


Figure 3.5.2-1 Characteristics of Environmental Impact during the Operation Period of Road Works

The road works improves the regional transportation environment, but traffic noise will exert a certain impact on the planned residential area close to the road after the completion of the road.

(2) WWTP component

Combined process of “coarse grid + fine grid + grit chamber + regulating tank + hydrolysis acidification tank + amended oxidation ditch + rotary filter tank” is adopted as the wastewater treatment process;

Sludge treatment process of “sludge storage pool + Plate-and-frame filter press” is adopted for sludge dewatering, and “ultraviolet disinfection” process is adopted for disinfection. The following figure describes the main environmental impact link and its environmental impact characteristics during the operation period of the Project:

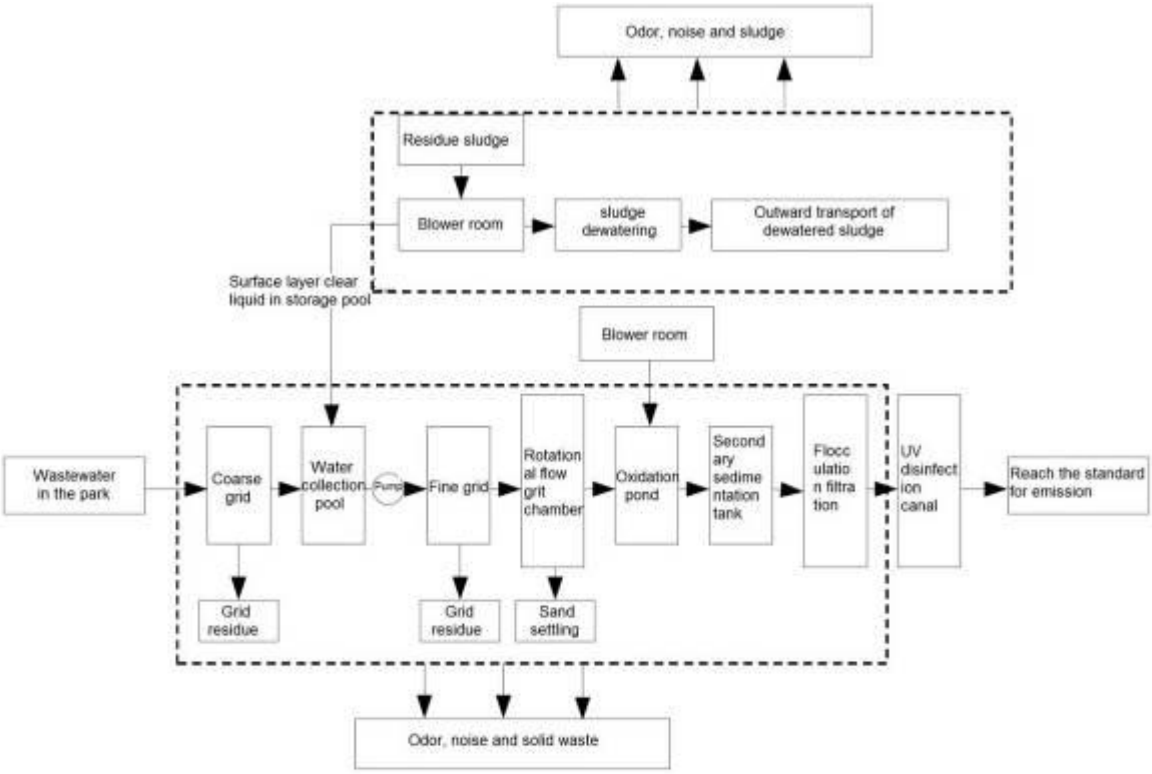


Figure 3.5.2-2 Characteristics of Environmental Impact during the Operation Period of WWTP Works

2. Analysis on pollution sources during the operation period

See the table below for major environmental impacts during the operation period:

Table 3.5.2-1 Major Environmental Impact of the Project during the operation period

Aspects and Elements	Item Type	Environmental Impact
Ecological environment	Road works	Road construction leads to regional landscape reconstruction, and the original topography and rural original ecological landscape are transformed to road landscape and long-term green landscape upon transformation.
Acoustic environment	Road works	After the operation of road works, turbulence caused by the vehicles traveling on the highway and friction between the tire and road surface are the main sources of noise; engine, cooling system, exhaust system, transmission

Aspects and Elements		Item Type	Environmental Impact
			system and other parts of the vehicle may produce noises; and high-speed moving car generates vibration noises due to road surface flatness or other reasons.
		WWTP	Noises are from the operation of equipment, which mainly include wastewater pump, blower, sludge pump, air compressor and centrifugation, thickening and dewatering integration machine.
Air environment		Road works	Automobile exhaust is mainly produced by crankcase leakage and fuel oil volatilization, and most of the NO_2 and CO is emitted from the exhaust pipe. CO comes from the incomplete combustion of fuel, depending on air-fuel ratio and the uniformity of various fuel distributions in the cylinder, while NO_2 is generated by excessive oxygen and nitrogen in the cylinder with high temperature and pressure. At present, unleaded gasoline has been used, so lead impact may be ignored. Car tire moving raises the dust on the road surface, resulting in secondary fugitive dust.
		WWTP	The places with relatively high foul odor value include coarse grid, fine grid, oxidation pond, sludge dewatering pump room and sludge storage tank, in which sludge dewatering pump room and sludge storage tank generate strong foul odor, with main component of H_2S and NH_3.
Water environment	Surface water	WWTP	WWTP tail water discharge impacts the rivers within the project area.
		Road works	Initial road rainwater exerts a slight impact on the river.
	Groundwater	WWTP	Under normal operating conditions, it will not impact the groundwater quality, but may impact the groundwater environment in case of leakage of facilities like wastewater tank.
		Wastewater interceptors and wastewater pipeline network works	Under normal operating conditions, it will not impact the groundwater quality, but pipeline leakage may impact the groundwater environment under abnormal conditions.
Solid waste		WWTP	Grid residue, grit chamber and sludge are produced during wastewater treatment process and domestic waste is produced by WWTP staff.
		Other items	Street refuse is regularly collected to the waste transfer station and finally to Linshui landfill for treatment.

- **Road works**

(1) Ecological landscape impact

Landscaping works at the outer separators of the road or median separator of the road has been considered in road works. Different landscaping will be designed according to different road works to build an urban green corridor and form a colorful street landscape. The rational allocation of landscaping upon the completion of road works will increase the beauty of the city, beautify city appearance and give a comfortable feeling.

(2) Road traffic noise

After the operation of road works, turbulence caused by the vehicles traveling on the highway and friction between the tire and road surface are the main sources of noise; engine, cooling system, exhaust system, transmission system and other parts of the vehicle may produce noises; and high-speed moving car generates vibration noises due to road surface flatness or other reasons.

(3) Automobile exhaust gas emission

Air pollutants mainly cover automobile exhaust, which mainly impacts some area of both sides of the road and bridge where is 60~90m away from the road centerline. The surrounding air quality within the project area is good at present, and moreover, the implementation of road greenbelt may reduce the impact of automobile exhaust on the crops and residents on both sides of the road to a large extent.

See the table below for single motor vehicle emission coefficients.

Table 3.5.2-2 Pollutant Emission Coefficients of Single Motor Vehicles (National IV Standard) Unit: g/km per vehicle

Vehicle Model and Pollutant Type		Emission Coefficient
Small vehicle	CO	1
	NO_2	0.1
Middle-sized vehicle	CO	1
	NO_2	0.2
Large vehicle	CO	1.5
	NO_2	3.5

(4) Characteristic of impact on surface water

Pollution on nearby waters during the operation of road works is mainly reflected as road runoff and gasoline leakage and engine oil pollution on road surface in case of poor vehicle maintenance status, vehicle failure or accident. The road runoff generated after the rainfall may be discharged directly into the river or natural waters, which will result in a slight pollution on waters. Therefore, it is considered to discharge the initial rainwater after being collected for precipitation in the design.

Road construction requires a large area of land leveling, which may impact the drainage path and pattern of natural waters within the scope of construction.

(5) Solid waste

The solid waste during road operation mainly includes a small quantity of transport materials being thrown to the ground during vehicle driving and street refuse.

- **Wastewater interceptors and pipe network component**

Wastewater interceptors and wastewater pipe network will not impact the environment under normal operating conditions. When the wastewater interceptors and wastewater pipe network are completed, the domestic sewage within the LETDZ will be effectively collected to avoid or reduce the domestic sewage seeping into the groundwaters. As such, the operation of the Project has a positive impact on groundwater quality within the project affected area.

If leakage of wastewater interceptors and wastewater pipe network occurs, the wastewater may seep into the ground to pollute the groundwater. According to analogy investigation, if the pipeline breaks, the wastewater may seep into the ground and gradually spread to pollute the groundwater under normal circumstances. The rule is that the closer to the pipeline damage location, the longer and more severe the leakage will be. Therefore, early discovery and early actions are the key to prevent environmental risks.

- **WWTP component**

(1) Ecological landscape

WWTP belongs to environmental protection works itself and WWTP landscape has been considered in the design, in which the landscaping coefficient of Linshui No. 3 WWTP accounts for 40%. “Point, line and surface” combined comprehensive landscaping principle is applied for the organization of landscaping system, in order to create an ecological and landscaped plant area together with the small square, waters and hard ground.

(2) Noise impact

WWTP noise is mainly generated by construction machinery, including various types of pumps, blowers and dewatering machine. According to the analogy survey data, the noise source intensity is shown in the table below.

Table 3.5.2-3 Source Intensity of Various Types of Equipment

SN	Description	Noise Value [dB(A)]
1	Lift pump	80～85
2	Wastewater pump	80～90
3	Blower	85～95
4	Sludge pump	80～90
5	Air compressor	90～100
6	Plate-and-frame filter press	80

*****Data from the *Environmental Impact Report for Chengnan WWTP in Ziyang City*

(3) WWTP odor pollutants

Odor pollutants refer to characteristic air pollutants, also main pollutants, produced by the Project. During WWTP operation, odor pollutants like H_2S and NH_3 will be produced due to the metabolism of microbes, protozoa, bacteria groups, etc., which may bring odor to the surrounding air environment. Based on the process settings of the Project, the odor is mainly produced in the pretreatment zone (wastewater lifting pump room, coarse and fine grid room and grit chamber), biological treatment zone (oxidation ditch) and sludge treatment zone (sludge thickening and dewatering room).

According to the feasibility study, deodorization of the Project is mainly focused on waste gas sealing in coarse grid, lifting pumping room, fine grid and grit chamber with larger odor. After being collected in the pipeline, the odor will be disposed by a set of efficient UV light odor releasing device with air volume of 15,000m^3/h, by which the deodorization and purification effect may achieve more than 99%. Therefore, the concentration of NH_3 and H_2S in the exhaust of biological deodorization device may be ignored. The collection efficiency of biological deodorization system in this assessment is conservatively calculated by 80%, while the other 20% is mainly produced in oxidation pond, sedimentation tank and other treatment units, of which the area of structure is large and not convenient for seal treatment, so such odor emission is unorganized. Analogy source intensity in this assessment applies the air source intensity of non-organized non-point source in the *Environmental Impact Report for Chi’an WWTP in New Wuyi District* having the same treatment technology with Linshui County No. 3 WWTP.

Table 3.5.2-4 Emission Source Intensity of Engineering Odor Pollutants

Structures Name	Source Form	Source size (m^2)	Odor Pollution Source Output	
			NH_3	H_2S
			g/h	g/h
Inorganization	Analogy non-point source	225×206	84	4.152
Oxidation ditch	Non-point source	840	1.52233	0.07525
Secondary sedimentation tank	Non-point source	76	0.13773	0.00681
Rotary filter tank	Non-point source	81	0.14680	0.00726
Sludge tank	Non-point source	24	0.04350	0.00215

(4) WWTP tail water impact

When WWTP operates normally, the effluent quality may achieve Standard A in Urban WWTP Pollutant Discharge Standard (GB18918-2002), so its discharge is qualified; while in case of accidental discharge, untreated wastewater is directly discharged when considering the most unfavorable circumstance. The near and long-term discharge of major water pollutants in such two conditions is shown in the table below.

Table 3.5.2-5 Emissions of Major Water Pollutants of WWTP

Wastewater Volume (10,000m^3/d)	Pollutant	Normal Discharge		Accidental Discharge	
		kg/d	g/s	kg/d	g/s
0.4	COD_{cr}	200	2.31	1200	13.89
	NH3-N	20	0.23	104	1.20
0.8	COD_{cr}	400	4.63	2400	27.78
	NH3-N	40	0.46	208	2.41

(5) Impact on groundwater

The impact on groundwater during the operation period of the Project is mainly from WWTP wastewater leakage or excessive discharge and excessive discharge due to accident or other reasons. It will not only directly impact the quality of the waters receiving wastewater, and the polluted surface waters will seep into the ground through the surface, which will also pollute the groundwater.

Since leakage prevention for all structures, ground and pipe gallery of the Project is fully considered in the design and construction, the wastewater will not seep into the ground during WWTP stable operation, and thereby the groundwater will not be impacted. Maintenance and management of WWTP pipe network and pump station, consideration of alternate equipment in the design and strict control over technological parameters of wastewater treatment units shall be implemented during WWTP operation, in order to avoid accidents.

During normal WWTP operation, the groundwater within the plant will not be impacted.

(6) Solid waste

The solid waste during road operation refers to a small quantity of transport materials being thrown to the ground during vehicle driving. Street cleaning shall be strengthened.

The solid waste produced in WWTP mainly includes residue sludge, grid residue, grit and domestic waste. The estimation of residue production rate during the operation period of the Project, based on the residue production rate of WWTP of the same kind, is shown in the table blow.

The residue sludge discharged from the oxidation ditch and secondary sedimentation tank is dewatered by the filter press dewatering machine to form dewatered sludge, after which the moisture content will be lower than 60%. The sludge includes synthetic organics, parasite eggs, bacteria, pathogens and other environmentally harmful substances. It, with complex composition, is perishable, may turn into fluid state when mixing with water, and is easy to cause secondary pollution on the environmental, so it shall be properly disposed. The residue production rate of the residue sludge is calculated as 1t (dry mud) / 10,000t (wastewater), and the dry mud output is about 146t/a. The dewatered sludge cake will be finally sent to Linshui Urban Domestic Waste Treatment Plant for landfill.

Grid residue is intercepted from the coarse grid and fine grid, with major components including foamed plastic, discarded plastic bag, film, fiber, peel, leaves, paper, wood chip and so on. The grid residue amount is $0.2m^3/d$ and unit weight is $187.2kg/m^3$, with an output of 37.4kg/d and an annual output of 13.7t/a.

Muddy sand is the main component of the grit. Its proportion is larger than that of inorganic residue of water, but moreover, it also adsorbs some organic dirt. The grit amount is $0.08m^3/d$ and unit weight is $1500kg/m^3$, with an output of 120kg/d and an annual output of 43.8t/a.

When taking 11 WWTP staff and 0.8kg/d of domestic waste discharge coefficient, the domestic waste by WWTP staff will be 8.8kg/d, with an annual output of 3.2t/a.

Table 3.5.2-6 Solid Waste Production Amount and Disposal/Treatment Method

SN	Discharging Source	Category	Discharge Amount	Discharge Direction
1	Coarse and fine grid	Grid residue	37.4kg/d, with an annual output of 13.7t/a	Municipal unified collection and transport
2	Grit chamber	Sand	120kg/d, with an annual output of 43.8t/a	
3	Residue sludge	Residue sludge	0.4 t/d (146t/a) Moisture content of 60%	
4	Office life	Domestic waste	8.8kg/d, with an annual output of 3.2t/a	

(7) Risk analysis

Risk pollution incident is mainly reflected as wastewater discharge that may occur during WWTP abnormal operation, which will cause a large number of untreated wastewater to discharge directly into nearby waters, resulting in accidental pollution.

4 Linshui Public Training Center

The Project is merely intended to give financial support to the establishment of Linshui Public Training Center for training materials and teaching equipment procurement, school administrators and teachers training, Linshui enterprise employment investigation. No new teaching buildings or other infrastructures will be built. By doing this, the existing infrastructures of the School can be fully used, realizing the sharing of resources and facilities and avoiding repeated construction and adverse impact incurred on the construction period.

Linshui Public Training Center will be established in Linshui Vocational School, which was established in 1985 and located in No. 25, Jianxin Road, Dingping Town, Linshui County, Guang'an City, with a floor area of 54000m^2 and 185 teaching and administrative staff; the School has developed courses in machinery, electronic information (computer application and computer network technology), public affairs and arts and sports.

After the establishment of Linshui Public Training Center, it will provide a training platform for part of the land-lost farmers, migrant workers and laid-off workers on auto maintenance, computer application and electronic and electrical skills, which is benefit to the development of human resources from Linshui County and the areas around.

The training personnel may have domestic sewage and wastes during the training. However, Linshui Vocational School is located in the treatment scope of Linshui No. 1 WWTP, the domestic sewage of the training personnel will be discharged through the municipal pipeline to Linshui No. 1 WWTP for treatment after pretreatment; and the domestic wastes will be collected and then transported by Linshui Environmental Health Administration Office to the refuse landfill for centralized treatment.

4 Alternative Analysis

4.1 “With Project” or “Without Project” Scenario

When compared with the “Without Project” scenario, the economic, environmental and social benefit of the Project seems to be versatile.

Linshui County is located in the east of Sichuan, the south of which is located on Yubei District of Chongqing, only a 97km’s drive from Jiangbei Airport via Dazhou-Chongqing Expressway and less than 50 minutes’ drive from Yuzhong District of Chongqing. Then, the “One pole, one axis and one block” development strategy of Sichuan Province puts Linshui in the leading position of “One block” to develop with the support of Chongqing. It is clearly stated in the *Regional Planning of Chengdu-Chongqing Economic Zone* issued by the State Council last year that “Sichuan-Chongqing cooperation demonstration areas shall be established in Tongnan (Chongqing) and Guang’an (Sichuan)”, and Linshui plays a leading role among other demonstration areas due to its special regional advantages. So the Project is intended to grasp this good opportunity to implement the relevant government spirits, construct the infrastructures of Chongqing-Guang'an Cooperatively Constructed Electromechanical Industrial Park in LETDZ, Phase 3, perfect urban infrastructures, enhance the function to provide urban services; improve people's living quality and adapt to the develop-the-west strategy for all-round progress of national socio-economic development and social undertakings.

Moreover, the construction of Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area not only can provide the basic material conditions for carrying on the industrial transfer tasks from home and abroad and accelerating the socio-economic development, but also can provide demonstration and reference for underdeveloped areas in western China to facilitate the scientific development and fumble new development strategies with the support of central cities, and it also serves as the useful practice on fumbling the new mode for integrating urban and rural development and coordinating the regional development.

Additionally, the Project is an inevitable choice for improving the opening up image and investment attraction effect of the demonstration area. However, it's still growing on the construction and development way and the supporting infrastructures, comprehensive supporting production factor services and other hard environments are inadequate when compared with other areas. In addition, the competition on attracting foreign investment becomes extraordinarily fiercely since the nationwide ETDZs at all level have intensified the opening up and publicity. In order to play a role in the massive industrial transfer of the coastal development area and achieve real investment attraction effects, in addition to the police environment, supporting industrial facilities, transportation and logistics conditions and labor costs, the investor will pay more attention to the comprehensive service level and comprehensive supporting infrastructures of the LETDZ. According to the existing construction and development of the Demonstration Area, efforts must be exerted to the tangible environment and the supporting infrastructures and public services of the Demonstration Area shall be upgraded to improve the opening up image and increase the attraction to and enhance the confidence of the foreign investors. Thus, the infrastructure construction of the Demonstration Area takes on a high priority in the regional development.

It is clearly stated in the *Overall Construction Scheme for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area* that it is required to construct the Linshui Electromechanical Industry Cooperation Park, Wusheng Agricultural and Sideline Products Processing Cooperation Park, Yuechi Pharmaceutical Industry Cooperation Park and Huaying Electromechanical Industry Cooperation Park, actively carry on the industrial transfer and create a Sichuan and Chongqing connected, coordinated and supported industrial base. The Project will better improve the infrastructure of LETDZ and is necessary to actively accept the industrial transfer, functional extension, element contribution and cultural radiation from the main urban area and Liangjiang New Area of Chongqing, create a half-hour traffic circle and an economic circle highly integrated with Chongqing with seamless communication and promote the industrialization and urbanization development.

The LETDZ is located in the south of the downtown of Linshui, which is the only way that must be passed when you go to Chongqing from the old downtown of Linshui and the new downtown in western Linshui. According to the *General Planning of Linshui County Downtown*, it is planned to build three expressway outlets around LETDZ, namely West Linshui Outlet of Shanghai-Chengdu Expressway, East Linshui Outlet of Shanghai-Chengdu Expressway and South Linshui Outlet of Dazhou-Chongqing Expressway, of which West Linshui Outlet of Shanghai-Chengdu Expressway and South Linshui Outlet of Dazhou-Chongqing Expressway will be constructed and put into operation in 2015. With the completion of the above expressway outlets, the traffic volume from Linshui to Chongqing will be extremely increased and that of the LETDZ will see an explosive increase. The Project will improve the traffic condition of LETDZ and meet the increasing traffic demand.

Since the constructed roads of the LETDZ are mainly concentrated in the northeast, and with the approval of *Overall Construction Scheme for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area*, an increasing number of enterprises have been resided in LETDZ, which makes the available land in the constructed area be in such a deficiency. Therefore, the south of the LETDZ will become the next development zone attached with great importance.

The West Ring Road of LETDZ is the main access connecting Shanghai-Chengdu Expressway and Dazhou-Chongqing Expressway, which is being constructed by the Linshui Transport Bureau and will be completed and put into operation in 2015; the city entrance avenue is the main access connecting the old downtown of Linshui and Dazhou-Chongqing Expressway and the unconstructed sections of the city entrance avenue and the Dazhou-Chongqing Expressway are being constructed by the Management Committee of LETDZ and will be completed in 2015.

The proposed Road 1 and West Ring Road is an importance access that connects LETDZ and the new downtown in western Linshui, while the other proposed roads will be connected to the proposed roads during 2014~2015, which makes up the main road network of the south of LETDZ. In general, the roads of the Project will better improve the urban road and traffic network structures, the traffic condition for residents along the roads and the traffic organization of the entire road network after completion.

Rainwater and wastewater combined system is adopted by the majority of drainage systems in the constructed area of LETDZ, where the wastewater directly flows into the Shiba River without treatment, producing serous pollution to the environment of the LETDZ. During the Project, the constructed area of LETDZ will be subject to the transformation of rainwater and wastewater diversion system, which will directly improve the pollution of main watercourses within the Park. Since the LETDZ and the old downtown are separated by the Shanghai-Chengdu Expressway, the wastewater from the LETDZ cannot be collected to the existing WWTP. According to the *Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown*, two WWTPs are planned to be established in the north and south of LETDZ. In case the wastewater from the north of LETDZ is directly discharged into the Shiba River without treatment, which will produce serious pollution to the Shiba River. In the Project, two wastewater interceptors will be laid on both sides of Shiba River and the wastewater will be collected to the proposed Linshui No.2 WWTP (planned to be completed in 2015) for treatment, which will greatly improve the environment of the LETDZ and reduce the pollution of Shiba

River. In general, the construction of the Project will greatly improve the living environment of residents in the LETDZ, reduce environmental pollution and improve the people’s living standard.

To sum up, Linshui will be faced with multiple opportunities and enter into the "Golden age” of development acceleration in the next 5 years. On the one hand, as the significant base of “National Western Demonstration Area Embracing Industrial Transfer”, Linshui meets the opportunity of embracing the massive industrial transfer; on the other hand, Chengdu-Chongqing Economic Zone takes on a high priority in the national develop-the-west strategy, so Linshui certainly will meet the opportunity of massive regional development. Therefore, it is urgent to accelerate the Infrastructure Project for Chongqing-Guang’an Cooperatively Constructed Electromechanical Industrial Park in LETDZ, which satisfies the requirements of the *General Planning of Linshui County Downtown* and *Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown* and is essential and feasible.

4.2 Alternative Analysis of WWTP

1. Alternative analysis of plant site

Through repeated survey of the Designer and the local government, two sites are selected, namely Group 3, Xinhe Village, Chengnan Town, Linshui County (site 1) and Group 5, Shitai Village, Moujia Town, Linshui County (site 2); the alternative analysis is shown as follows:

For the status quo of site 1, it is located on lower south side of LETDZ, being on the downstream, adjacent to Danshuitan River, on the downstream of site 2, with a ground elevation of 298.0-320.0m;

For the status quo of site 2, it is located on lower south side of LETDZ, being on the downstream, adjacent to Mazi River, with a ground elevation of 298.0-309.0m;

Site 1: Group 3, Xinhe Village, Chengnan Town, Linshui County

Site 2: Group 5, Shitai Village, Moujia Town, Linshui County

Table 4.2-1 List for Alternative Analysis of Plant Site

SN	Item	Site 1	Site 2
1	Traffic	Convenient	Convenient
2	Drainage condition	Convenient to drain into the Bajiao River	Convenient to drain into the Bajiao River
3	Land area	With large available area and land for expansion	With limited available area
4	Demolition	Nearly without demolition	With numerous residents and

SN	Item	Site 1	Site 2
			massive demolition
5	Site	With high terrain and great difficulty in land preparation	With high terrain and great difficulty in land preparation
6	Flood control	With high terrain, meeting the flood control requirements	With high terrain, meeting the flood control requirements
7	Comprehensive analysis	Better	Worse

According to the above analysis, the land areas of the sites are limited due to the terrain. However, considering from socio-economic benefits, urban development and environmental protection, site 1 (Group 3, Xinhe Village, Chengnan Town, Linshui County) is more suitable for constructing the No. 3 WWTP, so it is selected as the WWTP site in the design.

2. Alternative Analysis of Receiving Water

The WWTP is adjacent to the Danshuitan River, which is a primary branch of Bajiao River, originating in the Huaying Mountain in the west of Linshui County, and flows into Bajiao River in Niulaojie of Moujia Town. The flood season is from May to October, during which the precipitation makes up 81% of that of the whole year, while the dry season is from November to the next April, during which the precipitation makes up 19% of that of the whole year; the annual runoff is exceedingly uneven, with a coefficient of variation in the annual discharge of 0.37, having great inter-annual changes. The Tanshuidan River flows into Bajiao River at about 1.5km from the downstream of the proposed WWTP.

Bajiao River originates in Dazhu County and runs through Xicao, with a catchment area before boundary of 1787.97km^2, length of section within the County of 100.5km, average discharge of 31.3m^3/s over years; the average discharge for the assessed section is 28.3m^3/s over years.

Table 4.2-2 Comparative Analysis of River Conditions

SN	Item	Danshuitan River	Bajiao River
1	Discharge	Branch, with low discharge	One of the three large rivers in Linshui County, with large discharge
2	Discharge in dry season	With great changes in discharge and nearly without discharge in the dry season	With large catchment area before the boundary and with large discharge in the dry season
3	Environmental capacity	Low	High
4	River section	Small	Large
5	Distance from the WWTP	Near	Far
6	Conclusion	Unsuitable for being receiving water	Suitable for being receiving water

According to the comparison in the above table, Bajiao River is selected by the Project to be the receiving water for the No.3 WWTP, which discharges the tail water to the Bajiao River through drainage pipes. The tail water discharge pipes are laid along the Danshuitan River, ultimately into the Bajiao River, with pipe length of 2650m and pipe diameter of DN600. **3. Alternative analysis for process of WWTP**

(1) Alternative analysis for biological treatment process

Industrial wastewater makes up the majority of the wastewater within the LETDZ, where the enterprises include machining, electronic industry and food processing, the wastewater discharged by which contains a large quantity of nitrogen and phosphorus contaminants, so the Project requires to eliminate the organics and have the nitrogen and phosphorus removal, and the FSR proposes three biological treatment processes.

Table 4.2-3 Comprehensive Alternative Analysis of Wastewater Treatment Processes

Content	Option I (modified oxidation ditch process)	Option II (A^2/O process)	Option III (food chain reactor)
Characteristic	With strong resistance to impact load. With stable sludge, being easy for treatment. With sophisticated process.	With high oxygen utilization when blower is used for oxygen supply and fine bubble aerator for aeration. With sophisticated process and rich operation experience.	With small floor area, low energy consumption, small sludge production and beautiful appearance.
System composition	Oxidation ditch	A/A/O, fine bubble aerator and blower room	food chain reactor
Aeration efficiency	Stable	High in the early and dropped after operation	High in the early and dropped after operation
Operation management	With few equipment, being easy and convenient for management.	With plenty of equipment and structures, being complicated and highly-required for operation management.	With integrated equipment, being convenient for management.
Equipment and maintenance	With single type of and few equipment, being convenient for maintenance and management.	With a wide variety and large quantity of equipment, with complex pipes of aeration system, highly-required for aeration head construction and with a large number of maintenance. Underwater operation needed in aerator maintenance, being extremely difficult for replacement	Being convenience for maintenance and management and the plants being easy for planting.
Investment	With small investment in equipment and structures	With large investment in equipment and structures	With high one-time investment
Energy consumption	Low	Low	Low
Disadvantages	With relatively large floor area	With large floor area and long flow path.	Being a patented product, having some technologies being undisclosed; with long growing duration for plants in winter.

According to the above techno-economic comparison and demonstration in process mechanism, flow, characteristics, parameters, main works and comprehensive factors, the modified oxygen ditch process is proposed as the biological treatment process of the Project.

(2) Alternative analysis for outlet sterilization treatment

According to the *Notice on Printing and Distributing the Technological Policy for Treatment of Municipal Sewage and Pollution Control* issued by SEPA and MOST (CJ [2000] No. 124) and *Urban WWTP Pollutant Discharge Standard* (GB18918-2002), the WWTP shall be equipped with sterilization facilities to sterilize the water outlet.

The sterilization method can be divided into two categories, namely, the physical method and chemical method. The physical method mainly includes heating, freezing, irradiation, ultraviolet ray, microwave sterilization. The chemical method is to sterilize with various chemical agents and the frequently used chemical sterilizers include various oxidizing agents (such as chlorine, ozone, bromine, iodine and potassium permanganate), some heavy metal ions (such as silver and cuprum) and cationoid surfactant.

Table 4.2-4 Comprehensive Comparison of Frequently Used Outlet Sterilization Technologies

Item	Liquid Chlorine	Chlorine Dioxide	Sodium hypochlorite	Ultraviolet Ray
Sterilization effect	Good	Good	Good	Better
Formation of THMs (cancerogenous substance)	Distinct	None	None	None
Time in water	Long	Long	Long	Short
Continuity of sterilization effect	Available	Available	Available	None
Sterilization speed	Medium	Fast	Medium	Fast
Dose used in equivalent conditions	More	Little	Common	—
Water treatment	Large	Large	Large	Large
Scope of application	Wide	Wide	Wider	Wide
Effect of ammonia	Great	None	Common	None
Raw materials	Accessible	Accessible	Accessible	—
Convenience for management	More convenient	Convenient	Convenient	Convenient
Operational safety	Unsafe	Safe	Safest	—
Degree of automation	Common	Higher	Higher	High
Investment	Low	Common	Low	High
Equipment installation	Convenient	Convenient	Convenient	Convenient
Floor area	Large	Common	Common	Small
Maintenance work	Light	Light	Light	Common
Power consumption	Low	Common	High	High
Operating costs	Low	High	High	Low
Maintenance costs	Low	Low	Low	High
Secondary pollution	Common	Minor	Minor	None
Comprehensive assessment	Better	Better	Good	Better

Sterilization technologies shall be used to control the quality of water outlet in the wastewater treatment process of the Project; through the introduction and analysis and discussion on the several common wastewater sterilization methods mentioned above, and considering the applicability in wastewater sterilization, the maturity, safety and reliability in project application, convenience and accessibility in operation and treatment costs, ultraviolet ray sterilization process is recommended to be used in treating the wastewater from the No.3 WWTP.

(3) Alternative analysis for sludge treatment

Minimization is the primary method that shall be used to treat the sludge from the No. 3 WWTP, through which the sludge will be thickened and dewatered (water content of sludge cake＜ 60%), and then the sludge cake will be delivered to the outside for filling. According to the development of sludge treatment technology in recent years, the current methods to minimize the volume for sludge treatment include the followings:

Table 4.2-5 Alternative Analysis for Sludge Treatment

SN	Item	Option I Gravity Thickening and Mechanical Dewatering	Option II Mechanical Thickening and Dewatering
1	Number of structure	Sludge thickening tank Dewatering machine room	Sludge storage tank Sludge thickening and dewatering machine room
2	Main equipment	Peripheral dive thickener Dewaterer Chemical adding device	Air agitation Thickening and dewatering machine Chemical adding device
3	Installed power	Small	Small
4	Dosage of flocculent	3.0~3.5kg/T.DS	3.0~5.0kg/T.DS
5	Environmental impact	The sludge thickening tank is provided in the open air, with large exposed area, and the odor is bad for the environment, with large cover adding and deodorization works.	The sludge thickening tank is covered, with small exposed area, and the odor has little impact on the environment, with small cover adding and deodorization works.
6	Total costs of civil works (CNY 10,000)	High	Low
7	Total equipment costs (CNY 10,000)	Low	High
8	Total construction costs (CNY 10,000)	Slightly high	Common
9	Operating costs	Low	Common
10	Total floor area	Large	Small
11	The applicability in marketization and industrialization of environmental protection industry	Strong	Stronger
12	Secondary pollution to phosphorus in the residual sludge	With pollution, anaerote and phosphorus release and the supernatant requiring treatment	Without pollution
13	Overall advantage	With small installed power Small dosage of flocculent being mature and reliable on operational management With strong long-term coordination	With small floor area Low costs on civil works Being fully-closed, with good operation environment Without anaerote and phosphorus release in the residual sludge
14	Overall disadvantage	With large floor area With large area affected by the odor from gravity thickening tank and large cover adding and deodorization works With anaerote and phosphorus release in the residual sludge and supernatant requiring phosphorous removal	With large installed power Large dosage of flocculent High equipment costs

As biochemical sledge makes up the most of sludge in the Project and anaerobic fermentation is easy to occur, if sludge thickening tank is used to thicken the sludge, anaerote and phosphorus release will occur, which may lead to secondary pollution and increase the difficulty in phosphorous removal for the wastewater treatment system. Therefore, considering the particularity of the Project, Option II is recommended in the Design and mechanical thickening and dewatering integrated process will be adopted to dewater the sludge.

4.3 Alternative Analysis of Road

The road network structure of the LETDZ has been planned and the road orientation and width all have been determined, so the alternative analysis will be made only to the works for Road 1 intersecting Shanghai-Chengdu Expressway.

1. Intersecting options

Two options may be considered in the intersection of Road 1 and Shanghai-Chengdu Expressway, namely, undercrossing the Shanghai-Chengdu Expressway with frame bridges, and overcrossing the Shanghai-Chengdu Expressway with girder bridges.

In case of undercrossing, in order to ensure the design clearance of Road 1, its design elevation shall be reduced, through which a violation may occur when the design elevation of the undercrossing frame inlet and outlet are linked up with the planned design elevation. In this case, half of the expressway shall be closed, which will be a great disturbance to the driving on the expressway.

In case of overcrossing, the design elevation of Road 1 can be well linked up with the planned design elevation provided that the clearance of expressway is ensured. In this case, the expressway shall not be half-closed.

In general, considering the construction difficulty and the impact on the traffic of Shanghai-Chengdu Expressway, Road 1 overcrossing Shanghai-Chengdu Expressway

2. Structure scenarios

Option I: Hoisting precast hollow slab girder

1) General layout (including structural design, cross-section arrangement and control factors for longitudinal section)

The overall subgrade width of Road 1 is 40m, the median separator width is 3m; the bridge is divided into left and right frame with both width of 18.5, the width of bridge floor and subgrade are equal. And the roadway composition of bridge floor is consistent with that of the subgrade.

The pavement width of the Shanghai-Chengdu Expressway is about 25m; the Expressway intersects the Road 1 with an angle of 17.5°. Two-span arrangement is adopted for the bridge and precast hollow slab girder is used, with a span of 2×20m. Butt straps are provided behind the bridge abutment to connect with the subgrade. The overall length of the bridge in this option is 50.06m.

2) Structural design

Hollow slab girder is used for the upper structures, with a span of 20m, height of 0.95m, standard width for the central edge of 1.24m and standard width for side slab of 1.745m. Pile-connected capping beam and pile pier are adopted for the lower structures, having a cast-in-place pile foundation with a diameter of 1,5m. The pier is located in the median separator of the expressway. U-shaped bar connected pile foundation is adopted for the bridge abutment, having a cast-in-place pile foundation with a diameter of 1,2m. The bridge structure is continuous at the pier and expansion joints shall be provided on the bridge abutments. Butt straps shall be provided on the back of the abutments. After division, the joint between the abutments shall be backfilled with mortar rubbles to avoid soil leakage in the subgrade and settlement joint shall be provided on the abutment bodies.

3) Construction process

In this option, the left and right frame will be constructed simultaneously. During foundation excavation of bridge abutment and pier, temporary protection measures such as steel sheet pile shall be adopted to avoid subgrade collapse of expressway. During the construction, the disturbance of machines on the subgrade shall be minimized and rainy season construction shall be avoided to prevent collapse. The specific process is shown as follows.

(1) Backfill the right side of the expressway subgrade, i.e. the large-mileage end of Road 1, and the backfilling height shall be parallel with the pavement of expressway;

(2) Excavate the pile foundation pit slot of the abutment combined with standard pipe crest elevation, construct the pile foundation of the abutment and precast the prestressed hollow slab girder in batches;

(3) Erect formwork, bundle rebar and pour capping beam of abutment on site.

(4) Erect the prefabricated hollow slab girder, pour the auxiliary facilities such as hinge joints and bride deck system and construct the butt straps on the back of the bridge abutment.

Option II: Integrated cast-in-place rigid frame bridge

1) General layout

Similar as Option I, the width of rigid frame bridge and standard cross-section of subgrade are equal. A 3cm settlement joint shall be provided at the median of the median separator. Two-hole rigid frame bridge with a span of 16m shall be adopted, the central pier of which shall be provided on the median separator of the expressway. The overall length of the bridge in this option is 35.6m.

2) Structural design

The two-hole rigid frame bridge has a hole diameter of 16m and the two holes shall be constructed simultaneously. The thickness of roof is 1.2m and the length of the central pier and abutment pier are 1,2m. The width of the upper ribbed bar is 1,95m with a height of 0.65m. Platform bearing pile foundation shall be used; a 30cm × 30cm chamfer shall be provided at the junction between the rigid frame bridge and the bearing platform; 1.2m cast-in-place pile shall be provided at the abutment pier, while 1,5m cast-in-place pile shall be provided at the central pier. In addition, 3cm settlement joint shall be provided in the middle of the rigid frame bridge.

3) Construction process

The precautions are similar as those in Option I, and the specific process is shown as follows:

(1) Backfill the right side of the expressway subgrade, i.e. the large-mileage end of Road 1, and the backfilling height shall be parallel with the pavement of expressway;

(2) Excavate the pile foundation pit slot of the abutment combined with standard pipe crest elevation and construct the pile foundation and bearing platform;

(3) Erect formwork, bundle rebar and pour abutment pier and central pier.

(4) Erect full framing, reserve traffic channel for expressway under the framing, erect formwork, bundle rebar and pour the roof;

(5) Construct the auxiliary facilities such as bridge deck system and the junction between the abutment pier and subgrade shall be backfilled with graded broken stones.

3. Alternative analysis

As for construction process, both of the options are sophisticated processes without special structures.

According to the comprehensive consideration of the impact of construction on the expressway, during the upper structures construction of Option I, only one lane of the expressway will be occupied in the construction of pier 1, with little disturbance to the access of traffic on the expressway. The slab girder can be precast during the construction of lower structures, with short construction period. During the hoisting of girder, the expressway occupation limit is also small, which ensures the traffic safety.

In case of Option II, after the completion of lower structures, the rigid frame pier shall not be poured until the concrete strength reaches 70%, which is the same in the roof pouring. A lane of express will be occupied during the construction of Piers 1 and 2, with a longer construction period than that of the Option I. The full framing erected during the roof pouring has a big disturbance to the traffic on the expressway and will impact the traffic safety.

Through comprehensive comparison of the structures, construction period, construction complexity for the above options, Option I, hoisting precast hollow slab girder shall be the recommended option for the design.

5 Investigation and Assessment of the Exiting Environment

5.1 Physical Environment

1. Geographic location

Linshui County is located on the west edge of Paralleled Ridge Valley of East Sichuan, with a geographic coordinates of (106°41′~107°18′ E, 30°01′~30°33′ N). It is on the Dianjiang River and Changshou County from the northeast and adjacent to Guang'an District and Huangying City from the west, next to the Jiangbei District from the south and opposite to the Dazhu County from the north. The width from east to west is 59km; the length from south to north is 57.5km; the County covers an area of 1919km^2, with a total population of about 976,200, having 18 towns and 27 townships; the county government resides in Dingping Town. It is about 90km from the south to Chongqing and 120km form the north to Dazhou.

2. Landform

Linshui County is located in the center of the landform area of Paralleled Ridge Valley of East Sichuan, classified as the landform alternated with mountain ridges and U-shaped valleys, the west of which is Huaying Mountain Chain, the middle of which is Tongluo Mountain and the east of which is Mingyue Mountain, forming the landform of “three mountains mingled with two U-shaped valleys”.

It is high in the north and low in the south, and low and medium-sized mountains and hills make up the majority of the landform, of which 745km^2 is mountain, making up about 38% and 1190km^2 is hill and flatland, making up about 62%. The mountain altitude within Linshui County is usually 290m~420m, of which the highest point lies in the main peak of Huangying Mountain, Gaodeng Mountain, with an altitude of 1704m and the lowest point lies in the Xiaonanhai Valley of Bajiao River in the south of Yulin Town, with an altitude of merely 185m.

The planned area is located in the western U-shaped valley of the “three mountains and two U-shaped valleys” of Linshui County, where shallow hills make up the most of the landform units and the micro-relief units are mainly (mild) slope, low and rounded hills and U-shaped valleys in mountains.

3. Geology

Linshui is located in the west of the East Sichuan Concave Fold Bundle and

Mesozoic formation is the primary exposed formation. Paleozoic and Quaternary formations are rare and upper Silurian system, upper and lower Carbon system and Devonian system are lacking. The county downtown is surrounded by low and mild open valleys. The mountain is made up of Bailong formation of Cretaceous system and the downtown is located on the Holocene alluvium of the Quaternary system (Q4), forming a distinct dual structure by the upper clay sand and lower sand gravel and cobble, with a thickness of 2~18m. The foot of hills and platform around the front of the county are made up of shallow alluvium clays and clay sands, with a thickness of 1~7m.

The county is made up of U-shaped valleys, hills and some flatland, with an average altitude of about 358m. It is located in the syncline hilly area of Linshui between the anticlines of Huangying Mountain and Tongluo Valley. In the syncline U-shaped valley, siltstones from middle and lower artesian well of Jurassic system as well as red formation of upper and lower middle Shaximiao Formation. The basic earthquake intensity is VI. Ordinary buildings are classified as VI and earthquake prevention area shall be provided, and earthquake protections shall be provided for the important buildings and works according to the magnitude as required by the specifications.

4. Climate and weather

Linshui County enjoys the subtropical monsoon climate, warm and moist, with abundant precipitation, characterized by the early spring and long summer, continuous autumn rains and warm and foggy winter. The average temperature is 16.5℃~17.5℃ over years, the extreme minimum temperature is -3.8℃ (January 8, 1961) and the extreme maximum temperature is 40.5℃ (August 23, 1959). The annual average frost period of the whole district is 40-70 days, and the average relative humidity is 84% over years. According to the precipitation data observed by Linshui Meteorological Station from 1971 to 2005, the annual average precipitation of Linshui is 1039.8mm over years, the maximum annual average precipitation is 1292.8mm (1998) and the minimum annual average precipitation is 754.4mm (1997). The average monthly precipitation is imbalance over years, with distinct seasonality. The precipitation mainly concentrates in May ~ September, making up over 70% of the annual average precipitation over years. The maximum 50-year annual precipitation is 1551.4mm, the maximum daily precipitation is 286.1mm and the maximum continuous precipitation is 386.5mm.

Seen from the contour map of annual average precipitation of Linshui County over years, the maximum annual average precipitation of the County over years (≥1200mm) presents at the medium-sized mountain area of Huangyang Mountain in the west of Sihai Township and the medium-sized mountain area of Mingyue Mountain in the east of Liangshan Township, while the minimum annual average precipitation of the County over years (≤1050mm) presents at the U-shaped valleys and hilly areas in the south of Jiufeng Township, the west of Yaotan Town and the east of Zizhong Township. The annual average precipitation of the rest areas over years increases zonally from the center, Tongluo Mountain to the east and west edges.

According to the ground meteorological data statistics of Linshui area over years, the calm wind frequency in all seasons is 20.3~76.0% and the dominant wind direction is NE.

5. **Biological resources**

The plants in Linshui County mainly include pinus massoniana, cunninghamia lanceolata, cupressus funebris, german oak, quercus aliena blume, citrus medica L., angiospermae, birch and wild cherry. Phyllostachys bissetii makes up the most of the bamboo forest and the trees in the zonally distributed brushwood in mountain areas mainly include camellia, litsea cubeba and V. crassifolium Rehd. There are 164 herbaceous plants, which are densely distributed on the slope, with a height of 70~150cm and a degree of coverage of over 90%. It is surrounded by continuous mountains, which is suitable for animals to breed, including colored fox, wild cat, fawn, fox and squirrel and sparrow, garrulax canorus and white crane are common in shallow hills and flatland.

The LETDZ is adjacent to the built-up urban area of Linshui County, greatly influenced by human activities, where crops and the common arbor, shrub and vegetation and the plants all around make up the major vegetation and where the rare animals, plants and ancient famous trees are not required to be protected. The animals mainly include poultry livestock and rare animals and plants not requiring special protection.

6. Water resource

(1) Surface water

Linshui County enjoy a dense hydrographic net, where the water systems are classified as the Yangtze River Basin and the rivers from the west to east include trunk stream Yulin River, Baishui River and Dahong River, of which Yulin River is also called as Bajiao River and Dahong River is called as Donghe River. The river direction in Linshui County is from the northeast to the southwest, with a parallel trend.

Bajiao River originates in Yunwu Mountain Great Lake in Qingshui Township of Dazhu County. It enters from Taihe Township of Linshui County and flows to Xiluotan of Zizhong Township from the south of the western U-shaped valley, traversing Tongluo Mountain. After that, it flows to Yaotan Town to join with the Baishui River and then leaves Linshui County and enters Chongqing, where it joins with Dahong River at the river mouth in Zhongping Township of Jiangbei County, Chongqing and flows into Yangtze River at Dahonggang in Yubei District of Chongqing. The length of river in the entire basin is 147.35km, of which the river in Linshui County makes up 100.5km.

Bajiao River flows from North to South on the east of LETDZ, serving as the receiving water thereof. With an average width of 50m and an average discharge of 31.3m^3/s over years, the river has an average discharge of 28.3m^3/s over years at the assessed segment; by analyzing hydrologic data in recent decade, the monthly average discharge should be 4.38 m^3/s at 90% guaranteed during dry season with 485m natural head and 9.19‰ average gradient. The highest ever-known discharge is 6466 m^3/s and highest water level is 198.88m.

City moat (Xiaoxi River) is the primary tributary of Bajiao River and flows from the north to the south of downtown of Linshui, serving as the master receiving water of the built-up urban area, with a length of 21.25km in Xiaoxi River and an annual average discharge is 2.07m^3/s over years, joining with the Bajiao River at the suburbs.

Being a tributary of Xiaoxi River, Shiba River flows through Xitian Township, Chengnan Town and other towns and townships in Linshui County and flows into Xiaoxi River at Lingbao Mountain of Chengnan Town, with average discharge of 0.44m^3/s over years.

Danshuitan River is a primary tributary of Bajiao River, originating in the Huaying Mountain in the west of Linshui County, and flows into Bajiao River in Niulaojie of Moujia Town. The flood season is from May to October, during which the precipitation makes up 81% of that of the whole year, while the dry season is from November to the next April, during which the precipitation makes up 19% of that of the whole year; the annual runoff is exceedingly uneven, with a coefficient of variation in the annual discharge of 0.37, having great inter-annual changes. The Tanshuidan River flows into Bajiao River at about 1.5km from the downstream of the proposed WWTP.

Bajiao River serves as the receiving water of the LETDZ and the function of assessed section mainly includes irrigation and other ordinary industrial and agricultural water through investigation. The cross-section where Bajiao River leaves Sichuan Province and Linshui County is at 45km from the downstream of drain outlet of Linshui No.3 WWTP; the confluence from Bajiao River and Yangtze River is free of integrated portable water intake and other environmental protection targets.

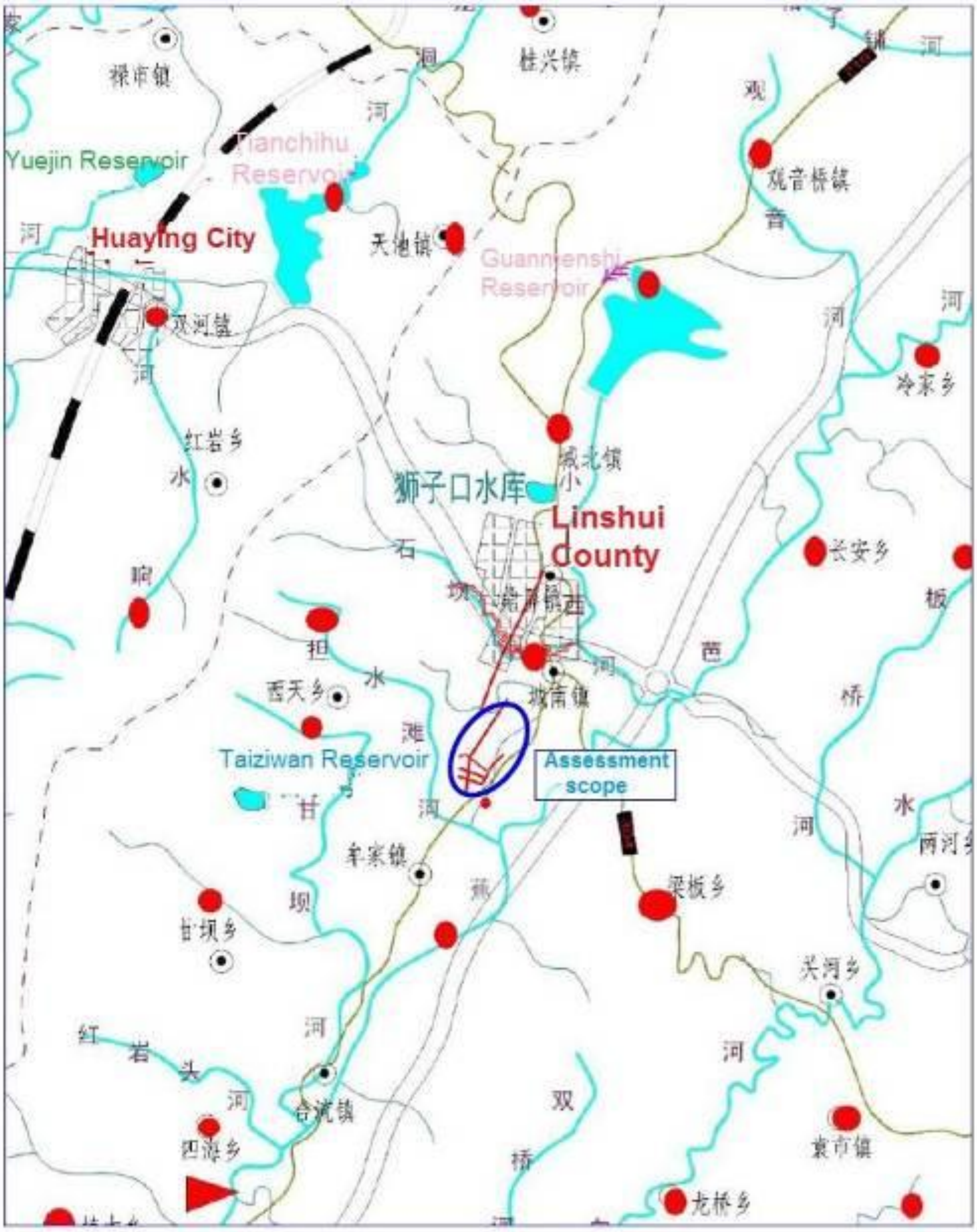


Figure 5.1-1 River System Diagram of Linshui County

(2) Groundwater

The groundwater of the assessed area is divided into two categories according to the water-bearing media and occurrence condition, namely, clastic rock pore-fissure water and bedrock fissure water.

1) Clastic rock pore-fissure water

The groundwater in east of Linshui County is classified as red bed confined water from the clastic rock pore-fissure water. The spring discharge is generally 0.005-0.376L/s and yield of single well is 100-500t/d, which is classified as the area with medium water yield according to the water yield property.

The supply, runoff, discharge of such groundwater is related with the spatial distribution and hydraulic connection of water-bearing formation and the landform and terrain of the distribution area. The water-bearing formation is exposed as parallel strip in N-NE direction and deflects to the syncline side under the ground, forming the multi-layer artesian slope formation. The groundwater of the planned area does not have a uniform regional direction and is supplied mainly by atmospheric precipitation; all natural groundwater exposures, manual wells, springs and pools are the **discharge and circulation approaches of such groundwater**.

2) Bedrock fissure water

The groundwater in the west of Linshui County is classified as weathered zone network fissure water from the bedrock fissure water. The spring discharge is generally 0.11~1L/s, classified as the area lacking of water yield according to the water yield property.

The bedrock fissure water is mainly supplied by the atmospheric precipitation and the supply condition is controlled by factors such as fissure development degree, landform and terrain features, precipitation and surface water distribution.

5.2 Socio-Economic Conditions

5.2.1 Socio-economic status of Guang’an City

Located in the east of Sichuan Basin, being one of the seventeen prefecture-level cities under the jurisdiction of Sichuan Province, Guang’an is not only the hometown of Comrade Deng Xiaoping, the general designer of the reform of opening up and the socialist modernization, but also the significant part of the Chengdu-Chongqing Economic Zone, called as “Portal of East Sichuan”. In July 1998, Guang’an City was founded, having jurisdiction over Guang’an District, Yuechi County, Wusheng County and Linshui County, administrating Huangying City. In February 2013, Qianfeng District was established, covering an area of 6344km^2, with a total population of 4.7 million. Guang’an is located in the zone that Sichuan Basin begins to transit to the surroundings, high in the east and low in the west. The hilly area is located in the middle and west, while the parallel gorges and low mountain areas are located in the east. The altitude is from 185m to over 1700m. Qujiang River passes through the middle of city from the north to the south, while Jiangling River passes through the west of the city from the north to the south. With abundant agricultural resources and being rich in grain, oil, pig, cocoon and fruit, Guang’an is honored as the national grain production base, the lean-type live pig base and the Realm of Silk. The mineral resources are also abundant, with over 20 varieties of minerals such as coal, iron, limestone and petroleum, with large storage and high grade.

In 2011, the gross output value of the whole city was CNY 65.6 billion, with an annual average increase of 15%. The general financial budget revenue was doubled, with an annual average increase of 24.2%. The gross industrial output value of enterprises over designated size reached CNY 90 billion, and GETDZ was successfully upgraded to the national economic and technological development zone and the industrialization ratio was increased to 40.2% from 28.6%. As one of the significant national and provincial red tourism destination, the construction of Zaoshan Modern

Logistics Industrial Park in Guang'an was commenced, through which the service industry realized an annual average increase in added value of 11.5%. The cumulatively completed fixed asset investment across the nation reached CNY 131.57 billion, with an annual average increase of 27.1%; the completed total investment in urban and rural construction reached CNY 24.91 billion; the urban area was increased by 55km^2; and the urbanization ratio was increased by 9.4%. The endowment insurance trial coverage for urban and rural residents reached 80% and the old enjoying the rural minimum subsistence guarantee system were included into the new rural social endowment insurance. The annual average increase of disposable income per capita for urban residents reached 13.2% and the annual average increase of net income per capita for farmers reached 14.3%.

5.2.2 Socio-economic status of Linshui County

Located in the east of Sichuan Basin and under the jurisdiction of Guang’an City, Sichuan Province, Linshui County is not only the nearest city to the central downtown and Liangjiang New Area of Chongqing, but also the central city in northern Chongqing in service, energy and human resources. Moreover, the southeast is located on the Dianjiang County, Changshou District, Yubei District of Chongqing and the northwest is adjacent to Huaying City, Qianfeng District and Dazhou City. It is located in the low mountain and hill areas in East Sichuan Concave Fold Bundle Paralleled Ridge Valley and Huangying Mountain, Tongluo Mountain and Mingyue Mountain are paralleled in anticline direction, forming the special landform unit of “three mountains mingled with two U-shaped valleys”. In addition, deep and shallow hills, platforms and flatland are also included. Linshui County has jurisdiction over 18 towns and 27 townships, with a total population of 1.03 million, covering an area of 1919.22km^2, of which 18.12km^2 is for the built-up urban area, with a permanent population of 170,000. Moreover, Linshui County has a long history, with abundant natural resources and 27 varieties of proven mineral resources, including coal, natural gas, pyrite and barringerite, of which coal enjoys the largest storage, with about 400 million tons, and the annual raw coal output reaches 1.5 million tons, making Linshui County one of the top 100 coal production counties across the nation. The storage of natural gas is also large and the annual natural gas output reaches 400 million m^3, making Linshui County the major gas production area of East Sichuan Gas Field.

In 2012, the regional gross output value across the county reached CNY 14.82 billion, increased by 13.9% compared with the last year, in which CNY 3.21 billion was for the primary industry, with an increase of 4.6%, 7.17 billion was for the secondary industry, with an increase of 20% and CNY 4.43 billion was for the tertiary industry, with an increase of 11.1%. The contribution ratio of the three industries on economic growth were 7.1%, 68.0% and 24.9%, making an economic growth rate of 1.0%, 9.4% and 3.5% respectively. The structure ratio of the three industries were adjusted to 21.7：48.4：29.9.

In 2012, the gross gain output across the county reached 480,900 tons, with a total industrial added value of CNY 5.57 billion, increased by 22.8%, with a contribution ratio on economic growth of 58.7%. The fixed asset investment across the nation reached CNY 10.16 billion, with an increase of 23.1%. The annual local public financial revenue reached CNY 489 million, with an increase of 18.0%, of which CNY 328 million was for tax revenue and CNY 161 million was for nontax revenue.

The annual disposable income per capita for urban residents reached CNY 19,274, with an increase of 15.7%, in which CNY 14,364 was income from wages and salaries, with an increase of 12.3%, CNY 2588 was operational income, with an increase of 15.8%, CNY 289 was income from properties with an increase of 8.1%, CNY 3617 was transfer income, with an increase of 8.0%. The nonproductive expenditure per capita reached CNY 11,564, of which CNY 49,401 was food expenditure, with an Engel coefficient of 42.7%.

The annual income per capita for farmers reached CNY 7404, with an increase of CNY 949 (14.7%), of which CNY 3307 was income from wages and salaries, with an increase of 17.2%, CNY 3545 was household operational income, with an increase of 11.2%, CNY 40 was income from properties, with an increase of 81.4%, and CNY 512 was transfer income, with an increase of 20.6%. The nonproductive living expenditure per capita for farmers reached CNY 4063, of which CNY 2064 was food expenditure, with an Engel coefficient of 50.8%.

Three towns and townships are included in the assessed area, namely, Chengnan Town, Xitian Township and Moujia Town, the economic conditions of which are shown as follows:

- Chengnan Town of Linshui County, located in the northwest of Linshui County, 3km from the downtown, covering an area of 75km^2, with a population of 41,000, has jurisdiction over 22 village committees such as Poshi, Tuya, Hongdian, Sanhe, Wenxing, Shiba, Xin’an, Gaoping, Wupen, Paifang, Zhengjia and Nanya Village Committee and Dafoshi Village Committee. The township enterprises mainly include small hydropower station, agricultural machinery, coal mining and brickmaking industry; the agricultural production is dominated by rice, corn, wheat and rape; the livestock breeding mainly includes live pig, farm cattle, poultry and cocoon; the commercial crops include ramie and peanut; the roads mainly include National Highway 210 and provincial highway.
- Xitan Township of Linshui County, located at 6.7km from the southwest of the downtown of Linshui, the east of which is adjacent to Gaoping Village of Chengnan Town, the west of which is located on the Hongyan Village of Huangying City, the south of which is located on the Zhengjia Village of Chengnna Town, Yingfeng Village of Ganba Township and the north of which is next to the Cuibai Village of Chengbei Town. It covers an area of 46.48km^2, of which 9648.38*mu* is cultivated area and 31765.55*mu* is forest area and it has jurisdiction over 9 administrative villages, 75 groups, combined to 38 combined groups, 3412 households, 12980 persons, of which 10097 is for agricultural population. It has only one trunk highway from Wucha Road crossing of Chengnan Town to Ganhegou Coal Mine, of which about 12km from the residing location of township government to Ganhegou is classified as village-level highway, and only Yunding, Majia and Shijia Village have smooth highway of 12km.
- Moujia Town of Linshui County, is located at Chengnan end of Linshui County, the east of which is next to Liangban, the south of which is near to Heliu, the west of which is located on Ganba, the north of which is located on Chengnan and Xitian. It is 11km from the downtown Dingping Town, covering an area of 34.22km^2, having jurisdiction over 12 villages, 1 neighborhood committees and 106 villager groups, with a total population of 23,000 persons.

Table 5.2-1 List of Socio-Economic Conditions of Linshui County (Project Affected Area) (2012)

	Indicator	Linshui County
Population	Total population (10,000 persons)	103.26
	Male (10,000 persons)	54.33
	Female (10,000 persons)	48.93
	Nonagricultural population (10,000 persons)	17.09
	Labor resources (10,000 persons)	45.3
Cultivated land	Total cultivated area (1,000ha.)	41.3
	Paddy field (1,000ha.)	23.8
	Dry land (1,000ha.)	17.5
	Grain output (10,000 tons)	40.7
Output value	GDP (CNY 100,000,000)	148.1

	Indicator		Linshui County
	Primary industry	Output value (CNY 100,000,000)	32.1
		Proportion (%)	21.6
	Secondary industry	Output value (CNY 100,000,000)	71.7
		Proportion (%)	48.4
	Tertiary industry	Output value (CNY 100,000,000)	44.3
		Proportion (%)	30
	Per capita GDP (CNY)		20972
Income	Disposable income per capita for urban residents (CNY)		19274
	Net income per capita for rural residents (CNY)		7404

5.2.3 Cultural relics

The wastewater interceptor works of the Project involves the provincial cultural relic protection units such as Lingbaoshan carved stones and the ancient stone bridge. According to the *Notice of General Office of the People's Government of Guang'an on the Announcement of the Protection Scope of the First Batch of Municipal Cultural Relic Protection Unit* (GAFBF [2000] No. 122), Lingbaoshan carved stones on cliffs and the stone bridge of Song Dynasty are classified as provincial cultural relic protection units and the focused protection scope is within the river bank from the east, within 100m from the extension of bridge from the west and within rock ridge from the south and north. It is carved on the tablet that "Lingbaoshan carved stones and the ancient stone bridge is located in the suburbs of Chengnan Town, Linshui County, covering an area of 35km, embracing two rivers and surrounded by cliffs, with abundant cultural landscape relics. It enjoys carved stone relics and three stone bridges from and after Song Dynasty, eleven carved inscriptions from ancestors, two states, with a profound history value in the study of ancient architecture, calligraphy and stone carving arts and far-reaching significance on popularizing national culture and stimulating patriotic enthusiasm".

Figure 5.2.3-1 Pictures of Lingbaoshan Carved Stones

According to the existing design plan, the inverted siphon at the outside of ancient bridge of the wastewater interceptor is close to the bank of Bajiao River, After adjustment, the distance from wastewater interceptor to the construction control area will be over 15m, as shown in Figure 5.2.3-2. In this case, the construction will not impact the cultural relic protection unit.

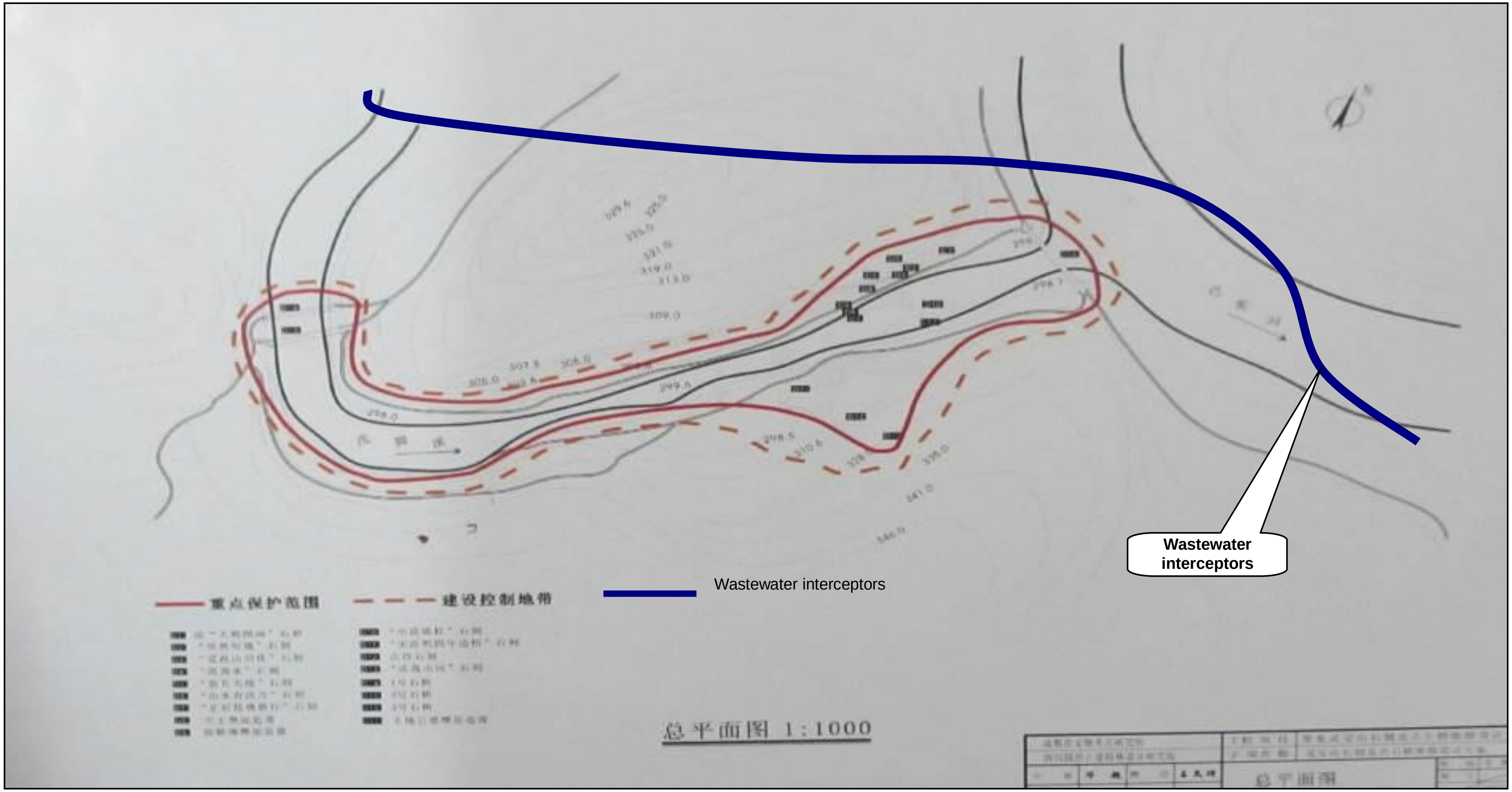


Figure 5.2.3-2 Locational Relation between Wastewater Interceptors and Lingbaoshan Protection Scope (After Adjustment)

5.2.4 Tomb

According to the *Resettlement Action Plan of Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area*, a number of tombs are included in the land area of this Project, which are ordinary rural tombs and the specific quantity statistics are shown as follows:

Table 5.2.4-1 Summary of Tombs in Expansion Works of Linshui Industrial Park (Infrastructure Project for Chongqing-Guang'an Cooperatively Constructed Electromechanical Industrial Park, Phase 3)

County (District)	Township/Neighborhood Office	Village/Neighborhood Committee	Tomb (Nr.)
Linshui County	Chengnan Town	Poshi Village	395
		Wenxing Village	425
		Dafoshi Village	34
		Wucha Village	483
		Zhengjia Village	622
		Paifang Village	47
		Xinhe Village	24
	Xitian Township	Yun'an Village	74
	Moujia Town	Mahe Village	33
County (total)			1626

5.3 Existing Environmental Quality and Assessment

5.3.1 Existing ecological landscape environment

1. Existing regional land utilization

In 2005, Linshui County covers a land area of 190844.88 ha., of which 159478.19 ha. is agricultural land, making up 83.56% of the total land area, 16564.75 ha. is land for construction, making up 8.68% of the total land area and 14801.94 ha. is other land, making up 7.76% of the total land area.

LETDZ is located in the south of the downtown of Linshui, with a planned area of 2818.13 ha., of which 2136.93 ha. is land for construction and 831.72 ha. is industrial land. Since the Phase 1 works has been put into operation, the developed area of LETDZ reaches 393 ha. and 40 enterprise have resided in LETDZ and put into operation, with a particular scale. The constructed land covers about 23.3% of the planned area, the majority of which is undeveloped, classified as natural rural ecological environment.

Figure 5.3.1-1 Existing Regional Ecological Environment

See the table below for the existing land utilization of LETDZ.

Table 5.3.1-1 Statistics of the Existing Land Utilization of LETDZ

SN	Code of Land	Name of Land	Land area (ha.)
1	R	Residential land	66.07

SN	Code of Land	Name of Land	Land area (ha.)
2	C	Land for utilities	6.96
3	M	Industrial Land	170.52
4	W	Land for warehouse	2.3
5	T	Intercity transportation land	2.87
6	S	Land for roads and squares	30.39
7	U	Land for municipal utilities	3.12
8	G	Green land	60.38
Total		Planned construction land	322.61
10	E	Waters and other lands	50.39
Total		Total planned land area	393

2. Existing ecological environment quality

(1) Existing regional plant resources

The Project is located in Chengnan area of Linshui County, where the land is mainly covered by shallow hill, agricultural land and cultivated vegetation and the ecological system is relatively single at the project area.

1. Existing plant resources of the project area

As shown in relevant historical data, the assessed area enjoys 99 families, 258 genera and 354 species of tracheophyte, of which 16 families, 20 genera and 30 species are pteridophyte, 4 families, 7 genera and 8 species are gymnospermae and 79 families, 231 genera and 316 species are anglosperm. Since the natural vegetation has been greatly influenced by the frequency human activities, the diversity of species is inadequate.

As for the flora features, each genus of spermatophyte in the assessed area can be divided into 13 distribution types and 10 subtypes according to the dividing system for distribution area types of Chinese spermatophyte of Wu Zhengyi (a famous Chinese botanist). Most of genera are distributed in tropical area (dominated by pantropical and tropical Asia), then it’s genus distributed in temperate zone (dominated by north temperate zone or north temperate zone-south temperate zone), which indicates that this area is an area that tropical and temperate components are overlapped, both of which are dominated.

According to Directory of National Key Protected Wild Plants (Batch I), and according to the record, 4 national key protected plants are distributed in the assessed area, namely, gingko, metasequoia, cinnamomum camphora and toona ciliate. As required in the *Law of People´s Republic of China on the Protection of Wildlife*, only the wild species listed in the protection directory shall be protected by the law of the nation. However, the stated species in the assessed area are planted by manpower and not the ancient trees and famous wood species under the governmental protection, the assessed area is free of plants under the protection of the national law.

According to the *Sichuan Vegetation*, the assessed area is located in “Evergreen Broad-Leaved Forest Region of East Sichuan Basin and Southwest Mountain Areas—Wet Broad-Leaved Forest Region of East Sichuan Basin—Hill and Low Mountain Vegetation Region on the Bottom of Sichuan Basin—Mesa and Hill Vegetation Area of Central Sichuan”. The natural vegetation is divided into 6 categories, 7 formation-classes, 14 formations and 3 cultivated vegetation categories as shown in the table below.

Table 5.3.1-2 List of Regional Vegetation Classification System

Category of Vegetation	Formation-Class	Formation-Group	Formation
I Broad-leaved forest	(I) Subtropical low-medium mountain deciduous broad-leaved forest	1. Alder	(1) Alder
		2. Riparian zone deciduous broad-leaved forest	(2) Maple and poplar forest
			(3) Poplar forest
II Coniferous forest	(II) Subtropical low mountain evergreen coniferous forest	3. Pine forest	(4) Pinus massoniana forest
		4. Cypress forest	(5) Cypress forest
	(III) Low mountain mixed coniferous and broad-leaved forest	5. Mixed alder and cypress forest	(6) Mixed alder and cypress forest
III Bamboo forest	(IV) Subtropical low mountain and hill bamboo forest	6. Major-diameter bamboo forest	(7) Bambusa emeiensis forest
IV Shrub	(V) Mountain shrub	7. Deciduous broad-leaved shrub	(8) Vitex negundo and coriaria nepalensis shrub
			(9) Rosa cymosa and pyracantha crenatoserrata shrub
V Fruticeta-herbosa	(VI) Mountain herbosa	8. Grass herbosa	(10) Imperata herbosa
			(11) Heteropogon contortus herbosa
		9. Pteridophyta herbosa	(12) Fernwort herbosa
VI Wetland vegetation	(VII) River wetland vegetation	10. Riparian zone plant formation	(13) Caccharum arundinaceum and ridge grass formation
			(14) Erigeron annuus and persicaria hydropiper formation
VII Cultivated vegetation	1. Economic fruit trees		
	2. Eucalyptus forest		
	3. Crops		

The common vegetation of Sichuan Basin is mainly distributed in the assessment area, and the economic fruit trees are distributed around the residential areas; the majority of land there is agricultural land, mainly planted with rice, vegetables and other crops. Influenced by human activities, the trees there are mainly secondary forests and open forests. Most ridges and bank slopes are covered with ulberries, camptotheca acuminata decne and willows, and surrounded by bamboos (mountain bamboo, mottled bamboo and ma bamboo), hemp willow, fruit trees (such as citrus reticulate, peach, apple, pear and loquat).As for cultivated agricultural vegetation, crops mainly include rapeseed, cabbage and wheat, and economic fruit trees mainly include citrus, peer and peach. There are many kinds of trees, including 80 kinds of arbors, 60 kinds of shrubs and 10 kinds of bamboos. Arbors mainly include pinus massoniana, cunninghamia, cypress, fir, cypress and poplar, erythrina variegate, eucalyptus robusta Smith and cinnamomum camphora; bamboos include sinocalamus affinis, bambusa textilt, Xifeng bamboo, mottled bamboo, pleioblastus amarus and phyllostachys pubescence; shrubs mainly include Rubus corchorifolius L. f. and pyracantha crenatoserrata. The assessment area is mainly distributed with cultivated land, shrub, bamboo forest and orchard, in which the major crops planted in the cultivated land include rice, wheat, corn, tuber and rapeseed. (2) Existing regional animal resources

According to the historical data, the assessed area enjoys 4 classes, 26 orders and 71 families of vertebrates, of which 1 order, 2 families and 7 species are amphibians, 3 orders, 9 families and 16 species are reptiles, 16 orders, 43 families and 124 species are birds and 6 orders, 12 families and 23 species are beasts.

The land animals in the scope of assessment mainly include the common amphibians, reptiles, birds and beasts. The amphibians are mainly distributed in the existing farmland, such as frog and toad. The reptiles are mainly distributed in the shrubs and herbaceous plants, including geckos, lizards and zaocys dhumnade; however, greatly influenced by human activities, a variety of animals begin to habitat in the farmland for adapting to the human production activities, and they can habitat both in the farmland and the shrubs and herbaceous plants. Birds in the scope of assessment mainly include passeriformers, of which sparrow, crow, magpi and turtledove have a large variety, and the common migrant birds include cuckoo and spring swallow. The assessed area is free of large wild beasts due to the frequent human activities. However, mustelidae and rodent animals such as mustela sibirica, lepus capensis, house mouse and other common species are distributed in the trees, shrub and farmland in low mountain and hilly areas.

(3) Existing living aquatic resources

According to the status survey, diatom takes on a high priority among the plants in the river of this area. The river is free of large aquatic tracheophyte formation and national or local listed aquatic protected plants, but mainly include equisetum arvense, ranunculus sceleratus, humulus japonicas, alligator alternanthera, roegneria pendulina and cynodon dactylon.

Zooplankton mainly includes rotifer, ciliate, Beatles, crab and shrimp; benthic invertebrates mainly include mollusk and insects; fish mainly includes the common crucian, carp and loach.

With the rapid development of society and economy and the gradual operation of LETDZ, the ecosystem of rivers such as Shiba River and Bajiao River, which has formed for a long time, has been destroyed to some extent, and the original living environment of aquatic organism and fish has been destroyed. According to site survey and local resident visit, the number of aquatic organism is decreasing year after year due to industrial pollution.

5.3.2 Existing acoustic environment and assessment

1. Existing acoustic environment quality

According to field investigation, the road in the construction scope of LETDZ mainly includes the National Highway G201, with heavy traffic volume, especially for trucks, and cement pavement. The National Highway G201 will be cancelled after the roads within the LETDZ are completed. Currently, the construction has slightly influenced the three sensitive areas, namely Xujiawan, Zhangjiawan and Yantangwan, while other sensitive areas are free of intensive noise source and mainly include noise from social life, with excellent acoustic environmental quality.

2. Existing acoustic environment monitoring

(1) Standards and specifications

Environmental Quality Standard for Noise (GB3096-2008);

Acoustics--Measurement Method of Environmental Noise (GB/T3222-94);

Technical Specification for Environment Monitoring (Noise)

(2) Implementation plan

1) Instrument

B&K2238 sound level meter shall be used for monitoring the existing environmental noise and all instruments shall pass the test of metrological verification authority and shall be calibrated before or after each measurement.

2) Time and method

The noise source there is mainly from highway traffic. During the monitoring, the equivalent sound level monitored in a time period during the day and night respectively for 1h with integrating sound level meter will present the equivalent sound level of the existing environmental noise for the assessed area during the day and night.

3) Measurement and assessment value

The environmental noise is measured to be continuously equivalent sound level A, which is considered as the assessment value.

4) Monitoring time and frequency

The monitoring time is from July 1, 2014 to July 3, 2014, at a.m.9:00 ~ 20:00 and p.m. 22:00 ~ 23:30, each time period once.

5) Monitoring point arrangement principle

It is required to select the typical sensitive areas and provide monitoring points at the area that is nearest to the proposed road after demolition and the category 4a, 3 and 2 functional zones after road completion. Fourteen monitoring points are provided during this monitoring, and the details are shown in the figure below.

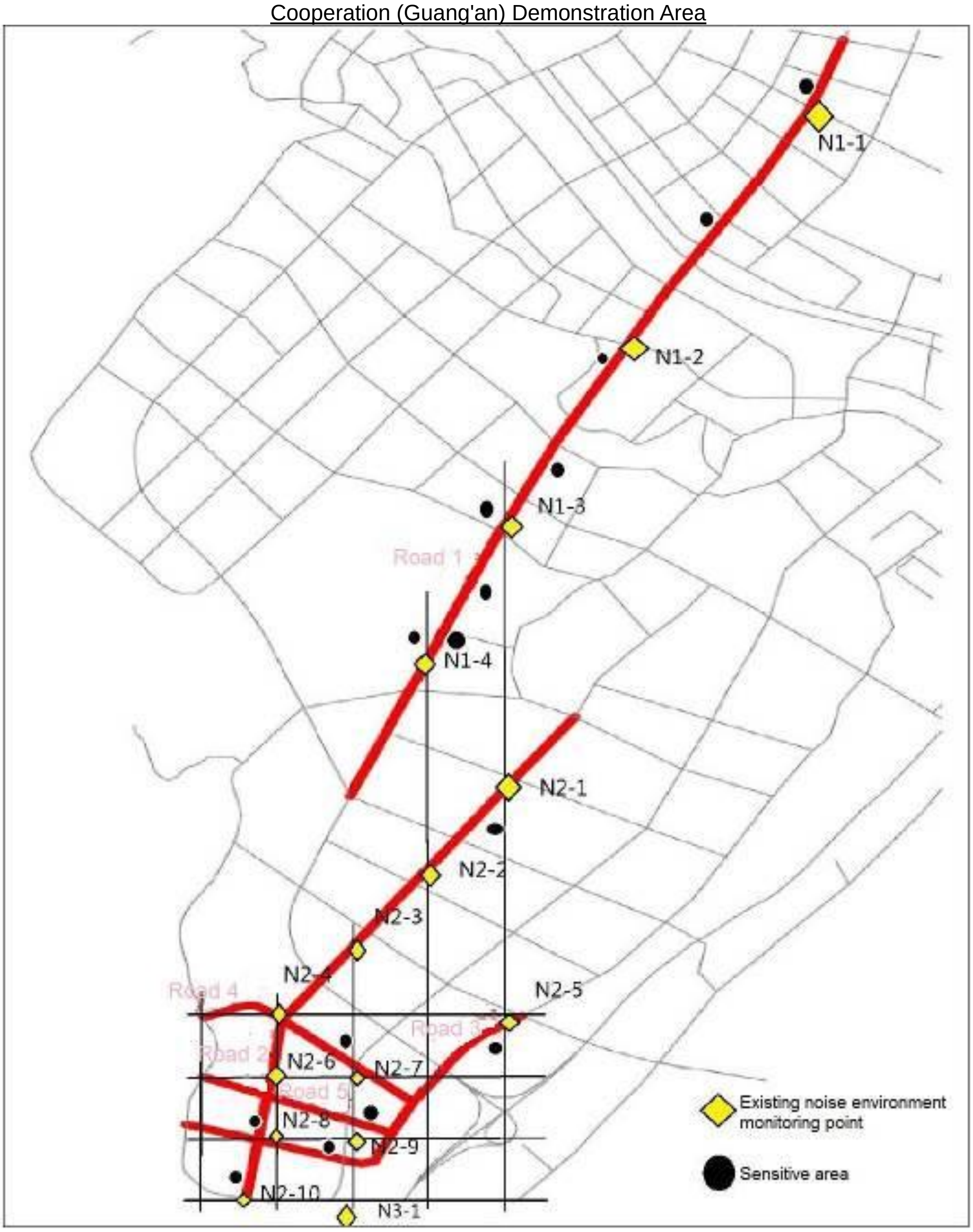


Fig. 5.3.2-1 Environmental Noise Monitoring Value

6) Monitoring results

According to the relevant provisions in *Environmental Quality Standard for Noise* (GB3096-2008), combined with the highway assessment in *Technical Guidelines for Environmental Impact Assessment—Acoustic Environment*, the monitoring points for roads are provided by the method of gridding combined with sensitive area. 14 monitoring points are provided to monitor the environmental noise and 1 monitoring point is provided at the WWTP. The detailed monitoring results are as follows:

Table 5.3.2-2 Statistics of Noise Monitoring Results Unit: dB(A)

No.	Existing Value		Standard		Up to Standard (Yes/No)
	Day	Night	Day	Night	
N1-1	53.4	46.2	60	50	√

N1-2	46.3	39.5	60	50	√
N1-3	45.7	40.2	60	50	√
N1-4	52.4	44.6	60	50	√
N2-1	46.4	38.7	65	55	√
N2-2	45.9	39.2	65	55	√
N2-3	53.3	45.1	65	55	√
N2-4	48.7	41.2	65	55	√
N2-5	44.8	37.5	65	55	√
N2-6	47.3	38.6	65	55	√
N2-7	48.8	41.2	65	55	√
N2-8	51.1	44.8	65	55	√
N2-9	48.6	40.6	65	55	√
N2-10	45.3	39.5	65	55	√
N3-1	48.7	45.3	60	50	√

According to the acoustic environment monitoring and assessment, the overall acoustic environmental quality of the area is good, being 44.8~53.4dBA at day and 37.5~46.2dBA at night and the noise condition satisfies the requirements of category 2 acoustic environment functional zone specified in GB3096-2008.

5.3.3 Existing air environment and assessment

1. Section design

Considering the functional division of the assessed area and combined with the features of the ground wind field, 8 monitoring points are provided in the assessment.

Table 5.3.3-1 Existing Air Environment Monitoring Section

No.	Monitoring Location
1#	Residential district planned on the west
2#	Residential district planned on the east
3#	Industrial land in the west area
4#	Industrial land in the east area
5#	Urban area of Linshui
6#	Moujia Town
7#	Xitian Township
8#	Lingbaoshan cultural relics protection unit[i]

(2) Monitoring factors

PM_{10}, SO_2 and NO_2

3) Monitoring time

The sampling time is from July 2, 2014 to July 4, 2014.

PM_{10}, SO_2 and NO_2 monitoring continues for 3 days, in which PM_{10} is subject to daily average value monitoring and the daily sampling time shall not be less than 12 hours and SO_2 and NO_2 are subject to average hour value monitoring and sampling shall be made 4 times and each for 1 hour, with a frequency of 2:00 ~ 3:00, 8:00 ~ 9:00, 14:00 ~ 15:00 and 20:00 ~ 21:00.

Table 5.3.3-2 Statistics of Existing Air Environment Monitoring Results Unit: mg/m³

Monitoring Factors	Monitoring Date	Monitoring Time	1#	2#	3#	4#	5#	6#	7#	8#	Standard
SO_2	July 2, 2014	02:00~03:00	0.008	0.01	0.007	0.01	0.011	0.011	0.01	0.012	0.5
		08:00~09:00	0.007	0.008	0.007	0.01	0.01	0.01	0.013	0.013	0.5
		14:00~15:00	0.01	0.011	0.007	0.013	0.007	0.01	0.007	0.008	0.5
		20:00~21:00	0.008	0.01	0.008	0.011	0.007	0.009	0.012	0.01	0.5
	July 3, 2014	02:00~03:00	0.008	0.01	0.007	0.007	0.007	0.011	0.011	0.008	0.5

Monitoring Factors	Monitoring Date	Monitoring Time	1#	2#	3#	4#	5#	6#	7#	8#	Standard
		08:00~09:00	0.009	0.011	0.009	0.007	0.011	0.008	0.009	0.009	0.5
		14:00~15:00	0.009	0.012	0.011	0.007	0.007	0.009	0.012	0.007	0.5
		20:00~21:00	0.011	0.012	0.008	0.007	0.009	0.012	0.009	0.012	0.5
	July 4, 2014	02:00~03:00	0.007	0.007	0.014	0.01	0.007	0.01	0.01	0.011	0.5
		08:00~09:00	0.007	0.007	0.013	0.009	0.008	0.008	0.009	0.011	0.5
		14:00~15:00	0.008	0.009	0.007	0.011	0.007	0.007	0.011	0.01	0.5
		20:00~21:00	0.007	0.008	0.011	0.009	0.008	0.008	0.008	0.009	0.5
	Daily Average		0.00825	0.00958	0.00908	0.00925	0.00825	0.00942	0.01008	0.01	0.15
NO_2	July 2, 2014	02:00~03:00	0.009	0.005	0.007	0.011	0.009	0.007	0.01	0.014	0.2
		08:00~09:00	0.013	0.005	0.006	0.006	0.013	0.009	0.009	0.013	0.2
		14:00~15:00	0.008	0.007	0.007	0.008	0.015	0.01	0.013	0.01	0.2
		20:00~21:00	0.009	0.007	0.005	0.006	0.01	0.007	0.008	0.006	0.2
	July 3, 2014	02:00~03:00	0.007	0.006	0.011	0.008	0.005	0.009	0.006	0.005	0.2
		08:00~09:00	0.005	0.008	0.008	0.007	0.012	0.012	0.01	0.008	0.2
		14:00~15:00	0.007	0.009	0.007	0.008	0.015	0.01	0.007	0.008	0.2
		20:00~21:00	0.006	0.013	0.021	0.007	0.01	0.005	0.005	0.007	0.2
	July 4, 2014	02:00~03:00	0.005	0.005	0.005	0.005	0.007	0.006	0.009	0.007	0.2
		08:00~09:00	0.006	0.008	0.007	0.012	0.01	0.006	0.008	0.006	0.2
		14:00~15:00	0.006	0.007	0.008	0.01	0.009	0.005	0.007	0.006	0.2
		20:00~21:00	0.005	0.008	0.007	0.008	0.005	0.005	0.011	0.006	0.2
	Daily Average		0.007166667	0.00733	0.00825	0.008	0.01	0.00758	0.00858	0.008	0.08
PM_{10}	July 2, 2014		0.057	0.051	0.091	0.051	0.062	0.053	0.052	0.058	0.15
	July 3, 2014		0.088	0.099	0.096	0.105	0.1	0.095	0.08	0.081	0.15
	July 4, 2014		0.089	0.096	0.101	0.109	0.089	0.088	0.101	0.089	0.15
	Daily Average		0.078	0.082	0.096	0.08833	0.08367	0.07867	0.07767	0.076	0.15

According to the monitoring results in the table above, the indicators of each monitoring point within the air assessment scope are up to the standard and satisfy the related standard of Class II standard in the *Ambient Air Quality Standard* (GB3095-1996), so the ambient air quality of the assessed area is excellent.

5.3.4 Existing surface water environment and assessment

1. Water system overview

The related areas of the Project mainly include trunk stream Bajiao River, Shiba River, Danshuitan River, Mazi River and City moat. Water system in Linshui County mainly originates in Yangtze River Basin, which from the west to east includes trunk stream Bajiao River, the south and north of which passes through the entire county, with a length of 100.5km; Bajiao River leaves Linshui at Yaotan Town and flows to Yangtze River at Taihonggang of Yubei District, Chongqing after entering Chongqing and flowing for about 46.85 km. Bajiao River flows from North to South on the east of LETDZ, serving as the receiving water thereof. Shiba River, Danshuitan River, Mazi River and City moat are tributaries of Bajiao River, which will ultimately flow into Bajiao River.

2. Existing drainage for downtown of Linshui County

Linshui No. 1 WWTP has already been constructed, with a treatment scale of 20,000m^3/d and service area of 9.3km^2, mainly including the domestic sewage from local area of Dingping Town, Chengnan Town and Chengbei Town. Currently, the domestic sewage beyond the treatment scope of Linshui No. 1 WWTP is discharged into ground waters such as agricultural irrigation ditches after simply treatment, while the production wastewater from resided enterprises cannot be discharged until it reaches the Class I standard in *Integrated Wastewater Discharge Standard* (GB8978-1996) or relevant industrial standard after being treated according to the requirements of Linshui Environmental Protection Bureau.

3. Existing surface water environment quality assessment

During the EIA, the EIA monitoring data of LETDZ in 2012 has been collected.

1) Section design

Table 5.3.4-1 Surface Water Monitoring Section

No.	Monitoring Location
1#	1000m downstream of the area where Danshuitan River flows into Bajiao River
2#	1000m downstream of the area where Shiba River flows into Bajiao River
3#	Upstream of Shiba River
4#	Confluence of City moat and Shiba River
5#	500m upstream of the area where City moat flows into Shiba River

Two monitoring sections are provided on Bajiao River, one monitoring section is provided on Shiba River and City moat (Xiaoxi River) respectively, and one monitoring section is provided at the confluence of Shiba River and City moat (Xiaoxi River).

2) Water quality factors

COD, BOD5, NH3-N, TP and petroleum.

3) Monitoring results

See the table below for water quality monitoring results

Table 5.3.4-1 Water Quality Monitoring Results Unit: mg/L (excl. pH)

Monitoring Factors / Monitoring Sections	Sampling Time	Chemical Oxygen Demand (COD_{Cr})	Five-Day BOD (BOD5)	NH_3-N	Petroleum	pH	TP
1#	7.3	8.06	2	0.085	ND	7.73	0.03
	7.4	5.84	1.2	0.072	ND	7.67	0.05
	7.5	7.22	1.6	0.076	ND	7.61	0.05
Average		7.04	1.6	0.078	/	7.63-7.73	0.043
Class III Standard in (GB3838-2002)		20	4	1	0.05	6~9	0.2
Out of Specification		No	No	No	No	No	No
2#	7.3	10.8	2.6	0.071	ND	7.68	0.06
	7.4	8.89	2.2	0.091	ND	7.63	0.07
	7.5	7.78	2	0.076	ND	7.54	0.05
Average		9.157	2.267	0.079	/	7.54-7.68	0.06
Class III Standard in (GB3838-2002)		20	4	1	0.05	6~9	0.2
Out of Specification		No	No	No	No	No	No
3#	7.3	7.22	1.6	0.033	ND	7.17	0.07
	7.4	5.56	1.1	ND	ND	7.21	0.05
	7.5	5	1	0.028	ND	7.17	0.05
Average		5.927	1.233	0.0305	/	7.17-7.21	0.057
Class III Standard in (GB3838-2002)		20	4	1	0.05	6~9	0.2
Out of Specification		No	No	No	No	No	No
4#	7.3	9.16	2.3	3.04	ND	7.14	0.27
	7.4	9.97	2.5	3.26	ND	7.21	0.27
	7.5	8.89	2.2	3.23	ND	7.15	0.29
Average		9.34	2.33	3.17	/	7.14~7.21	0.27
Class III Standard in (GB3838-2002)		20	4	1	0.05	6~9	0.2
Out of Specification		No	No	No	No	No	No
5#	7.3	8.34	2.1	2.35	ND	7.10	0.29
	7.4	8.61	2.1	2.43	ND	7.04	0.30
	7.5	7.40	1.8	2.40	ND	7.07	0.30
Average		8.12	2.00	2.39	#VALUE!	7.04~7.10	0.30
Class III Standard in (GB3838-2002)		20	4	1	0.05	6~9	0.2
Out of Specification		No	No	Yes	No	No	Yes

Note: "ND" means the result is below the monitoring line. As shown in the monitoring results, the upstream water environment quality of Bajiao River and Shiba River both are excellent and all monitored water quality factors are up to the category 3 waters standard in *Environmental Quality Standard for Surface Water* (GB3838-2002).

City moat passes through the downtown of Linshui County, along which a lot of integrated residential areas are distributed and local domestic sewage is discharged into the City moat, which makes the content of NH_3-N and TP exceed the limit of category 3 waters standard in the *Environmental Quality*

Standard for Surface Water (GB3838-2002).

5.4.5 Existing groundwater environment and assessment

1. Existing groundwater environment

The groundwater in LETDZ is divided into red bed confined water from the clastic rock pore-fissure water, being classified as medium water yield area according to the water yield property, and bedrock fissure water, being classified as water yield lacking area according to the water yield property. The majority of residents in Linshui County take the water from Guanshimen Reservoir as their domestic water and only a few residents take water from the self-drilled well via interview and survey.

2. Existing groundwater environment monitoring

In order to know the existing groundwater environment quality of the project area, four monitoring points are provided in the assessment and the specific locations are shown in Table 4.4.5-1 and Monitoring Point Diagram. The groundwater quality shall be in accordance with the Class III standard in the *Environmental Quality Standard for Groundwater* (GB/T14848-93).

1) Monitoring point location

According to the groundwater flow direction of the assessed area and the geographic location of the planned site, 4 monitoring point locations are provided in the groundwater status monitoring and the specific locations are shown in the table below.

Table 5.3.5-1 Location of Existing Groundwater Environment Monitoring Point

No.	Description
1	West area of LETDZ
2	East area of LETDZ
3	Water wells of residents midstream of LETDZ segment of Bajiao River
4	Water wells of residents 500m downstream of LETDZ segment of Bajiao River

2) Monitoring Indicators pH, TH, TDS, sulfate, chloride, Fe, nitrate, NH_3-N, volatile phenol, cyanide, fluoride, Zn, As, Hg, Cr (VI) and Cd.

3) Monitoring period

One day, for once.

4) Existing groundwater quality monitoring and the assessment results

The existing groundwater quality monitoring of the planned EIA was performed on July 5, 2014 and the monitoring results are shown in the table below.

Table 5.3.5-2 List of Groundwater Monitoring Results Unit: mg/L

Monitoring Factors / Monitoring Point Location	pH	TH	TDS	Sulfate	Chloride	Fe	Nitrate	NH_3-N	Volatile Phenol	Cyanide	Fluoride	Zn	As	Hg	Cr (VI)	Cd
1#	7.36	391	484	42.2	2.49	0.04	0.38	0.03	ND	ND	0.5	ND	ND	ND	ND	ND
2#	7.42	324	448	119	2.64	0.04	0.93	0.05	ND	ND	0.4	ND	ND	ND	ND	ND
3#	7.53	333	435	116	2.54	ND	0.87	0.04	ND	ND	0.4	ND	ND	ND	ND	ND
4#	7.48	209	247	46	2.79	0.14	1.95	0.09	ND	ND	0.2	ND	ND	ND	ND	ND
Class III Standard in (GB/T14848-93)	6.5~8.5	≤450	≤1000	≤250	≤250	≤0.3	≤20	≤0.2	0.002	≤0.05	≤1.0	≤1.0	≤0.05	≤0.001	≤0.05	≤0.01
Up to	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

standard																

It is known from the above table that the groundwater monitoring factors at each monitoring point meet the Class III standard in the *Environmental Quality Standard for Groundwater* (GB/T14848-93).

3. Geological Conditions of the Formation

The WWTP works of the Project is located on the edge of Central Sichuan Fold Structure System of Sichuan Subsidence Zone of Neocathaysian System, on the southeast of synclinal side of Tanziba, the secondary structure in the central of the upheaval fold bundle of Huaying Mountain and on the northwest of anticlinal side of Tongluo Mountain. The site is in monoclonal structure and the rock formation inclines to the southwest, with an angle of inclination of 17°. According to the rock core observation and the adjacent surface investigation, weathering fissure develops on the surface of mudstone formation; structural fissure is rare; fault and fracture zone are not founded in the site; and the geologic structure is simple. The formations of the site include Quaternary Holocene filling (Q4ml), eluvial slope silly clay (Q4dl+el); the bedrock includes the mudstone and sandstone from Middle Jurassic Upper Shaximiao Formation (J2S). The formations from new to old are shown as follows:

(1) Quaternary Holocene formation

1) Filling, variegated, composed of sandy clay mixed with rock fragment, rock block and random stone, with domestic and construction waste exposed in drilling hole at local segments, self-weight consolidation not yet completed, with loose structure and large hole, hole collapse existing in drilling. The thickness is 0.40-5.80m and the top distribution elevation is 345.03-345.76m. This kind of filling is distributed on all the sites.

2) Silly clay, in yellow brown and grey white, composed of cohesive soil and a small quantity of silt-fine sand, with even component, slightly dense, slightly wet-wet, plastic-hard-plastic, viscous and sandy when entwisting. The thickness is 0.90-6.90m, the top distribution elevation is 339.64-345.06m, and the top depth is 0.70-5.80m. This kind of soil is lacking in local segments of the site since the bedrock is exposed on the flat field.

(2) Middle Jurassic Upper Shaximiao (J2S) Bedrock Formation

The bedrock formation of the site is composed of mudstone (dominated) and sandstone, produced in interbedding.

1) Mudstone, in yellow brown and purple red, composed of kaolin, hydromica, montmorillonite and other clay minerals and a small quantity of detrital minerals, in pelitic texture and medium-thick stratified structure, with common calcite cementation, with local stratum mixed with thin stratified argillaceous sandstone band or irregular block. According to the drilling hole exposure thickness, the mudstone from the top to the bottom can be divided into intensely weathered mudstone and moderately weathered mudstone in terms of weathering intensity.

① Intensely weathered mudstone, in old-fashioned color, weathering fissure developed on the rock mass, in soft texture, with rock core mainly in soil or pie but scarcely in fragment or short column, with fragment easy to break up. The thickness is 0.80-4.10m, the top distribution elevation is 334.21-345.01m, and the top depth is 0.40-11.30m.

② Moderately weathered mudstone, in bright color, scarcely with weathered joint fissure, with integrated rock core, in column in most cases, in hard texture, with fragment hard to break up. The thickness of drilling hole is limited in 0.90-6.10m, the top distribution elevation is 331.97-342.27m, and the top depth is 2.90-13.50m.

2) Sandstone, in light grey, grey white and brown yellow, composed of feldspar, quartz and a small quantity of mica, chlorite, kaolinite and limonite, in fine-medium grain and stratified structure, produced in thick-stratum, silicon and calcium cementation, stratum mixed with thin stratified argillaceous sandstone band or irregular block. It can be divided into upper intensively weathered mudstone and lower moderately weathered mudstone according to the control thickness of drilling hole and weathering degree.

① Intensively weathered sandstone, in old-fashioned color, intensively weathered, majority of structural formation being damaged, with developed fissure, rock core broken into powders, blocks and short columns, fragment being easy to broken up, in soft texture. The thickness is 1.10-3.30m, the top distribution elevation is 338.76-343.81m, and the top depth is 1.80-6.70m.

② Moderately weathered sandstone, With section being in bright color, joint fissure being rare, with clear structural formation and integrated rock core, mostly in long column, then in short column, in hard texture. The drilling hole exposure thickness is 0.70-1.40m, the top distribution elevation is 334.78-337.93m, and the top depth is 7.50-10.70m.

The mudstone formation is distributed in most of the segments within the site, while only a few sandstones are distributed within the site. The bedrock formation is stably and continuously distributed in the entire site, with an altitude of rock formation of 165°∠17°.

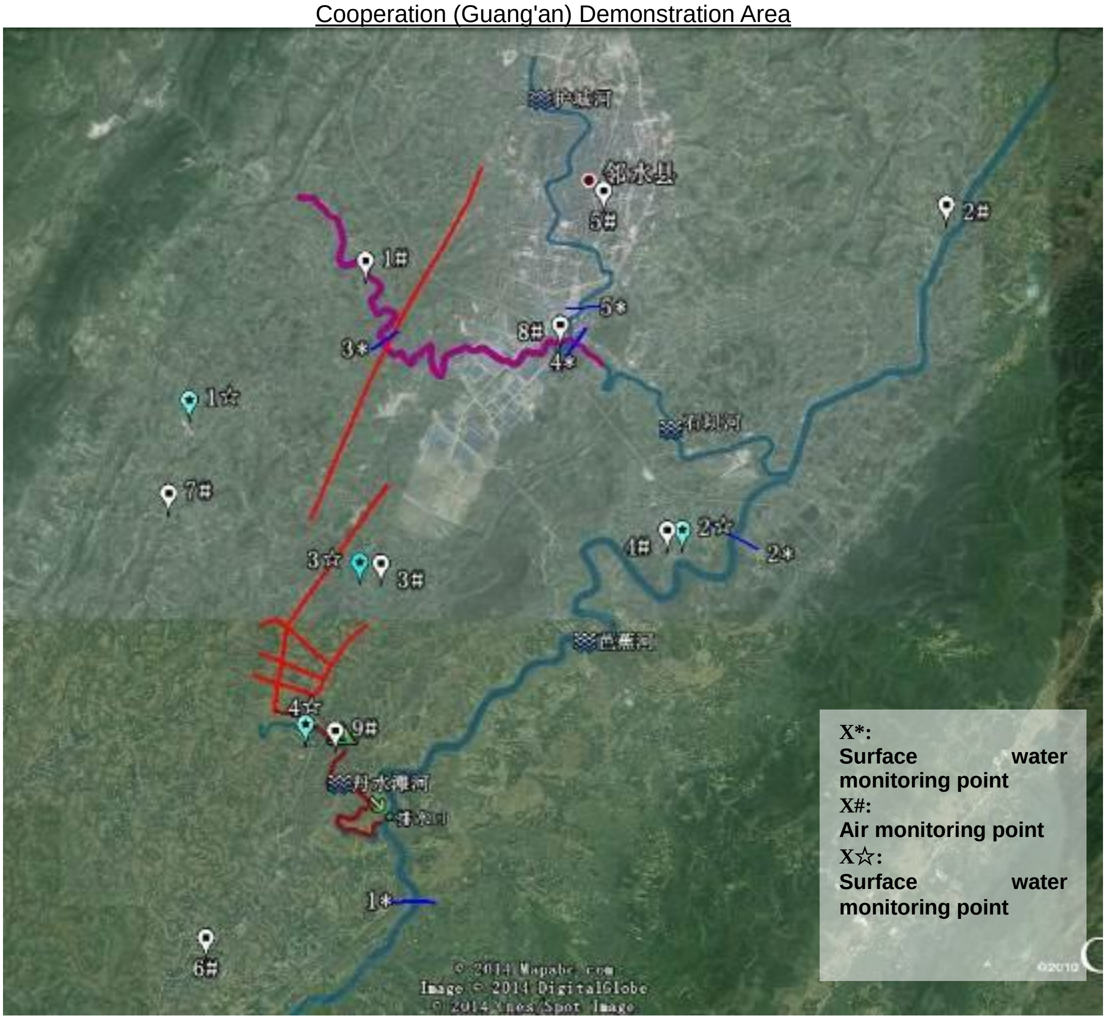


Figure 5.3.5-1 Air and Water Environment Monitoring Point Diagram

5.3.6 Existing solid waste and assessment

The built-up waste disposal plant of Linshui County is located in Wucha Village, Chengnan Town, Linshui County, about 5km from the Linshui No.3 WWTP, put into operation by the end of 2008, with a daily disposal capacity of 125 tons, covering an area of 86.19*mu*, of which 58.1*mu* is for waste storage, with a design lifetime of 14 years, the disposal process of “sanitary landfill” adopted, owned by Linshui Urban Domestic Waste Treatment Plant. The 14-design lifetime of the Plant is calculated according to the urban population of the county in 2004 and the annual increase ratio, however, the downtown has developed rapidly in recent years and the annually increasing urban population is far beyond the increase ratio calculated at that time, which leads to the tremendously increase of urban domestic waste. In order to improve the environment, waste from other towns of Linshui County is delivered to the Plant for disposal and the existing daily disposal capacity has reached 160 tons. The phase 1 storage capacity of the Plant has basically reached, so the phase 2 works is planned to be construct. The phase 2 works is intended to increase 20*mu* land for expanding the capacity at the upper end of the existing landfill, with an estimated investment of CNY 8.9 million. The source of capital will be 60% from the local financial fund and 40% from the owner and the preliminary works is predicted to be commenced in 2015 and be put into operation in 2016.

In the downtown of Linshui County, about 160 tons of domestic waste is transferred, collected and disposed every day. The waste is collected in two ways, for the waste swept on the street, it will be collected to the landfill with the waste truck from Linshui

Environmental Health Administration Office; for packed waste on the back of the street or alley, it will be collected to the waste transferring station with handcart by the waster collecting personnel from the Linshui Environmental Health Administration Office and then delivered to the Wucha Waste Disposal Plant for landfilling.

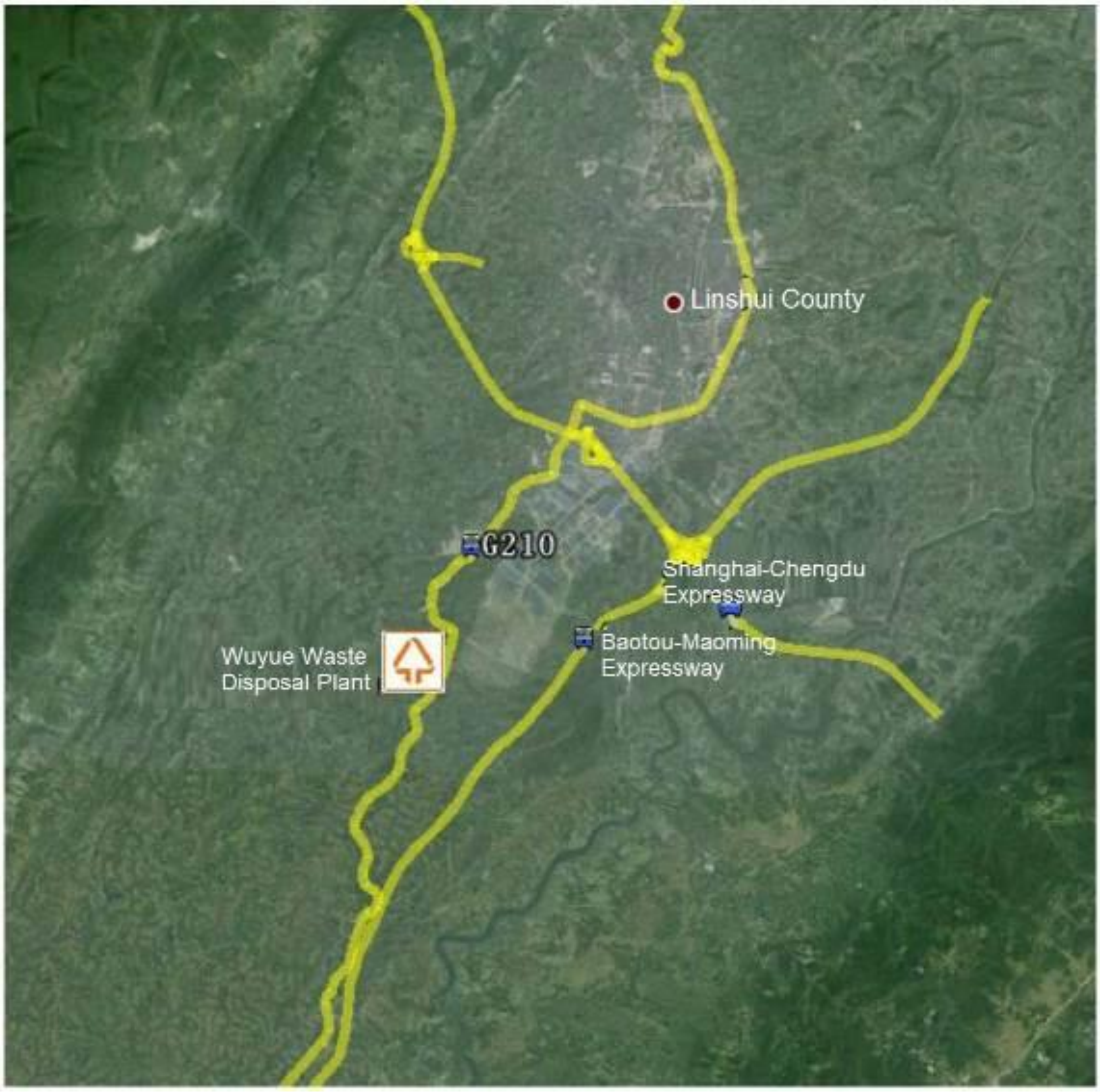


Figure 5.3.6-1 Locational Diagram of Linshui Waste Landfill

5.3.7 Infrastructure construction

1. Existing water supply works

The downtown of Linshui County has 2 water plants (No.1 Water Plant, with a design capacity of 20,000m^3/d, established in 1980s and No. 2 Water Plant, with a design capacity of 50,000m^3/d, established in 2005), with a total design capacity of 70,000m^3/d and actual water supply of 20,000m^3/d. No.1 Water Plant is closed now, used for emergency standby water plant, and only the No. 2 Water Plant operates. No. 2 Water Plant is being expanded during the operation, with an expansion scale of 30,000m^3/d and the existing scale and operation of water plants are shown in the table below.

Table 5.3.7-1 List of Water Plants in the Downtown

SN	Name of Water Plant	Design Capacity (10,000m^3/d)	Actual Water Supply Capacity (10,000m^3/d)	Water Source	Remarks

SN	Name of Water Plant	Design Capacity (10,000m^3/d)	Actual Water Supply Capacity (10,000m^3/d)	Water Source	Remarks
1	No. 1 Water Plant	2	0	Shizikou Reservoir	Emergency standby water plant
2	No. 2 Water Plant	2+3 (under construction)	2.0	Guanmenshi Reservoir	
Total		7	2		

No. 1 Water Plant was established in early 1080s, with a design capacity of 12,000m^3/d, and the water treatment capacity reached 20,000m^3/d after potentiality exploration reconstruction. However, the equipment of the Plant is old, simple and aged since it has been established for a long time. The treatment capacity and water quality is poor, so it is only used for emergency water plant. The expected design capacity of No. 2 Water Plant is 50,000m^3/d, which will be implemented in two phases, of which phase 1 has a design capacity of 20,000m^3/d, which was put into operation in 2005 and phase 2 has a design capacity of 30,000m^3/d, which is under construction and is predicted to be put into operation by the end of 2014.

The (existing) service scope of No. 2 Water Plant includes Zhaojiaqiao, the Detention Center, Group 2, Dongbei Village of Zijingshanzhuang (Xinlongwan) to the north; Chengnan Electromechanical Industrial Park (for the constructed part) in the LETDZ, Casting Industrial Park, low-rent housing in Dafoshi to the south; Ring Road, Group 5 and 6, Shuangjing Village, Tuya Village, Hongdian Village (Niubeishan Substation) to the east; and Linshui County People's Hospital, Melon Seed Plant of Second High School of Linshui County, the old downtown, Hongfan Square, residential area in Xitan and the resettlement housing of the Industrial Park behind the rice transferring storage to the west.

2. Existing water drainage works

(1) Existing drainage pipe network

The old downtown of Linshui County has complete drainage system, but combined channel are mostly used. The drainage pipe in the downtown is now maintained by the Housing and Urban-Rural Construction Bureau of Linshui County and the old downtown has several of drainage pipes of 45.740km. Additionally, rainwater and sewage diversion system is adopted by a small number of drainage pipes.

At present, wastewater interceptors are provided at Shiba River segment in the old downtown, with a pipe diameter of DN400~DN800 and pipe length of about 6km, and the wastewater will ultimately discharged into the Linshui No. 1 WWTP in the old downtown for treatment.

(2) Existing drainage of the LETDZ

Presently, there are 60 enterprises in Linshui Industrial Park, concentrated in northeastern part of the north area and mainly engaged in automobile production, motorcycle parts processing, food, etc. According to the requirement of Linshui Environmental Protection Bureau, before the completion of Linshui No. 2 and No. 3 WWTP, the production wastewater from resided enterprises shall be discharged after being pretreated and reaching the Class I standard in *Integrated Wastewater Discharge Standard* (GB8978-1996).

(3) WWTP status quo

1) Overview

The old downtown of Linshui County has 1 WWTP, with a design capacity of 40,000m^3/d, CASS process adopted and planned to be implemented in two phases. The treatment scale of phase 1 works is 20,000m^3/d, established in 2004, located in Cojiatan of Dingping Town, put into operation in 2009, with a total investment of CNY 65.31 million, operated and managed by Sichuan Linshui Aizhong Environmental Protection Co., Ltd., with an operation and management period of 30 years. The phase 2 works cannot be implemented due to site limits.

Figure 5.3.7-1 Status Quo of Linshui No. 1 WWTP

Linshui No. 1 WWTP serves 103,400 people in all and the wastewater treatment scope mainly include the domestic sewage from Dingping Town, Chengnan Town and Chengbei Town, with a service area of 9.3km^2. The energy saving and emission reduction as well as the ecological environment construction have been greatly improved during the five-year operation of the WWTP, with a total wastewater treatment capacity of 32.56 million m3, total COD emission reduction of 5568 tons and municipal wastewater collection rate of 78%. The production, living and housing conditions of urban residents have been significantly improved.

City moat serves as the receiving water of Linshui No. 1 WWTP, which is a upstream tributary of Bajiao River, classified as category 1 waters, the water quality of which shall satisfy the Class I category A standard in *Integrated Wastewater Discharge Standard* (GB8978-1996).

2) Process flow

CASS process has been adopted by the WWTP and the flow diagram is shown as follows.

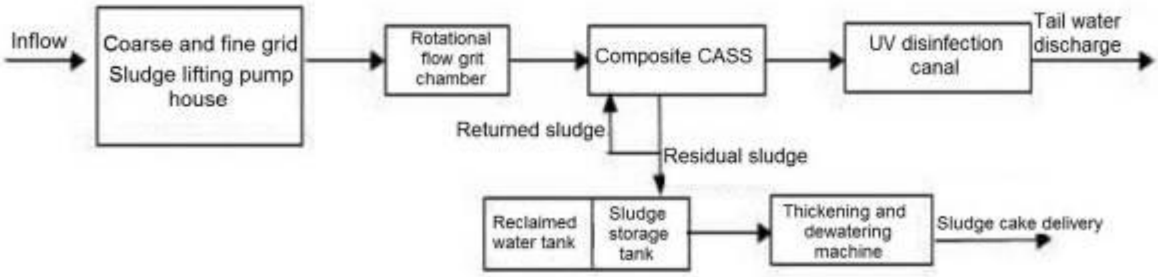


Figure 5.3.7-1 Process Flow of Linshui No. 1 WWTP

3) Sludge treatment

The sludge from the WWTP is delivered to the Linshui Urban Domestic Waste Treatment Plant for integrated landfilling. The WWTP is 10km from the landfill, with a sludge quantity of about 6 tons.

3. Existing environmental health works

The solid waste in the constructed area is collected and delivered to Linshui Waste Disposal Plant by sanitary workers of Linshui County for disposal. The built-up waste disposal plant of Linshui County is located in Wucha Village, Chengnan Town, Linshui County, about 5km from the Linshui No.3 WWTP, put into operation by the end of 2008, with a daily disposal capacity of 125 tons, covering an area of 86.19*mu*, of which 58.1*mu* is for waste storage, with a design lifetime of 14 years, and the disposal process of “sanitary landfill” adopted.

4. Existing power supply works

1. Existing power supply of the old downtown

The old downtown of Linshui County has 10 10kV power supply lines with a length of 75.78, 352 10kV distribution transformers with a capacity of 134235 KVA, with 40,000 users. The power consumption of 2013 has reached 128.6686 million KWh, with the maximum daily load of 37,000KW.

2. Existing power supply in the LETDZ

The LETDZ has seven 10kV power supply lines with a length of 33.35, 86 10kV distribution transformers with a capacity of 52205 KVA. The power consumption of 2013 has reached 67.9347 million KWh and the maximum daily load has been 15,000KW.

5. Existing gas supply works

So far, the downtown has a gas storage and distribution station in Taziqiu area, with a scale of 40,000m^3/d and the gas is from Zhangsan Gas Well in the downtown; the gas popularization rate among residents is 95%, without natural gas storage and distribution station and purification pipe network.

6. Existing road works

Highway constitutes the primary intercity transportation of LETDZ and the highway there is well developed, including Dazhou-Chongqing Expressway in the SN direction, Shanghai-Chengdu Expressway in the EW direction and the Class I highway G210 in the Dazhou-Chongqing Expressway.

The National Highway G210, passing through Linshui County from NE to SW, is a significant access connecting downtown of Linshui County and LETDZ.

Dazhou-Chongqing Expressway is a section of Baotou-Maoming Expressway, which intersects with Shanghai-Chengdu Expressway in central LETDZ, and access has been reserved for Shanghai-Chengdu Expressway in the downtown of Linshui County, through which Shanghai-Chengdu Expressway is connected with Dazhou-Chongqing Expressway. Currently, Linshui County is planning to construct the West Ring Road, when it is commenced, an expressway access will be reserved for Dazhou-Chongqing Expressway on the southeast corner of LETDZ for connecting the West Ring Road, forming a more complete and unified road network.

6 Environmental Impact Assessment

6.1 Environmental Impact Assessment during the Construction Period

6.1.1 Ecological impact during the construction period

1. Impact of project occupied area and earthworks/stoneworks

The occupied area of the Project refers to acquired land, rented land and the land under the jurisdiction of the development and construction unit, including permanently and temporarily acquired land for construction, with land type covering paddy field, dry land, forest land, grassland, rural homestead, highway land, pond and hydraulic construction site. Statistics for the occupied area is shown in the table below.

Table 6.1.1-1 Analysis of the Impact on Project Occupied Area Unit: ha.

Project Composition / Sub-item	LETDZ Phase 3	Road 1	Wastewater interceptors	No.2 WWTP	No.3 WWTP	Subtotal
Occupied land (ha.)	307	15.1	10.15	6.17	6.17	344.59
Excavation volume (×10,000m^3)	5944	40.6	8.8	7.5	7.5	6008.4
Filling volume (×10,000m^3)	5944	94.1	7.4	6.9	6.9	6059.3
Spoil volume (×10,000m^3)	0	-53.5	1.4	0.6	0.6	-50.9

The spoil volume is all used for ground filling of LETDZ Phase 3. The earth and stone required for Road 1 is under the unified allocation of LETDZ, so borrowing is not needed.

2. Impact on terrestrial plants during the construction period

The infrastructure construction in the LETDZ will inevitably bring some damage to the regional ecological environment, which will change the existing land-use type and cause the surface vegetation to disappear. Moreover, rolling of various motor vehicles, activities of construction personnel and piling of earth and stone will also cause more serious damage and impact to the vegetation. As the construction continues, some plant species within the scope of land requisition will disappear and the vast majority of plant species will be greatly reduced, so the regional biodiversity will be affected hereby. However, all damaged vegetation types are common types in the assessed area, without national key protected rare or endangered plants and wild plants. Therefore, infrastructure construction in the park has little impact on the flora and vegetation type, which will not lead to the disappearance of the existing species and vegetation types in the region. After the construction period, the vegetation will be gradually restored through landscape construction, and it will make up the loss for plant species diversity. See the table below for impact on vegetation during the construction period.

Table 6.1.1-2 Impact Factors on Vegetation during the Construction Period

SN	Construction Link	Reason for Impact	Impact Range
1	Artificial excavation	Directly destroy the vegetation of the excavation zone	3m from both sides of the excavation zone
2	Backfill	If the backfill procedure is violated, the topsoil will suffer serious loss	10m from both sides of the site
3	Mechanical operation	Crush the vegetation on the construction site	Construction site

SN	Construction Link	Reason for Impact	Impact Range
4	Temporary sheds for machinery storage	Some short-term temporarily occupied land will destroy the vegetation	Some area

According to the statistics for the type of occupied land, the Project occupies permanent occupied forest land of 17.22ha. and grassland of 12.96ha. The forest land in the region is greatly impacted by human activities, mainly for pinus massoniana, cypress, vitex trifolia and coriaria sinica. The community structure is relatively simple. Although certain forest lands are occupied for road construction, the distribution of vegetation types and community structure of forest plants will not be changed.

In accordance with ecological restoration measures of soil and water conservation plan, in addition to the road surface, buildings and structures and hardened protective measures, the vegetation of the land occupied for construction will be restored. Please see the table below for specific number. It is unable to fully recover the original ecological environment in the region by artificial vegetation, but it may compensate the regional ecological environment, so the regional vegetation will not be greatly impacted.

Table 6.1.1-3 Statistics of Vegetation Restoration Measures during the Construction Period

Type of Measures	Prevention and Control Measures		Unit	Prevention and Control Area of Road Works							Prevention and Control Area Wastewater Interceptor Works				Prevention and Control Area of Linshui No.3 WWTP:					Total
				Subgrade Area	Bridge Area	Construction Road Area	Construction Site Area	Construction Camp Area	Temporary Soil Storage Yard	Subtotal	Pipe Area	Construction Road Area	Temporary Construction Area	Subtotal	Plant Area	Wastewater Pipe Area	Off-plant Drainage Pipe Area	Temporary Construction Area	Subtotal	
Vegetation measures	Arbor	Prunus cerasifera	Plant							0				0	85				85	85
	Shrub	Coriaria sinica	Plant			650	450	575	1225	2900	1225	325	1775	3325		550	2000	700	3250	9475
		Photinia fraseri	Plant							0				0	219				219	219
		Redflowered loropetalum	Plant							0				0	219				219	219
	Seed sowing	Area	ha.			1.01	0.23	0.50	1.09	2.83	2.64	1.40	1.42	5.46	0.35	0.48	1.59	0.80	3	11.51
		Bermuda grass	kg			50.5	11.5	25.0	54.5	141.5	132.0	70.0	71.0	273	17.5	24.0	79.5	40.0	161.0	575.5
		Bluegrass	kg			50.5	11.5	25.0	54.5	141.5	132.0	70.0	71.0	273	17.5	24.0	79.5	40.0	161.0	575.5

3. Impact on terrestrial animals during the construction period

The direct impact on terrestrial animals during the construction period is mainly from group activities of construction personnel and disturbance on animals during construction; while the indirect impact refers to the damage to vegetation and soil due to the construction of industrial enterprises, resulting in the loss of some terrestrial animal habitats. However, no important activity trace of mammals, amphibians and reptiles is found in the construction area, and the main animals are relatively small number of small mammals, small common birds and frogs and common lizards, which are in small number and have strong ability of migration. Therefore, the sustenance of such animals will not be impacted during the construction period. It is worth noting that the main mammal in the construction area is rodents, with many types and in large quantities, most species of which are harmful to the agriculture and forestry on different levels, especially the mouse. Due to the condense population and abundant foods during LETDZ construction, such mammal may breed in high density and some species may spread to the surrounding places, which may lead to large number and high density of mice in the surrounding places of the construction area. Therefore, the construction unit must conduct construction camp health and protection work in accordance with the requirements of the environmental management plan.

4. Impact on aquatic organisms during the construction period

Wastewater interceptors construction of Shiba River is mainly conducted on the embankment and cofferdam construction is only conducted at the place where inverted siphon is used crossing the river. The wading works will disturb the river sediments of this section and cause certain loss to the regional algae and benthic organisms. But when the project is completed, the original algae will be gradually restored and gradually stabilized. Wading construction will result in muddy water, change the pH value of the regional water, and may destroy the growing environment of some plankton, thereby reducing the biomass within the construction area. In spite of this, it may be basically restored when the construction is completed because the region for wading construction is relatively very small as compared to the entire river area, the plankton features cosmopolitanism and waters has self-purification capacity, and cofferdam construction may minimize the plankton impact range.

Cofferdam construction and pipeline construction on both sides of the river banks will not pose a significant adverse impact on the waters quality and will be less likely to impact the fish in the river. Construction vibration and noise may produce a temporary impact on the fish, but the fish itself may run to other places to avoid being impacted, so the construction will not have a significant impact on the fish. Besides, since no important protective fish and three grounds distribution exist in the river of this section, the impact on the fish caused by the construction is very few.

5. Impact on water and soil loss during the construction period

Subgrade filling, expanding excavation of river course, temporary piling of spoils and waste slag and housing demolition during construction crush the surface vegetation, disturb the topsoil structure and change the existing terrain. New water and soil loss may be caused under the action of gravity, raindrop hit, current scour and other exterior forces.

Concentrated rainfall in the project area will greatly aggravate the water and soil loss during the construction period, so construction in rainy season shall be avoided as much as possible.

According to the construction characteristic, construction process as well as the characteristic and status quo of water and soil loss in each region of the Project, the factors of impact on water and soil loss in project construction is shown in the table below.

Table 6.1.1-4 Analysis on Factors of Impact on Water and Soil Loss in Project Construction

Construction Behavior	Reason for Impact	Major Impact Links	Impact Degree
Cutting slope excavation, embankment filling and pipeline excavation	Earth and stone excavation, soil structure damage, vegetation destruction and bare slope	Slope and spoils	◇◎■
Land reclamation	Disturbance of soil structure due to construction and soil covering	Foundation excavation and soil covering	◇◎□
Spoil area	Surface vegetation destruction, soil structure damage, wastes piling and bare mining slope	Spoil and temporary soil piles	◆◎■

Construction Behavior	Reason for Impact	Major Impact Links	Impact Degree
Construction road	Soil structure damage, vegetation destruction and slope change	Earth and stone excavation and filling	◇◎■
Construction site	Vegetation and soil structure damage and exposed surface	New temporary facilities and land-use project construction	◇◎□

Note: ◆/◇——long/short term; ○/◎——favorable/unfavorable; ■ /□——serious/general

According to related contents in the *Water and Soil Conservation Plan for the Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area* and the prediction analysis on water and soil loss caused by the construction of the Project, the original topography disturbed and land and vegetation damaged by the Project cover 69.64hm2; and due to the construction disturbance of the Project, the total water and soil loss in the project area within the forecast period amounts 26485t, and 23191t of water and soil loss is added on account of project construction. Among all the additional amount of new water and soil loss, 17,790t occurs in the road works area, accounting for about 76.7% of the increment; 4,083t in wastewater interceptor works area, accounting for about 17.6% of the increment; and 1,317t in WWTP, accounting for about 5.7% of the increment.

The ecological impact on the region due to water and soil loss is mainly as follows:

(1) Surface vegetation destruction has a certain impact on the ecological environment in the project area. Cultivated land, forest land, waters, wasteland and other soil conservation facilities with soil and water conservation function occupied for the construction of main works cover an area of 46.69hm2, and surface vegetation destruction in the project area reduces its percentage of forestry and grass coverage, which will exert some impact on the ecological environment in the project area.

(2) Impact on river course

Wastewater interceptors are laid along Shiba River. If the loss water and soil flow into the river along the slope during construction, the river course may be blocked and it may impact the downstream of the dam.

(3) Impact on the project area and surrounding production and living environment. When the construction is conducted in new district of the town and the LETDZ, protective measures are not taken, so greater soil and water loss will adversely impact the surrounding production and living environment while impacting the construction schedule.

6.1.2 Acoustic environment impact prediction and assessment during the construction period

1. Noise sources and impact range during the construction period

Noise during the construction period mainly comes from construction machinery and transport vehicles. According to the actual investigation and analogy analysis, the construction machinery like bulldozer, loader, roller, excavator, dump truck and paver have a greater impact on the environment. See the table below for the maximum test value during the operation of the above construction equipment (noise value at 5m).

Table 6.1.2 -1 Noise Impact Range of Construction Machinery

Noise Level	Distance (m)	Standard Value (dB(A))	Standard Distance (m)

Construction machinery	5m	10m	20m	40m	60m	100m	150m	Day	Night	Day	Night
Wheel loader	90	84.0	78.0	72.0	68.4	64.0	60.5	70	55	28	281
Grader	90	84.0	78.0	72.0	68.4	64.0	60.5	70	55	28	281
Vibratory roller	86	80.0	74.0	68.0	64.4	60.0	56.5	70	55	32	177
Dual wheel roller	81	75.0	69.0	63.0	59.4	55.0	51.5	70	55	18	100
Three-wheel roller	81	75.0	69.0	63.0	59.4	55.0	51.5	70	55	18	100
Tire roller	76	70.0	64.0	58.0	54.4	50.0	46.5	70	55	10	56
Bulldozer	86	80.0	74.0	68.0	64.4	60.0	56.5	70	55	18	177
Hydraulic excavator	84	78.0	72.0	66.0	62.4	58.0	54.5	70	55	14	141
Paver	87	81.0	75.0	69.0	65.4	61.0	57.5	70	55	35	199

2. Analysis of environmental impact by construction noise

(1) If a single construction machinery is used, the noise level at the place where is 35m away from the construction site may achieve the value specified in *Noise Limits for Construction Site* (GB12523-2011) in the day and that is 218m away from the construction site may achieve the standard limit at night. But in the actual construction process, a variety of machines are often used at the same time, so the noise will have a boarder scope of impact.

(2) The construction noise of the construction noise sensitive point, where is around 5-30m away from the construction site on average, exposes greater impact on the surrounding acoustic environment. The acoustic environmental protection targets along the Project (Hejiayakou, Xujiawan and Xinwuzui) are substantially 30m away from the right of way (ROW). In the daytime, the first row of residential buildings on both sides of the road will produce different levels of impacts and the impact on rest of the residents is particularly obvious at night. Therefore, measures must be strictly taken to minimize the impact of construction noise on the environmental protection target.

(3) When the project is completed, the impact of construction noise will no longer exist, so the adverse impact of the construction noise on environment is temporary.

6.1.3 Air environment impact prediction and assessment during the construction period

The pollution to ambient air during the leveling and construction of the Project is mainly from: (1) fugitive dust produced by soil cement mixing, concrete mixing and vehicle transport during construction; and (2) asphalt smoke produced by pavement.

1. Fugitive dust from construction

(1) Fugitive dust on the road caused by transport vehicles

The fugitive dust on the road caused by vehicle transport in the construction area accounts for more than 50% of the total dust on the site. The amount of fugitive dust on the road is related to the transport vehicle speed, load capacity, load, contact area of tire and the ground, the amount of road dust and relative humidity. According to the experience of similar projects, the transport vehicle is mostly travelled on an earth road in the construction area during construction, which will produce high-content dust on the road, thereby causing serious fugitive dust on the road. The impact of the fugitive dust caused by soil cement transport vehicles on both sides of the road is more obvious especially in road earth and stone process stage. The fugitive dust pollution due to soil cement transport is the most severe one during the soil mixing process of highway construction, with TSP concentration greater than 10mg/m^3 at 50m away from the downwind area of the roadside and that at 150m away from the roadside greater than 4mg/m^3.

According to similar construction site monitoring, if only watering, without sweeping, is conducted on the road surface on which the vehicles are driving, the dust suppression rate will be 70~80%; while if watering after cleaning, it will achieve 90%. If the watering frequency on the construction site reaches 4~5 times/day, the dust impact distance will be within 20~50m.

(2) Construction fugitive dust

1) Impact of demolition fugitive dust

In the demolition process, the collapse of dry building materials produces a significant amount of fugitive dust pollution due to air operations and wide work surface. The production amount of demolition fugitive dust is connected with demolition volume, construction area, wind speed during construction, demolition construction method and other factors.

Based on the meteorological data, the wind speed in Linshui County is small, with dominant wind towards north and annual average wind speed of 1.9m/s, and the wind speed greater than 5m/s rarely occurs. During demolition, dust cloth fence is applied for enclosed construction and watering is conducted for dust fall, so that the impact range of demolition fugitive dust may be controlled in an enclosed area.

2) Impact of fugitive dust from earth, stone and foundation

Construction processes such as foundation excavation, land leveling and subgrade filling will lead to air pollution caused by dust, fugitive dust, etc. in case of strong winds. According to analogy analysis, TSP concentration monitoring result when watering is not conducted for the construction site at fixed time in fine weather is shown in the table blow.

Table 5.1.3-1 TSP Concentration on the Construction Site

Construction Contents	Dusting Factors	Wind Speed (m/s)	Distance (m)	Concentration (mg/m3)
Earth	Handling, transport and site construction	2.4	50	11.7
			100	19.7
			150	5.0
Soil cement	Handling, mixing and transport	1.2	50	9.0

3) Wind fugitive dust on open storage area and exposed site

Due to construction needs, some building materials shall be piled in an open manner and excavated earth and stone on some worksite shall be temporarily piled up, which will produce fugitive dust in dry and windy weather conditions. The fugitive dust volume may be calculated by the empirical formula for dust on the stack yard:

$$Q = 2.1A\left(V_{50} - V_{0}\right)^{3} \mathrm{e}^{-1.023\mathrm{w}}$$

Where: Q—the amount of dust, kg/ton per year;

V50—wind speed at 50m from the ground, m/s;

V0—dusting wind speed, m/s;

W—moisture content of dust particle, %.

V0 relates to particle size and moisture content, and therefore, reducing open storage, ensuring a certain amount of moisture content and decreasing exposed area are effective means to minimize the wind dust. The spread of dust particles in the air is connected with meteorological conditions like wind speed as well as settling velocity of the dust particle itself. Please see the table below for settling velocity of different particles.

Table 5.1.3-2 Settling Velocity of Dust Particles with Different Particle Size

Particle size (mm)	10	20	30	40	50	60	70
Sedimentation velocity (m/s)	0.03	0.012	0.027	0.048	0.075	0.108	0.147
Particle size (mm)	80	90	100	150	200	250	300
Sedimentation velocity (m/s)	0.158	0.170	0.182	0.239	0.804	1.005	1.829
Particle size (mm)	450	550	650	750	850	950	1050
Sedimentation velocity (m/s)	2.211	2.614	3.016	3.418	3.820	4.222	4.624

4) Material transport vehicles will produce a lot of dust on the road and construction site during operation.

According to the historical records, the fugitive dust produced by vehicle travel accounts for more than 60% of the total fugitive dust. Such dust may be calculated by the following empirical formula in completely dry conditions:

$$Q = 0.123\left(V/5\right)\left(W/6.8\right)^{0.85}\left(P/0.5\right)^{0.75}$$

Where: Q—the amount of dust during vehicle travel, kg/km per vehicle;

V—vehicle speed, km/h;

W—vehicle load capacity, t;

P—the amount of dust on road surface, kg/m^2.

The following table shows the amount of fugitive dust of a 10-ton truck under different road cleanliness and different driving speeds when passing the road with a length of 1km. Thus it can be seen that under road cleanliness conditions, the faster the speed is, the greater the amount of fugitive dust will be; while at the same speed, the more dirty the road is, the greater the amount of fugitive dust will be. Therefore, driving speed limit and road clean are effective ways to reduce vehicle fugitive dust.

Table 5.1.3-3 Vehicle Fugitive Dust Under Different Speeds and road cleanliness Unit: kg/vehicle per km

Vehicle Speed \ P	0.1	0.2	0.3	0.4	0.5	1
5 (km/h)	0.051	0.086	0.116	0.144	0.171	0.287
10 (km/h)	0.102	0.171	0.232	0.289	0.341	0.574
15 (km/h)	0.153	0.257	0.349	0.433	0.512	0.861
20 (km/h)	0.255	0.429	0.582	0.722	0.853	1.435

In conclusion: TSP pollution is severe during the construction period. During earth handling, transportation and construction and stone transport, the TSP concentration in the ambient air where is 100m away from the construction site reaches 8.8mg/m^3 and that in the ambient air where is 150m away is still as high as 5.0mg/m^3. Therefore, 200m from both sides of the site belongs to the construction impact range. For this reason, if dust prevention measures are not taken during road construction, material handling, mixing and other processes, the produced dust will have a greater impact on and cause pollution to the downwind residents. In particular, when the subgrade is completed but the surface remains unpaved, the construction vehicles will roll up a lot of fugitive dust to cause serious pollution to the surrounding air environment while driving on the road.

(5) Fugitive dust due to material mixing

Three kinds of wastes, soil cement and concrete are easy dusting during mixing. There are two ways of mixing during road construction, i.e., road mixing and station mixing. The Project applies station mixing, which refers to factory-style centralized material mixing, with concentrated impact of the fugitive dust on ambient air and more likely downwind pollution. But it is easier for manage and dust pollution may be effectively controlled after taking fugitive dust prevention measures.

2. Analysis of impacts of asphalt smoke during the construction period

Besides the fugitive dust, asphalt smoke is another major source of air pollutant caused by asphalt concrete road surface during construction. Purchased commercial asphalt is applied for asphalt concreting of the Project, so mixing plant and mixing point are not arranged on the site. At present, closed mixing process with dust removal facilities is applied for road construction and the asphalt is transported to the paving site with non-heat source or high temperature container. The emission concentration of asphalt smoke is low, which may meet the requirements for maximum allowable emission concentration of asphalt smoke specified in *Integrated Emission Standard of Air Pollutants* (GB16297-1996), and has less impact on the surrounding environment. Based on the related data, the impact distance of smoke pollutants emitted when conducting asphalt pavement is around 100m from the downwind. But according to the construction organization, the asphalt pavement operation time is short and its impact is temporary.

In summary, ambient air pollutants, mainly including fugitive dust on the road caused by transport vehicle and construction fugitive dust, are generated during the construction links like land leveling, subgrade construction, pavement, material transport, handling and mixing and asphalt pavement. Therefore, different levels of impacts on the air environment for the surrounding resident households will be produced during the construction period, but the impact is temporary.

3. Analysis of impacts on air environment at environmental sensitive points

A certain number of residents are distributed within 200m of both sides of urban road and wastewater interceptor works, and some are distributed sporadically in WWTP works area. Fugitive dust, mainly including fugitive dust caused by transport vehicle and construction fugitive dust, is generated during the construction links like land leveling, subgrade construction, pavement, material transport, handling and mixing. During construction, measures like watering for dust fall and enclosure will be taken, construction under windy weather be prohibited and, and construction site be reasonably determined, by which dust impact and pollution level will be significantly reduced. Moreover, the impact cycle during the construction period is short and the impact will disappear along with the completion of construction.

6.1.4 Prediction and assessment of impacts on surface water environment during the construction period

Wastewater during the construction period mainly derives from construction wastewater, domestic sewage produced by construction personnel and wastewater produced by pipe closed water test. The main pollutant of construction wastewater is SS, which may be reused after sedimentation, while that of domestic sewage includes SS, COD and grease, which may be discharged into waters or used as agricultural fertilizer for the surrounding area upon treatment in sedimentation tank or septic tank. The domestic sewage is prohibited to be directly discharged into nearby waters during the construction period.

1. Construction wastewater: since commercial concrete is used for the construction of the Project and concrete mixing point is not arranged in the construction site, concrete mixing wastewater will not be produced. Thus the production wastewater mainly includes mud wastewater and a small amount of oily production wastewater during the construction period.

   Construction muddy water (produced by the excavation work surface, rain wash, site and construction machinery flushing) is collected according to construction segment. After sedimentation, the upper water shall be reused as much as possible and excessive wastewater may be poured on the spot.

   Cleaning of vehicles and construction machinery will produce oil, which will increase the petroleum concentration in surface water, but the impact is temporary and little. Site wastewater may be reused as construction water as much as possible upon preliminary oil removal and sedimentation. The excessive wastewater may be poured on the spot, but the pouring volume and location shall be controlled to avoid the construction wastewater flowing along the surrounding roads.

   During later construction, curing of concrete ground of water plant and concrete pavement in the plant area produces a small amount of concrete curing wastewater. During concrete curing, thin film or plastic solution may be directly sprayed on the concrete surface, and after solution violation, it will combine with the concrete surface to form a layer of plastic film to separate the concrete and air. In this case, the water in enclosed concrete will no longer evaporate and escape and cement hydration will be completed with the aid of the water in the concrete. Due to the small amount of water consumption, it is completely evaporated. Therefore, special treatment for curing wastewater is not required.

2. Domestic sewage: the domestic sewage during the construction period mainly includes domestic wastewater produced by eating and washing and fecal sewage produced by construction personnel, containing animal and plant grease, detergent and other organic matters. The main components of the domestic sewage during the construction period are shown in the table below.

Table 6.1.4-1 Composition and Concentration of Domestic Sewage during the Construction Period Unit: mg/L

SN	Indicator	High	Middle	Low
1	suspended solids (SS)	350	220	100
2	Biochemical oxygen demand	400	200	100
3	Chemical oxygen demand	1000	400	250
4	Grease	150	100	50

A large number of construction personnel are required for the Project, so a certain amount of sewage is discharged every day. The discharge amount of the domestic sewage produced by construction personnel is calculated as follows:

$Qs=(K \cdot q1 \cdot V1)/1000$

Where: Qs —— discharge amount in the living area, t/d;

q1 —— the total amount of domestic sewage for each person every day, L/(person • day);

V1 —— the number of people in work area, person;

K —— domestic sewage discharge coefficient. It is generally 0.6~0.9, and 0.8 is taken for the Project.

According to this region's economic conditions and work characteristics of the construction personnel, 50~80L/(person • d) is taken as domestic water standard. The number of construction personnel varies a lot depending on the construction volume and difficulty level. Based on the construction scale, the number of construction personnel of roads and bridges pipe network works is calculated as 350 persons, that of wastewater interceptors works as 80 persons and that of WWTP works as 50 persons, so the total discharge of domestic sewage is 19.2t/d~30.7t/d.

3. Because the third WWTP is near Danshuitan River, it is required in the assessment that construction wastewater shall be reused after sedimentation in the sedimentation tank and direct discharge into Danshuitan River is not allowed. In addition, the domestic wastewater generated by the construction personnel shall be discharged upon treatment in septic tank or used as agricultural fertilizer. In this case, the construction of WWTP component has little impact on the water quality of Danshuitan River.
4. Leakage and pressure test is required to be performed after the connection of pipe network works like wastewater interceptors, and the water pollutants for pressure test is mainly SS, which may be collected as dust suppression water or landscaping water after sedimentation.
5. In order to avoid entering into the scope of protection for Lingbaoshan cultural relics, the wastewater interceptors of the Project along Shiba River cross the River twice. Pipe jacking construction is applied for the construction for crossing Shiba River, which has slight impact on the quality of river waters.

6.1.5 Prediction and assessment of impacts on groundwater environment during the construction period

The Project mainly includes new road works, wastewater interceptor works and WWTP works, of which the construction in general will not lead to changes in groundwater level and will not block the groundwater flow. Therefore, the impact on groundwater environment during construction is mainly from the following points:

1. The impact on groundwater during construction is mainly from construction wastewater and domestic sewage produced by construction personnel. If such wastewater is not untreated and discharged at will, it will impact the surface water quality, which in turn may impact the groundwater quality. In the Project, the construction wastewater is reused after treatment and domestic sewage is discharged upon treatment in septic tank or used as agricultural fertilizer, which in general will not impact the groundwater quality.
2. Drainage measures shall be considered for the water burst in the foundation construction process of WWTP. The groundwater burst to be pumped out of the pipe shall be collected by pipes for temporary treatment in sedimentation tank, and the wastewater may be reused as construction water after sedimentation. Due to small WWTP area and the groundwater is not very developed in the plant area, the construction will not impact the groundwater level in the region.
3. The burial depth of pipeline works like wastewater interceptors of the Project is

usually at 8~10m. Groundwater depth in some pipe construction section is shallow, so groundwater burst may occur during pipe excavation. Therefore, the principle of “block-based and prevention combined” shall be followed for pipe seepage and leakage during pipeline construction, in order to protect the groundwater environment and prevent groundwater leakage. Before the construction of such pipeline works, it is need to ensure that 0.5m below the bottom of the excavated foundation pit is dewatered during groundwater reduction, so detailed geological and hydrogeological survey on pipe landfill is required to be conducted before construction to develop detailed construction waterproof solutions.

6.1.6 Prediction and assessment of impacts on solid waste environment during the construction period

The solid waste produced during the construction period mainly includes construction waste, domestic waste produced by construction personnel and spoils due to excavation.

The Project involves demolition of buildings and structures within the scope of land acquisition, covering an area of 96,807m^2 and basically for the residents of farmers. Construction waste mainly relates to broken bricks, concrete, mortar, pile head and packaging materials, which generate demolition waste of about 6.58 × 104m^3. Such construction waste is delivered to Linshui Bureau for Environmental Health for unified treatment.

It is recommended in the assessment to mainly hire the houses of local villagers and residents as construction camps and try not do separate settings. The construction personnel inside the camp is relatively concentrated, by which the domestic waste generated mainly include coal ash, brick slag, glass, plastic, paper and peel, among which most are inorganic substances such as coal ash and brick slag and organic substances like canteen waste, plastic and paper scrap account for a minor part. The domestic waste discharge by the construction personnel is about 0.25kg/(person • day) and the average total construction personnel during the construction period is about 480 persons. The domestic waste discharge by the construction personnel is 120kg/d and total discharge amounts to 172.8t during the construction period.

If the construction waste and domestic waste produced during construction are untreated and stacked out of order, it will impact the soil, air, water environment and landscape in some area nearby.

In addition, excavation will generate spoils. Based on the water and soil conservation plan, the total excavation of the Project is 1.4263 million m^3 and total backfill 1.4263 million m^3, in which 104,000m^3 of topsoil is comprehensively used in backfill, without spoiling and borrowing. The construction spoils may be temporarily stored in the construction site. If stored improperly, such spoils may result in soil erosion, blockage of drainage channels, landscape destruction or secondary dust pollution under the action of wind due to rainwater leaching, thereby impacting the environmental health in the project area. Upon full earth and stone allocation, the remaining spoils are placed in unused low-lying land in the vicinity of the project area, which may be used for backfill of other open projects.

6.1.7 Analysis of impacts on social environmental during the construction period

1 Analysis of impacts of construction on cultural relics

After communication with the Designer, local adjustment is proposed to be performed for the pipeline plan and the pipeline will be adjusted to the place where is outside the scope of construction control area. Upon adjustment, the distance between wastewater interceptors and construction control area is greater than 15m, as shown below.

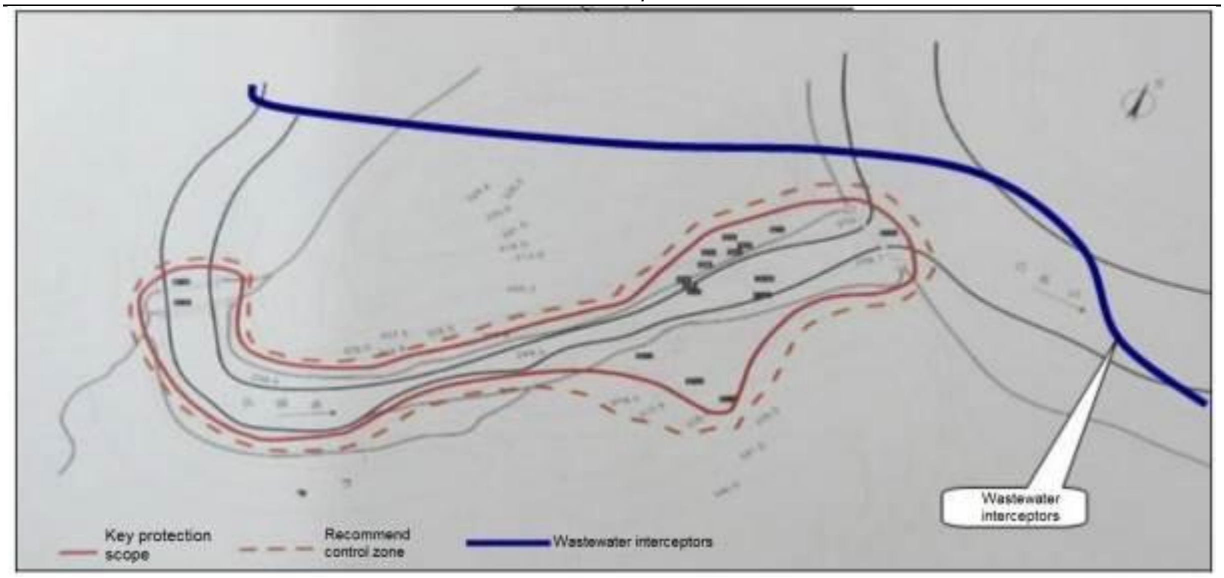


Figure 6.1.7-1 Diagram for Locational Relation between Wastewater Interceptor and Protection Scope of Lingbaoshan

According to the construction plan, pipe jacking method is applied for the pipeline construction of this section and mountain excavation and blasting are not needed. The pipes are laid along the riverbank when pipe jacking crosses the river.

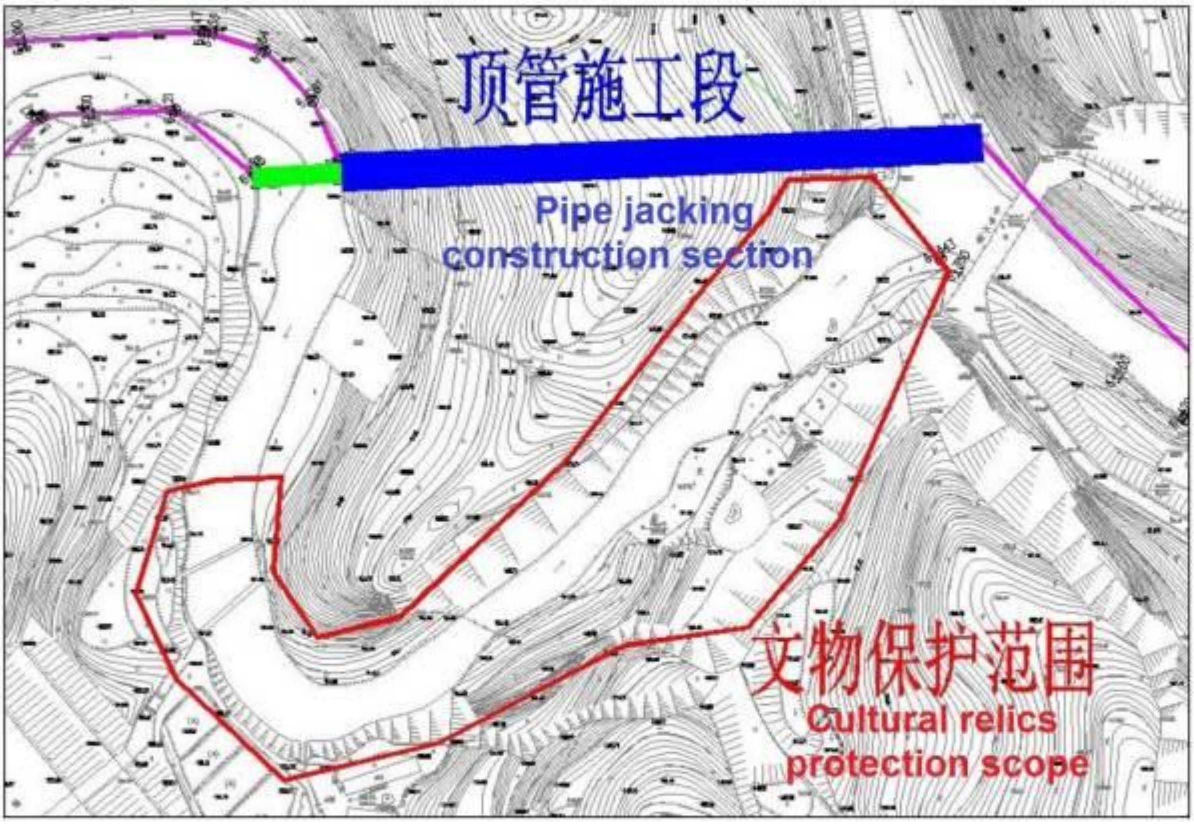
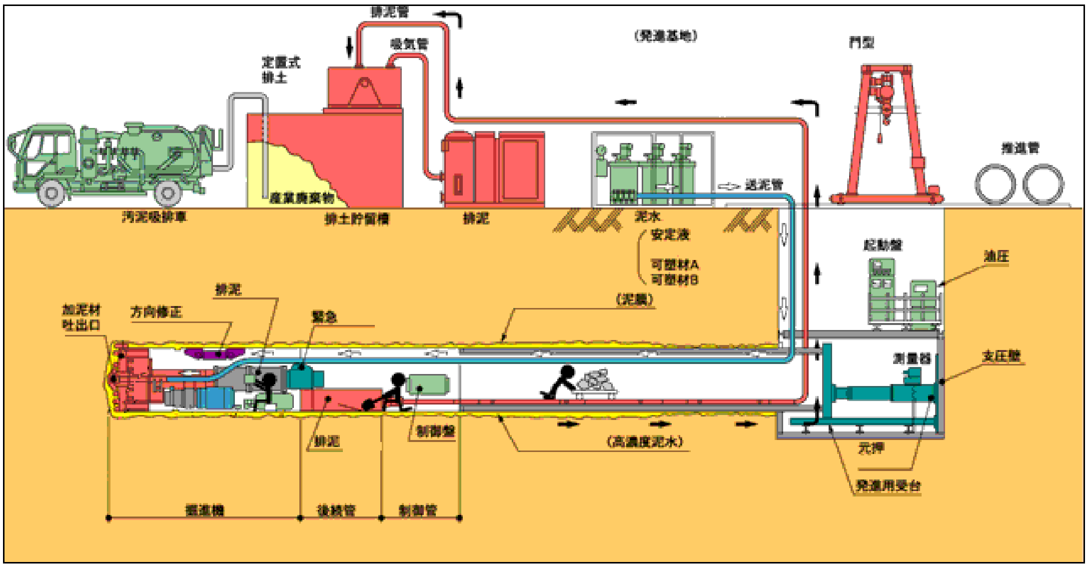


Figure 6.1.7-2 Diagram for the Position of Pipe Jacking Construction of Wastewater Interceptors

Surface excavation is not required for pipe jacking construction, which may cross roads, railways, rivers, above-ground buildings, underground structures and a variety of underground pipelines. During pipe jacking, tool pipe or heading machine is pushed from the working well to the receiving wells for lifting through the soil with the aid of the thrust of main jacking cylinder and intermediate jacking station. At the same time, the pipes followed by the tool pipe or heading machine are buried between the two wells, in order to achieve underground pipe laying without excavation. Pipe jacking construction process is shown below.



From here we see that construction will not impact on culture relic protection units when the route is adjusted to outside the construction control area.

2. Impacts of Land Acquisition, Demolition and Relocation

According to the World Bank policy on involuntary resettlement, the Owner prepares *Resettlement Action Plan* (RAP) (July 2014) for land acquisition, demolition and relocation of each component of World Bank loan funded projects.

The impacts of land acquisition, demolition and relocation and contents of resettlement plan are excerpted from RAP. From the impacts of land acquisition, demolition and relocation, we can know that urban road works, wastewater interceptor works and wastewater treatment works have permanently acquired land and demolition impact. See the table below for the impact type of land acquisition, demolition and relocation of each component.

Table 6.1.7-1 Impact Type of Land Acquisition, Demolition and Relocation of Each Component

SN	Components	Permanently Acquired Land	Temporarily Acquired Land	Demolition
I	Urban road	√	X	√
II	Wastewater interceptors	X	X	X
III	Wastewater treatment	√	X	√

It can be seen from the above table that the impacts of land acquisition, demolition and relocation of the Project are focused on the construction of urban road works and wastewater treatment works.

According to the summary of resettlement survey data, the overall condition of impacts of the Project is as follows: land acquisition of the Project involves nine villages, i.e., Poshi Village, Wenxing Village, Dafosi Village, Wucha Village, Zhengjia Village, Paifang Village and Xinhe Village in Chengnan Town, Yun'an Village in Xitian Township and Mahe Village in Moujia Town.

(1) Demolition impact

The project area is substantially located in the rural areas, so only rural residential housing demolition is involved. There are totally 161,369m^2 houses demolished, among which 12,904m^2 are of frame structure, 98,433m^2 masonry-concrete structure, 24,201m^2 masonry-timber structure and 16,132m^2 earth-timber structure, 5,107m^2 lumber room structure and 4,569m^2 other structures, affecting 704 households and 2,468 persons.

(2) Impact of land acquisition:

Land acquisition of the Project impacts 4,442 persons from 1,264 households and 881*mu* of land is required to be permanently acquired, including cultivated land of 660*mu* and non-cultivated land of 221*mu*. The acquired cultivated land belongs to collective land, in which paddy field covers 220*mu* and dry land covers 440*mu*. Besides, the acquired cultivated land belongs to collective land and state-owned agricultural land. No land is temporarily occupied by the Project except the permanently acquired cultivated land. Most of the cultivated land occupied by the whole project is in Zhengjia Village, Wucha Village and Poshi Village.

(2) Impact on tomb relocation

According to the preliminary survey, location of the tombs will be occupied for construction and 1,626 tombs are required to be relocated.

3. Analysis of impacts on urban traffic

The impact of construction on the traffic is mainly reflected in that earth piling and road excavation obstruct the traffic and impact the travel, and suddenly increased traffic volume on the transport road impacts travel conditions.

During the project implementation stage, the traffic volume of the roads such as National Highway 210 within the construction area will be increased, which will disturb the daily travel of residents and internal traffic conditions to a certain extent.

Negative impact on local transport and the environment in the project area will be caused during construction. The residents living around the project will suffer travel inconvenience and poor transport due to the project implementation, and in addition the environmental impact caused by noise, fugitive dust, etc. and large construction vehicle travel will cause some potential traffic safety hazard. However, the negative impact is temporary. When the project is completed, it will bring a positive impact on living environment improvement and road transport facilitation.

4. Analysis of impacts on the lives of residents

The impacts on the lives of residents caused by the project during construction are mainly from land acquisition, demolition and relocation. The Project covers an area of 78.99hm^2 in total, in which permanently occupied land covers 59.17hm^2 and demolition area 96,807m^2.

According to RAP and *Social Assessment Report*, the main problem during construction is that land acquisition, demolition and relocation cause the original residents lose their land and resettle their homes, and thereby lowering their short-term quality of life. Based on the survey, 4,442 persons from 1,264 households in the project will be impacted by the construction. But with the implementation of resettlement measures, the living or working environment of relocated residents and enterprises will be greatly improved.

Moreover, rural roads, irrigation ditch, power and communication may be obstructed in the construction process, and it is bound to bring impact and inconvenience to the normal life of residents.

5. Analysis of impacts on the landscape

Stacking disorder of waste bricks, woods and stones from demolished houses as well as domestic wastes due to demolition will impact the urban landscape and appearance and bring some visual impact to the surrounding residents.

6. Impacts of construction camps

From the size of the project, we can know that the construction will last for a period of time. The increase in the number of construction personnel may bring some impact to the area where construction personnel are gathered. On the one hand, it may interfere with the health and safety of local people, and on the other hand, if the living conditions in the construction camp is incomplete with poor sanitary conditions, epidemic disease is likely to rise.

Health risk mainly refers to the risk of infectious diseases such as AIDS and venereal disease brought by a large number of floating populations during the construction period. Unsanitary and unhealthy living habits of the construction personnel might infect local residents or other construction personnel with epidemic disease. Since isolation control measures are not provided on the construction during road construction, it is easy to cause harm to the children lacking of safety consciousness.

7. More job opportunities

More job opportunities may be provided during construction, so a lot of the rural labor forces may work on the construction site during such period.

6.1.8 Resettlement during construction period

1 Scope of acquisition, demolition and relocation

Infrastructure Project for World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area involves construction land in Qianfeng District and Linshui County of Guang’an City as well as 5 townships, 18 villages and 1200.93 *mu* of permanently acquired land within the two areas, of which 903.33 *mu* is of cultivated land, with 1717 affected households and 6072 affected persons; and 330548 m^2 is of demolished rural housing, including 12904 m^2 of frame structures, 213891m^2 of masonry-concrete structures, 60184 m^2 of masonry-timber structures, 26734 m^2 of earth-timber structures, 10308 m^2 of lumber room structures and 6856 m^2 of other structures, with 1125 affected households and 3983 affected persons. As Expansion Works of Linshui Industrial Park (Infrastructure Project for Chongqing-Guang´an Cooperatively Constructed Electromechanical Industrial Park, Phase 3) will be implemented simultaneously with the World Bank Loan Funded Project, and the resettlement will be implemented uniformly with that of the World Bank Project, the substantial impact of Expansion Works of Linshui Industrial Park is described in this section. Expansion Works of Linshui Industrial Park (Infrastructure Project for Chongqing-Guang´an Cooperatively Constructed Electromechanical Industrial Park, Phase 3) involve 3 townships, 7 villages and 6316.38 *mu* of permanently acquired land, including 4738.34 *mu* of cultivated land, with 4717 affected households and 16509 affected persons; 990689 m^2 of demolished rural housing, including 79255.18 m^2 of frame structures, 604320.7 m^2 of masonry-concrete structures, 148603.45 m^2 of masonry-timber structures, 99068.97 m^2 of earth-timber structures, 31702.07 m^2 of lumber room structures and 27739.31 m^2 of other structures, with 4716 affected households and 16511 affected persons.

2 Policy frame, compensation standard and resettlement cost estimate

The Resettlement Action Plan of the Project will be prepared in strict accordance with the relevant documents of PRC, Sichuan Province and Guang’an City as well as the requirements in the World Bank Safeguard Policies, OP4.12/BP4.12 Involuntary Resettlement. The resettlement will be implemented in strict accordance with the resettlement compensation standard and resettlement scheme identified in the Plan. As stated in the *Notice of the People’s Government of Guang’an on the Issuance of Land Acquisition Compensation* *and Resettlement Measures* (GAFF [2013] No. 13), the unified annual output of land shall be collected according to the unified annual output standard of land acquisition issued by the People's Government of Guang'an after the approval of Sichuan Provincial People's Government. The annual output of cultivated land in the affected area of the two project components is determined to be CNY 1880/*mu*; the compensation is made 20 times as much as the output of cultivated land and 10 times as much as that of other lands.

The compensation price is slightly higher than the local relocation price for the housing and structures of the Project, which is CNY 900/m^2 for the frame structure, CNY 830/m^2 for the semi-frame structure, CNY 750/m^2 for the masonry-concrete structure, CNY 550/m^2 for the masonry-timber structure and CNY 150/m^2 for the simplified structure.

The total resettlement cost of the Project is estimated to be CNY 370.18 million, including CNY 272.42 million of basic resettlement cost directly used to compensate affected people, CNY 70.52 million of taxes and administrative costs and CNY 27.24 million of contingencies.

The total resettlement cost for the Expansion Works of Linshui Industrial Park (Infrastructure Project for Chongqing-Guang´an Cooperatively Constructed Electromechanical Industrial Park, Phase 3) is estimated to be CNY 1.35139 billion, including CNY 921.85 million of basic resettlement cost directly used to compensate affected people, CNY 337.35 million of taxes and administrative costs and CNY 92.18 million of contingencies.

3 Measures and resettlement scheme to minimize the project impact

In Project planning stage while performing plan optimization and comparison, pay as much attention as possible to the impact on local social and economic environment by the Project, and make this a key factor for plan optimization and comparison. To reduce housing demolition and resettlement quantity, the optimal design shall design different width for different road sections while basically maintaining the original right of way width, thus to minimize the impact on the socio-economy and people's lives. At the same time, use waste land and state land as much as possible to reduce farmland occupation.

For people who are inevitably affected, the damaged housing shall be rebuilt, compensation shall be made for the land and other properties, and the infrastructure and income shall be recovered. The specific resettlement scheme is as follows:

(1) Resettlement scheme for land acquisition

The project involves 1200.93 *mu* of permanently acquired collective land, including 903 *mu* of cultivated land. As the land acquisition impact of the project is mainly caused by road construction, in linear distribution, the majority of affected households will not completely lose their land and the agricultural production of farmers will not be seriously affected by land acquisition. The followings are the resettlement modes for land acquisition:

Monetary compensation

Social insurance resettlement

Skills training

Employment promotion

(2) Resettlement scheme for housing demolition

For the rural housing acquired in the Project, incomplete supporting facilities, old and aging structures and poor lighting and ventilation conditions and other problems of different levels exist, the supporting conditions around the residential areas are poor, and some affected villages are far away from the urban area, which makes it inconvenient for the villagers to going out; however, the resettlement activity for housing demolition in the Project will create a good chance for the relocated households to improve their housing conditions.

The current alternatives for resettlement community in Linshui project component include: Western New City Resettlement Community Works planned to be constructed in 2 phases, namely Phase 1 and Phase 2 resettlement housings of LETDZ Western New City; Yixin Community and Tongxin Community planned to be constructed simultaneously. The above resettlement areas are close to the urban area, complete with well-developed service facilities and buses for easy travel; the housing type is divided into 70m^2, 105m^2 and 140m^2. The communities are to be constructed by Linshui Yuanfeng Industrial Development Co., Ltd (government-controlled entity) by financing from the Linshui County finance, the land acquisition will be implemented in June 2015, and the construction will be started in October 2015 and completed in June 2017.

The current alternatives of community for resettlement in Qianfeng project component are resettlement housing in Pingqiao Road area and Liujiaoqiu area, which are located in the main downtown of Qianfeng District, with convenient transportation, complete supporting facilities and the same housing type as that in Linshui County. The land for resettlement community construction has been acquired, which will be constructed by Qianfeng Construction Bureau through financing from Qianfeng District financial department and bank. The site leveling of such area has been finished in July 2014 and the construction will be completed in March 2016.

(3) Women development measures

Small-sum guaranteed loan for women

Enterprises residing in the development zone providing more jobs for women.

Enhancing the participation of women in the administration and discussion of state affairs in grassroot organizations

Women having equal decision-making rights in selecting the family resettlement scheme

(4) Resettlement measures for vulnerable groups

In addition to the normal relief and support of the state, the local government takes a series of measures against the vulnerable groups of the Project to help them benefit from the project.

For poor households: the poverty of poor households in the project area is mostly due to lacking of labor skills, so the local government takes the following supporting measures during the implementation of the project: giving priority to such households in skills training, reduction of training fees and recommending jobs.

For the disabled: the local government provides jobs for those who are able to work by entrusting the intermediary agencies to train them for vocational skills and offering labor dispatching posts of the government; for those who are unable to work, the government establishes rehabilitation center and fostering center to help them recover living ability as soon as possible.

For households enjoying the five guarantees: the relocated household with 1 family member will be counted as a two-member family and can select a 70m2/set resettlement housing; public rental housing and low-rent housing will be provided in the resettlement community, which are equipped with complete service facilities and habitable by bringing the luggage and necessities only.

(5) Restoration scheme for affected infrastructures

The affected infrastructures of the Project mainly are the electric power and communication facilities and oil and gas transmission lines. If the restoration is not required by the construction and operation of the Project, the owner shall be compensated directly according to the compensation standard stated in Chapter 5, if required, it shall be restored by the owner after being compensated according to the standard.

(6) Resettlement scheme for associated projects

The associated projects mentioned in the document will be constructed simultaneously with the proposed projects of the World Bank, so the compensation standard for land acquisition and housing demolition of the former shall be the same as that of the latter.

4 Resettlement organization establishment

In order to strengthen the leadership of Infrastructure Project for World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area, leading groups have been set up for Guang'an City, Qianfeng District and Linshui County respectively for the proper implementation of funds and smooth progress of works. The land acquisition, housing demolition and resettlement of the Project are carried out under the leadership of leading groups, where the Employer is responsible for general coordination, surveillance and complaint reception, the department of land and resources, the planning and construction department, the town and township government, the community committee and other departments coordinate the land acquisition, the housing demolition and the allocation of resettlement housings, and the finance bureau at district and county levels raises and distributes the funds required for the land acquisition, housing demolition and resettlement. The working personnel involved in the land acquisition, housing demolition and resettlement shall be trained for specific work so that they could finish their tasks successfully.

5 Consultation, participation and resettlement schedule

The resettlement related departments of the Project and governments at all levels have communicated and consulted for several times with the representatives of affected villages, groups and villagers for their opinions and suggestions. The whole process of land acquisition, housing demolition and resettlement will be performed in the spirit of consultation for the Project.

In December 2013, the Employer and local resettlement related departments organized a survey together with the resettlement experts from Sichuan Fontal Strategic-Consulting Co., Ltd. to collect opinions from local public. The survey is carried out in the forms of interview and questionnaire by sampling among all local relocated households, the sample size is 172 households representing 10% of total numbers. The purpose of such public opinion survey by sampling is to collect and understand the opinions and suggestions of the affected villages, groups and households on the project construction and resettlement.

According to the project schedule, the plan for the land acquisition, housing demolition and resettlement will be coordinated with the plan for project construction. The main activities of land acquisition, housing demolition and resettlement are planned to be performed from December 2013 to June 2016, the specific timing may be subject to the deviation of overall project progress.

6.2 Environment Impact during the Operation Period

6.2.1 Ecological Impacts during the Operation Period

1. Analysis of impacts on animals and plants during the operation period

Natural vegetation permanently acquired by the proposed road works will change the land-use nature, but through natural succession or artificial vegetation restoration, it may be gradually restored to secondary vegetation corresponding to the above vegetation characteristics, with quality inferior to that of corresponding native vegetation. When the road is under operation, the construction of the LETDZ will be stimulated and accelerated, leading to further reduction in native vegetation in the region.

Continuous occupation of animal habitats due to the construction of road works and the LETDZ forces the animals to find new living environment, which will definitely impact the their feeding, shelter and breeding. However, they all have certain migratory capacity and may gradually transfer to the surrounding neighborhood, while food sources are diversified. Therefore, they will not be greatly impacted by the construction.

During the project operation, vehicle exhaust and road dust will form surface runoff along with the rainfall, which may enter into the waters to cause short-term impact on regional water quality, and then to a certain extent impact the normal habitats of fish and benthonic animals.

2. Impacts on ecological landscape during the operation period

Ecological impacts during the operation period mainly refer to ecological impact on the landscape. After the operation of road works and wastewater interceptor works of the Project, the regional land use status will be changed, which will change the original rural hilly landscape into the LETDZ. When the project is completed, multiple aesthetic factors like plant-specific lines, colors and seasonal changes will be used for the road being built to form a strong characteristic with different tree species, ornamental period and configuration, and in addition, fit with street lamps, flower beds and garbage bins to form colorful streetscape. Also, the rational allocation of landscape will increase the beauty of the city, beautify city appearance and give a comfortable feeling. Besides, project implementation will promote urban development and urge the regional rural ecological landscape to gradually develop towards urban ecological landscape. Through the improvement of landscaping works on both sides of the roads and rivers, the urban ecological structure will tend to be more reasonable.

6.2.2 Impacts on acoustic environment during the operation period

1. Traffic noise prediction mode

Road traffic noise prediction is the main basis for reasonably planning road traffic and the layout of buildings on both sides and reducing the impact of traffic noise on the surrounding environment. Noise impact of the project is mainly from roads and many buildings are distributed along the roads. It is suitable to apply Cadna/A software to predict the noise impact of the Project.

With Cadna/A software, road traffic noise prediction is based on RLS90 mode. According to this mode, the average sound pressure level Lm of the receiving point is the function of road noise radiated sound level $L_{m,E}$ (sound source intensity), which is obtained by the average sound level of free sound wave of the place where is 25m away from the centerline of the lane when considering the impact of vehicle speed, road gradient and road materials[2]. The road radiated sound level $L_{m,E}$ is expressed by Formula (1):

$L_{m,E}=L_m^{(25)}+D_v+D_{stro}+D_{stg}$ …… (Formula 1)

Where: $L_m^{(25)}$refers to the average sound level of free sound wave of the place where is 25m away from the centerline of the lane; D_v refers to amendment to different maximum speed limit; D_{stro} refers to amendment to different pavement material and D_{stg} refers to amendment to correct the slope of road grade.

2. Prediction parameters

Based on the design documents, the annual traffic volume of each prediction year is shown in the table below.

Table 6.2.2-1 List of Annual Traffic Volume of Each Prediction Year

Unit: vehicle/hour

Characteristic Year	2020 (Short Term)						2026 (Medium Term)						2034 (Long Term)					
Traffic Volume	Heavy truck		Midsize car		Car		Heavy truck		Midsize car		Car		Heavy truck		Midsize car		Car	
Time	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
Road 1	207	46	248	55	310	69	231	51	277	62	346	77	268	60	320	71	400	89
Road 2	40	9	48	11	60	13	45	10	54	12	67	15	52	12	62	14	78	17
Road 3	12	3	15	3	18	4	14	3	16	4	20	5	16	4	19	4	24	5
Road 4	4	1	4	1	5	1	4	1	5	1	6	1	5	1	5	1	7	2
Road 5	3	1	3	1	4	1	3	1	3	1	4	1	3	1	4	1	5	1

3. Prediction results

(1) Trunk road prediction result

Based on the above mode and parameters, Road 1 and LETDZ southern district are selected to build prediction model. See the table below for traffic noise predictions of Year 2020 (short term), 2026 (medium term) and 2034 (long term).

Table 6.2.2-2 Regional Traffic Noise Prediction Results (Short Term) Unit: dB(A)

No. of Predicted Point	Predicted Value		Standard Value		Out of Specification	
	Day	Night	Day	Night	Day	Night
N1-1	55.7	49.1	70	55	No	No
N1-2	54.4	47.9	70	55	No	No
N1-3	66.7	60.2	70	55	No	5.2
N1-4	60.8	54.3	70	55	No	No
N2-1	52.4	46.2	65	55	No	No
N2-2	54.8	48.3	65	55	No	No
N2-3	63.1	56.5	65	55	No	1.5
N2-4	60.2	53.8	65	55	No	No
N2-5	54.1	47.6	65	55	No	No
N2-6	65.5	58.9	65	55	0.5	3.9
N2-7	67.3	60.8	65	55	2.3	5.8
N2-8	59.4	52.8	65	55	No	No
N2-9	65.8	59.1	65	55	0.8	4.1
N2-10	52.2	45.6	65	55	No	No

Table 6.2.2-3 Regional Traffic Noise Prediction Results (Medium Term) Unit: dB(A)

No. of Predicted Point	Predicted Value	Standard Value	Out of Specification

	Day	Night	Day	Night	Day	Night
N1-1	56.3	49.7	70	55	No	No
N1-2	54.9	48.4	70	55	No	No
N1-3	67.2	60.7	70	55	No	5.7
N1-4	61.3	54.8	70	55	No	No
N2-1	52.9	46.7	65	55	No	No
N2-2	55.3	48.8	65	55	No	No
N2-3	63.5	57.0	65	55	No	2.0
N2-4	60.5	54.1	65	55	No	No
N2-5	54.7	48.1	65	55	No	No
N2-6	66	59.3	65	55	1	4.3
N2-7	67.8	61.3	65	55	2.8	6.3
N2-8	59.6	53.1	65	55	No	No
N2-9	66.3	59.6	65	55	1.3	4.6
N2-10	52.7	46.1	65	55	No	No

Table 6.2.2-4 Regional Traffic Noise Prediction Results (Long Term) Unit: dB(A)

No. of Predicted Point	Predicted Value		Standard Value		Out of Specification	
	Day	Night	Day	Night	Day	Night
N1-1	57.1	50.5	70	55	No	No
N1-2	55.5	49	70	55	No	No
N1-3	67.8	61.3	70	55	No	6.3
N1-4	61.9	55.4	70	55	No	0.4
N2-1	53.6	47.4	65	55	No	No
N2-2	55.9	49.4	65	55	No	No
N2-3	64.2	57.6	65	55	No	2.6
N2-4	61.3	54.9	65	55	No	No
N2-5	55.4	48.8	65	55	No	No
N2-6	66.6	60	65	55	1.6	5
N2-7	68.5	61.9	65	55	3.5	6.9
N2-8	60.5	54	65	55	No	No
N2-9	66.9	60.3	65	55	1.9	5.3
N2-10	53.5	46.8	65	55	No	No

(2) Section prediction and standard distance analysis

Noise value and standard distance for different distances are predicted after road operation of the Project, and the results are as follows.

Table 6.2.2-5 Traffic Noise Predictions at Different Distances of the Trunk Road

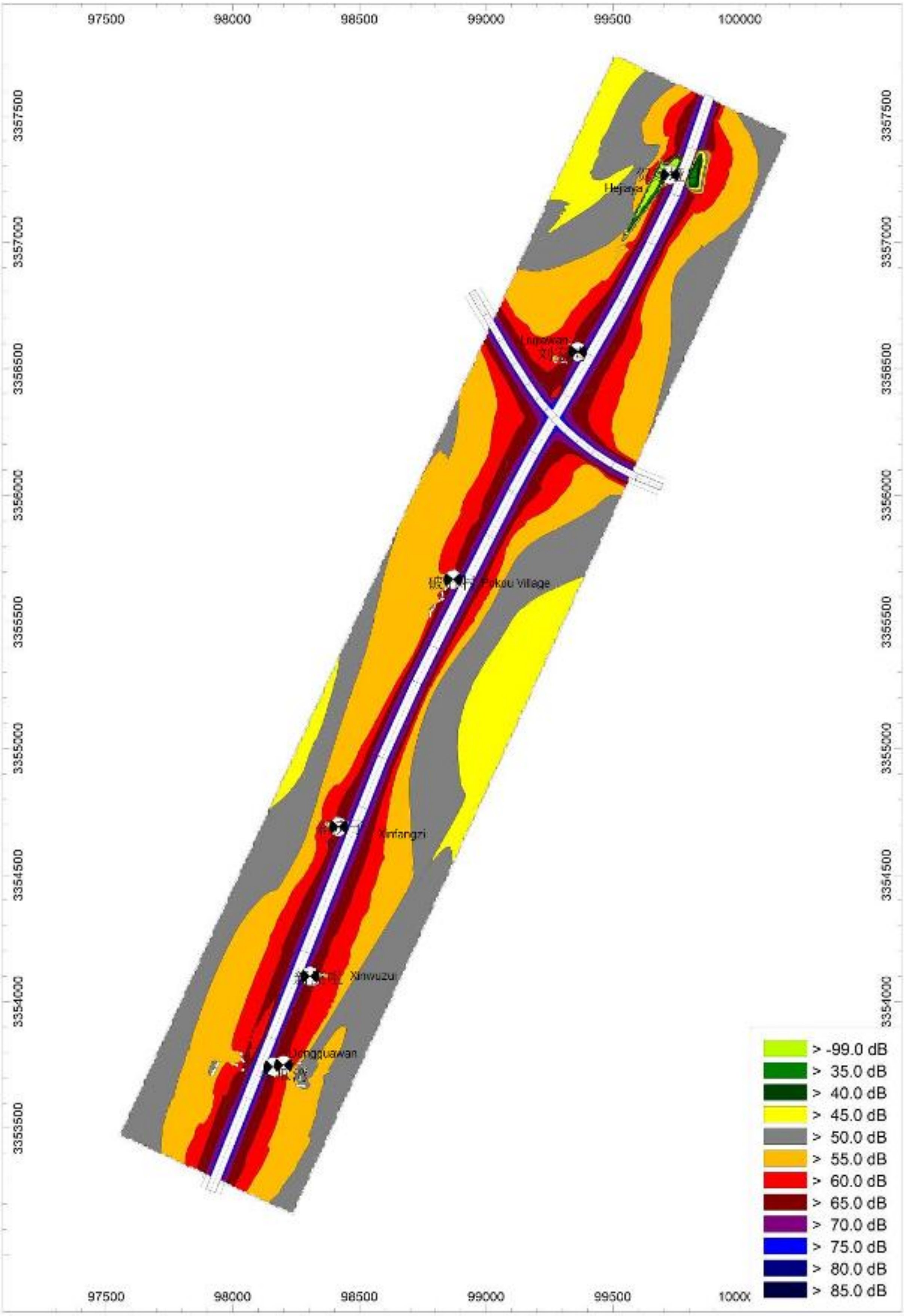
Operation Period	Period	Traffic Noise Predictions at Different Distances from the Center Line of the Road dB(A)										
		10	20	40	60	80	100	120	140	160	180	200
Short Term	Day	72.5	68.2	63.4	60.6	59.1	58.0	57.0	56.3	55.6	55.0	54.5
	Night	66.0	61.7	56.5	53.7	52.6	51.4	50.5	49.7	49.1	48.5	47.9
Medium Term	Day	72.7	68.7	63.5	60.7	59.6	58.4	57.5	56.7	56.1	55.5	55.0
	Night	66.4	62.1	56.9	54.1	53.0	51.9	51.0	50.2	49.5	48.9	48.4
Long term	Day	73.3	69.3	64.1	61.3	60.2	59.1	58.2	57.4	56.7	56.1	55.6
	Night	67.1	62.8	57.6	54.8	53.7	52.6	51.7	50.9	50.2	49.6	49.1

Table 6.2.2-6 Traffic Noise Predictions at Different Distances of the Sub-trunk Road

Operation Period	Period	Traffic Noise Predictions at Different Distances from the Center Line of the Road dB(A)										
		10	20	40	60	80	100	120	140	160	180	200
Short Term	Day	65.4	61.1	56.3	53.5	52.0	50.8	49.9	49.1	48.5	47.9	47.4
	Night	58.9	54.6	49.4	46.6	45.5	44.4	43.4	42.7	42.0	41.4	40.9
Medium Term	Day	65.9	61.6	56.4	53.6	52.5	51.3	50.4	49.6	49.0	48.4	47.9
	Night	59.4	55.1	49.8	47.1	46.0	44.8	43.9	43.1	42.4	41.9	41.3
Long term	Day	66.5	62.2	57.0	54.2	53.1	52.0	51.1	50.3	49.6	49.0	48.5
	Night	60.1	55.8	50.6	47.8	46.7	45.6	44.7	43.9	43.2	42.6	42.1

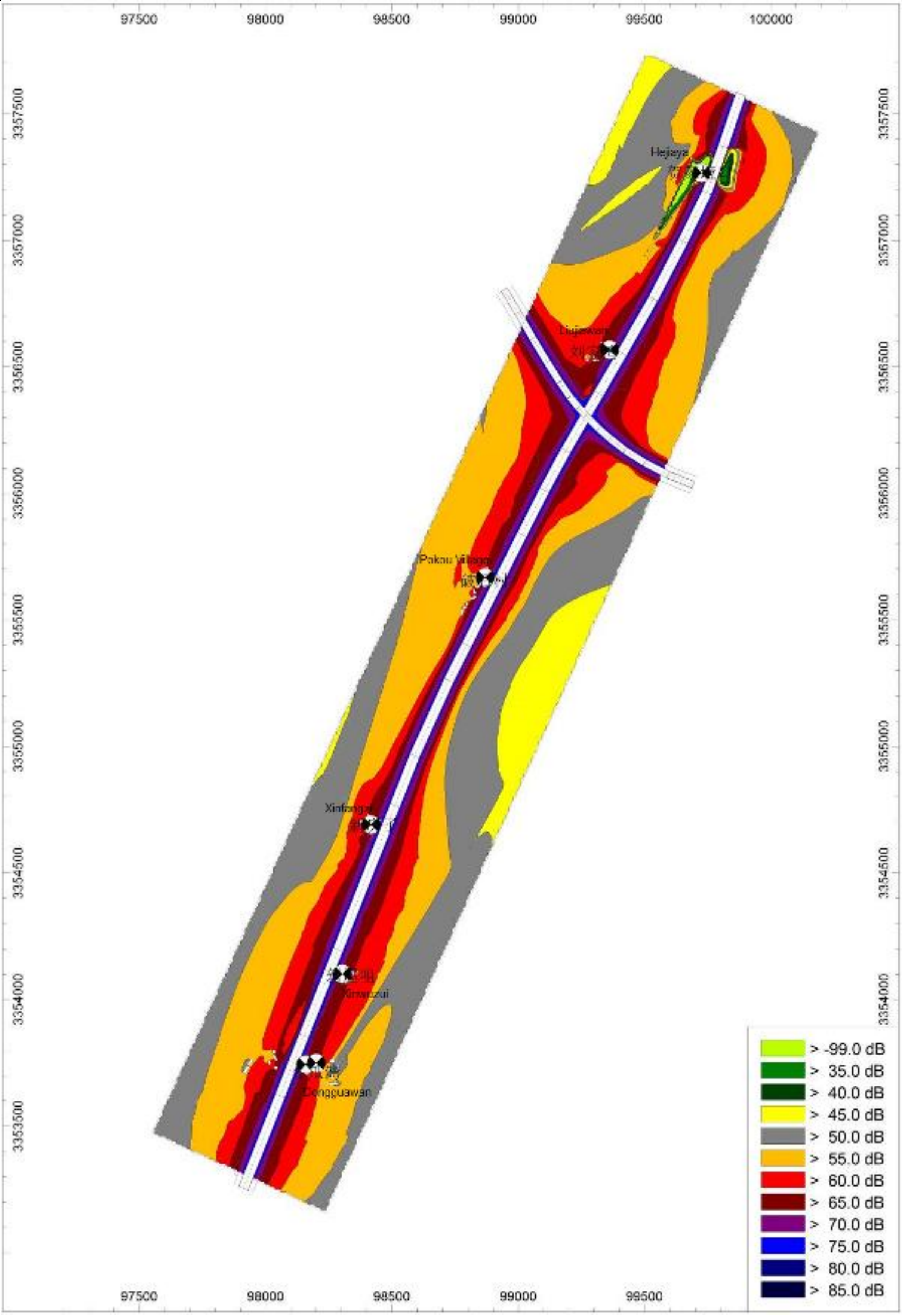
Table 6.2.2-7 Traffic Noise Predictions at Different Distances of the Branch Road

Operation Period	Period	Traffic Noise Predictions at Different Distances from the Center Line of the Road dB(A)										
		10	20	40	60	80	100	120	140	160	180	200
Short Term	Day	60.1	55.8	51.2	48.4	46.7	45.6	44.7	43.9	43.2	42.6	42.1
	Night	54.0	49.7	44.5	41.7	40.6	39.5	38.5	37.8	37.1	36.5	36.0
Medium Term	Day	60.8	56.5	51.3	48.5	47.4	46.2	45.3	44.5	43.9	43.3	42.7
	Night	55.4	51.1	45.9	43.1	42.0	40.9	39.9	39.2	38.5	37.9	37.4
Long term	Day	61.4	57.1	51.9	49.1	48.0	46.8	45.9	45.1	44.5	43.9	43.4
	Night	56.3	52.0	46.8	44.0	42.9	41.8	40.9	40.1	39.4	38.8	38.3

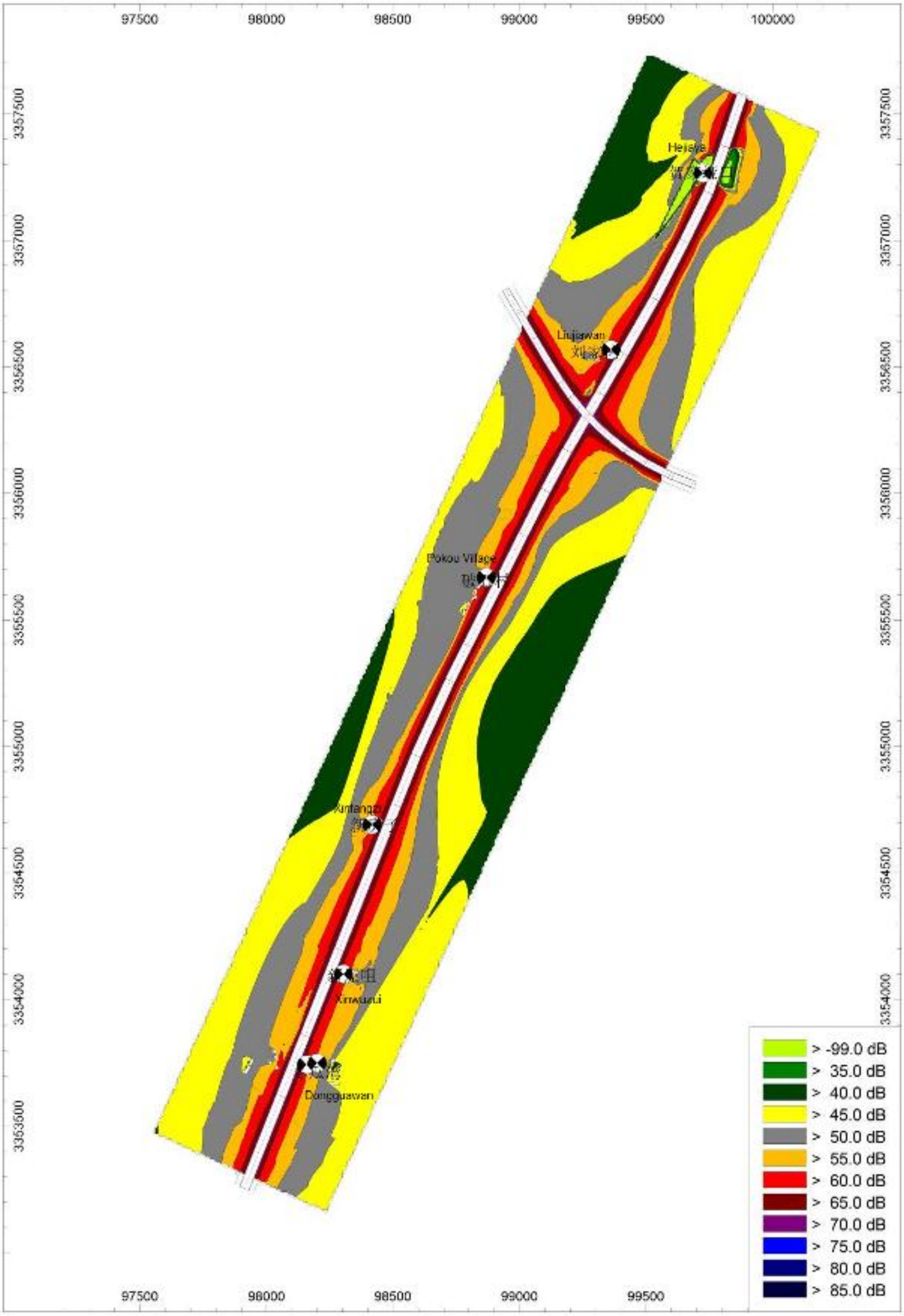


Noise Prediction Results of Road 1 (Daytime in the Short Term)

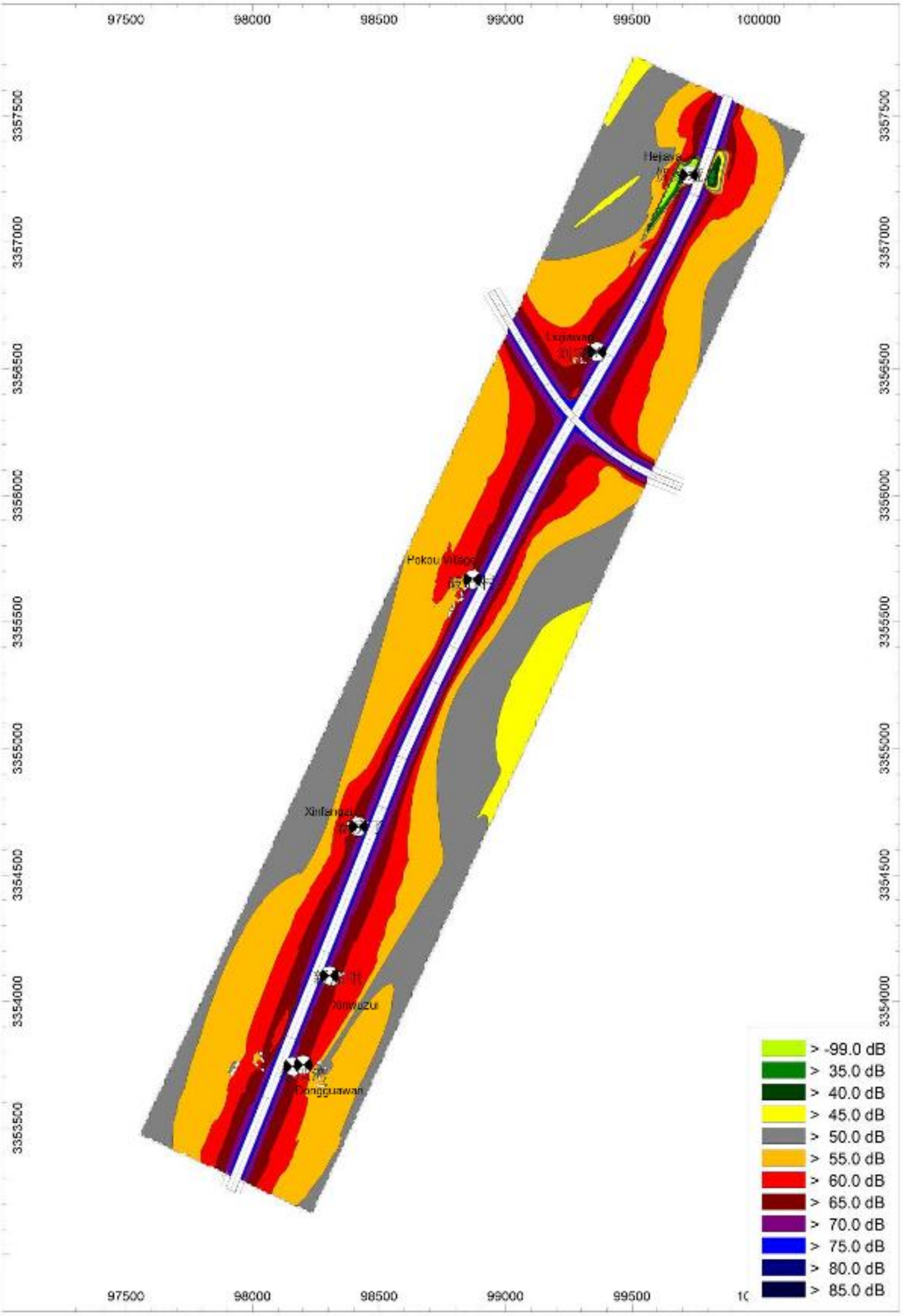
Noise Prediction Results of Road 1 (Nighttime in the Short Term)



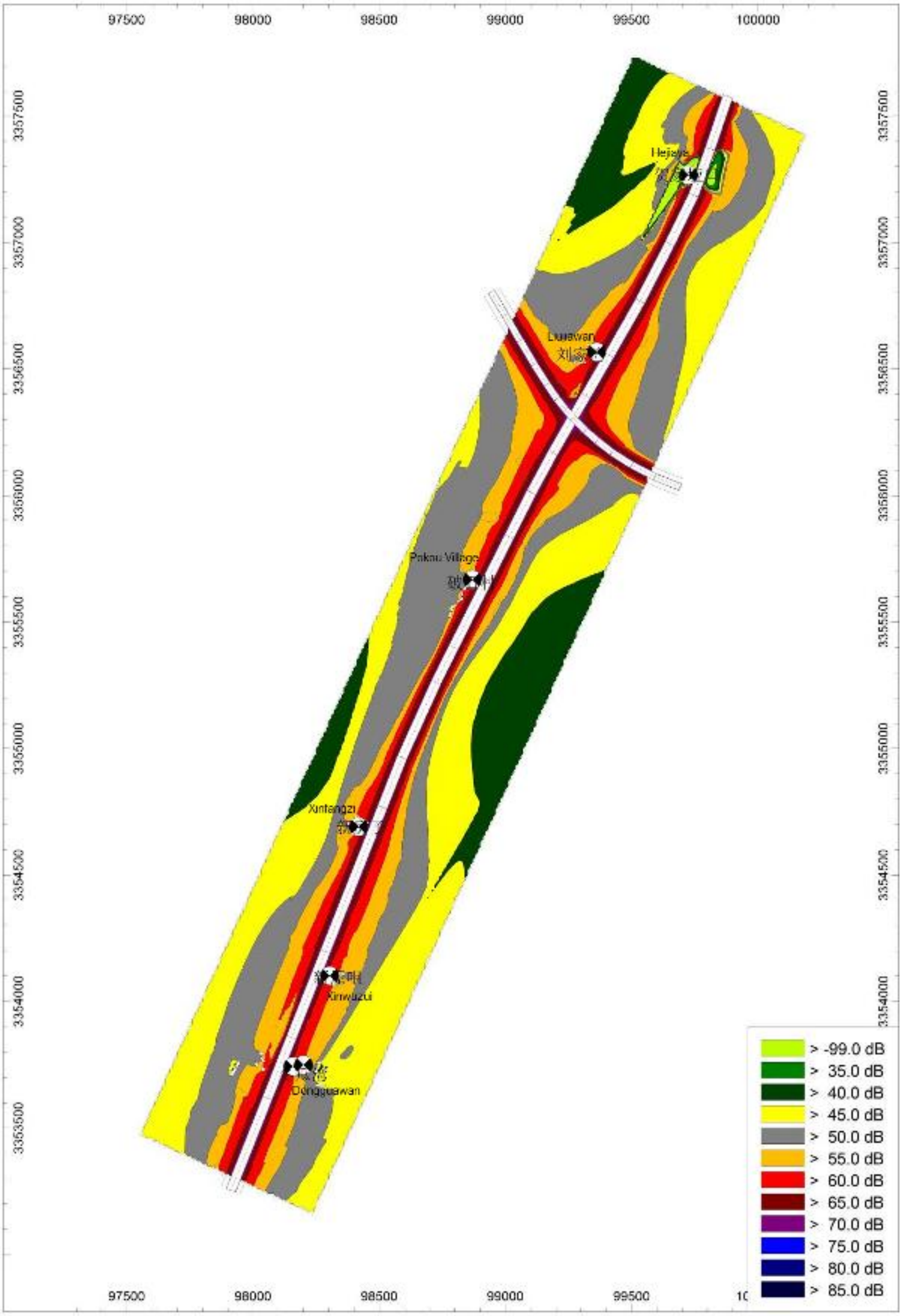
Noise Prediction Results of Road 1 (Daytime in the Medium Term)



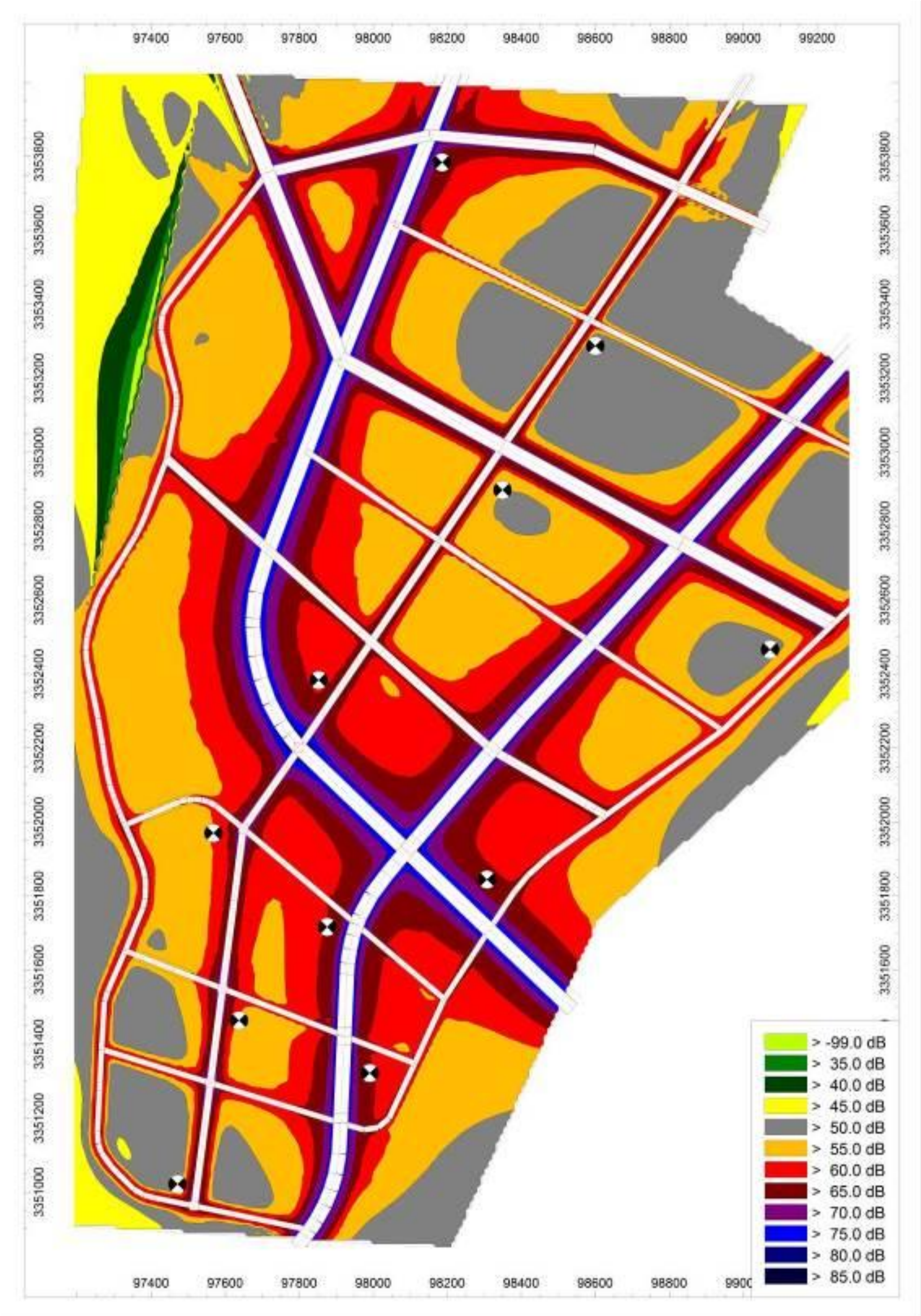
Noise Prediction Results of Road 1 (Nighttime in the Medium Term)



Noise Prediction Results of Road 1 (Daytime in the Long Term)

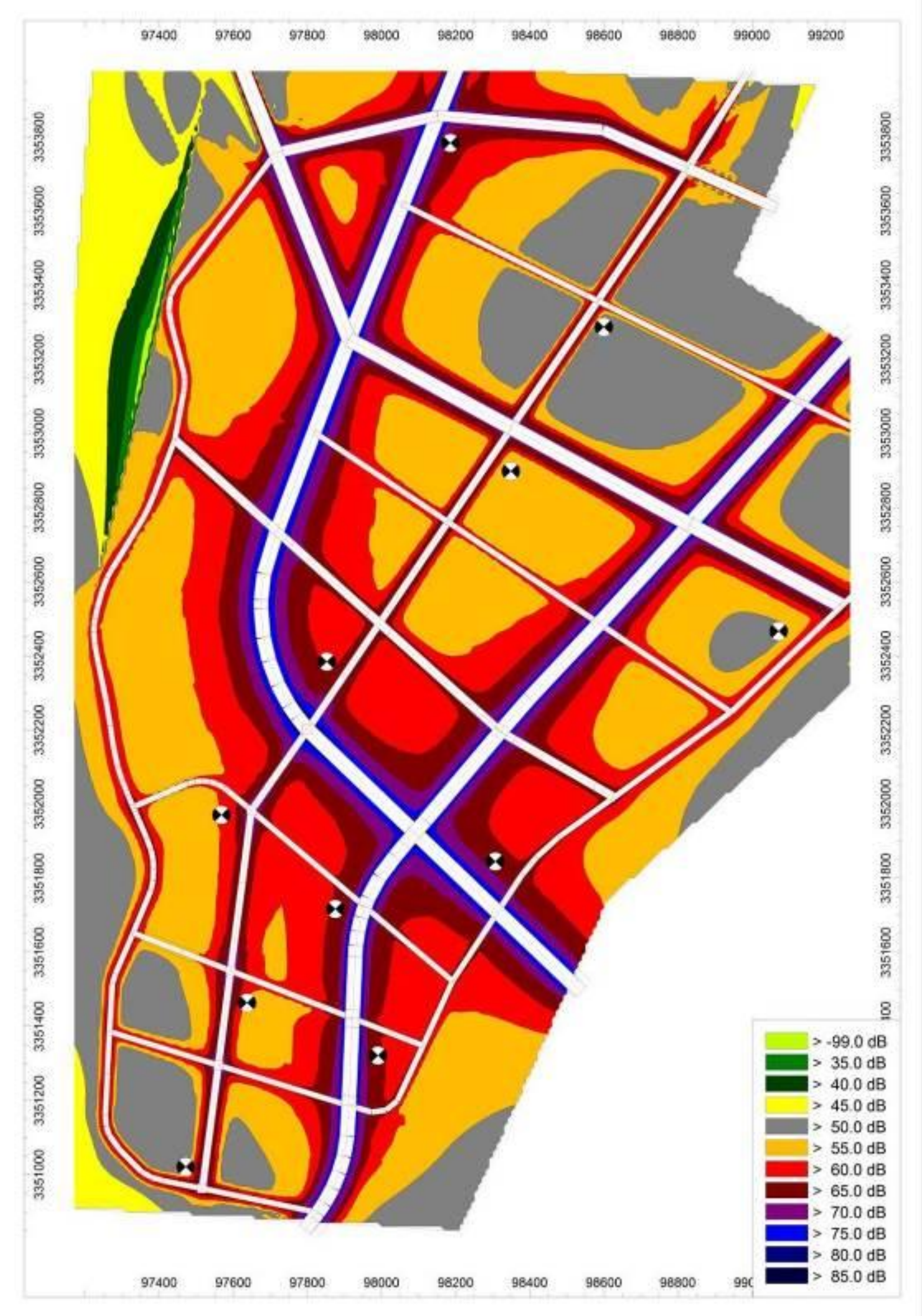


Noise Prediction Results of Road 1 (Nighttime in the Long Term)

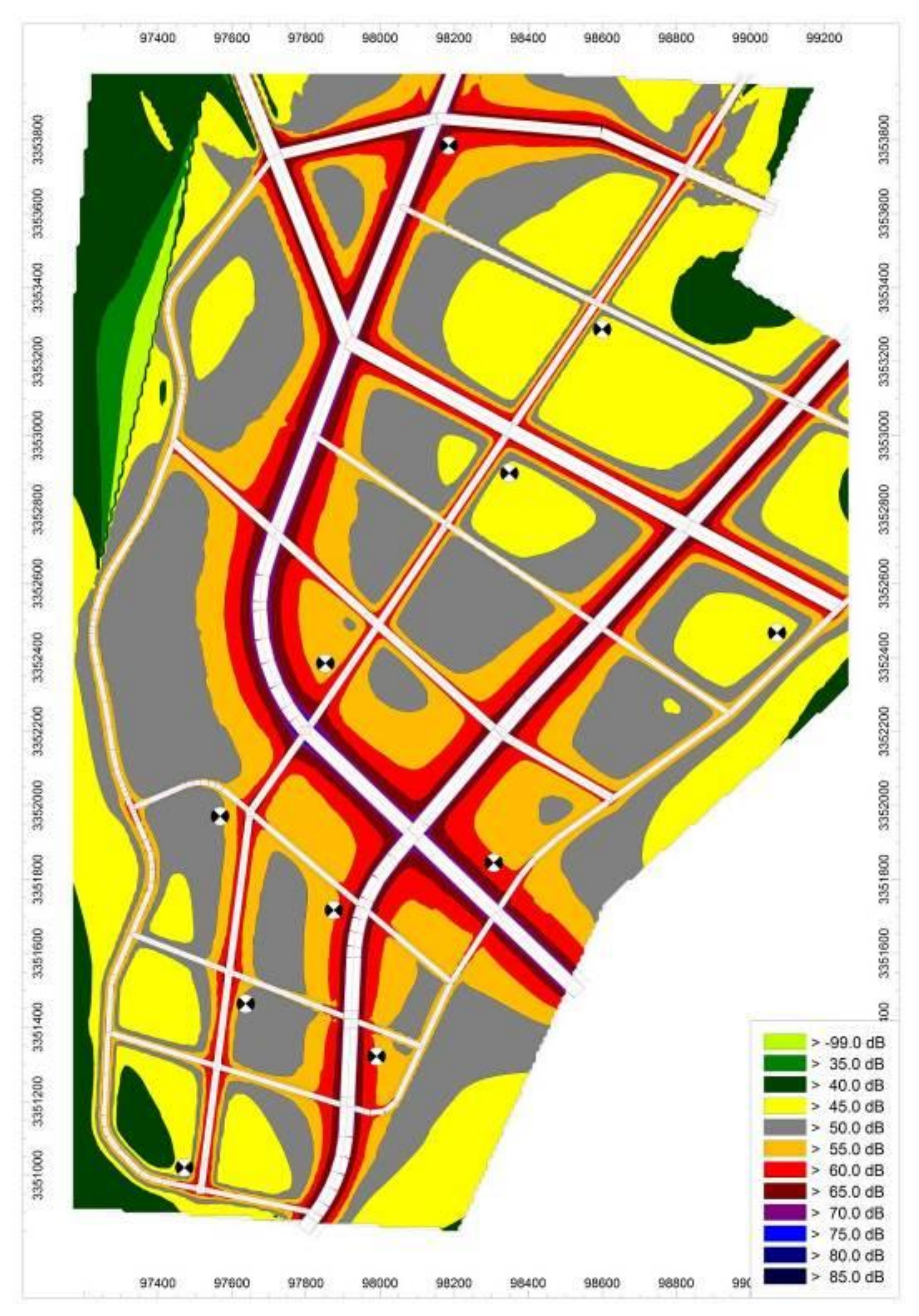


Regional Noise Prediction Results (Daytime in the Short Term)

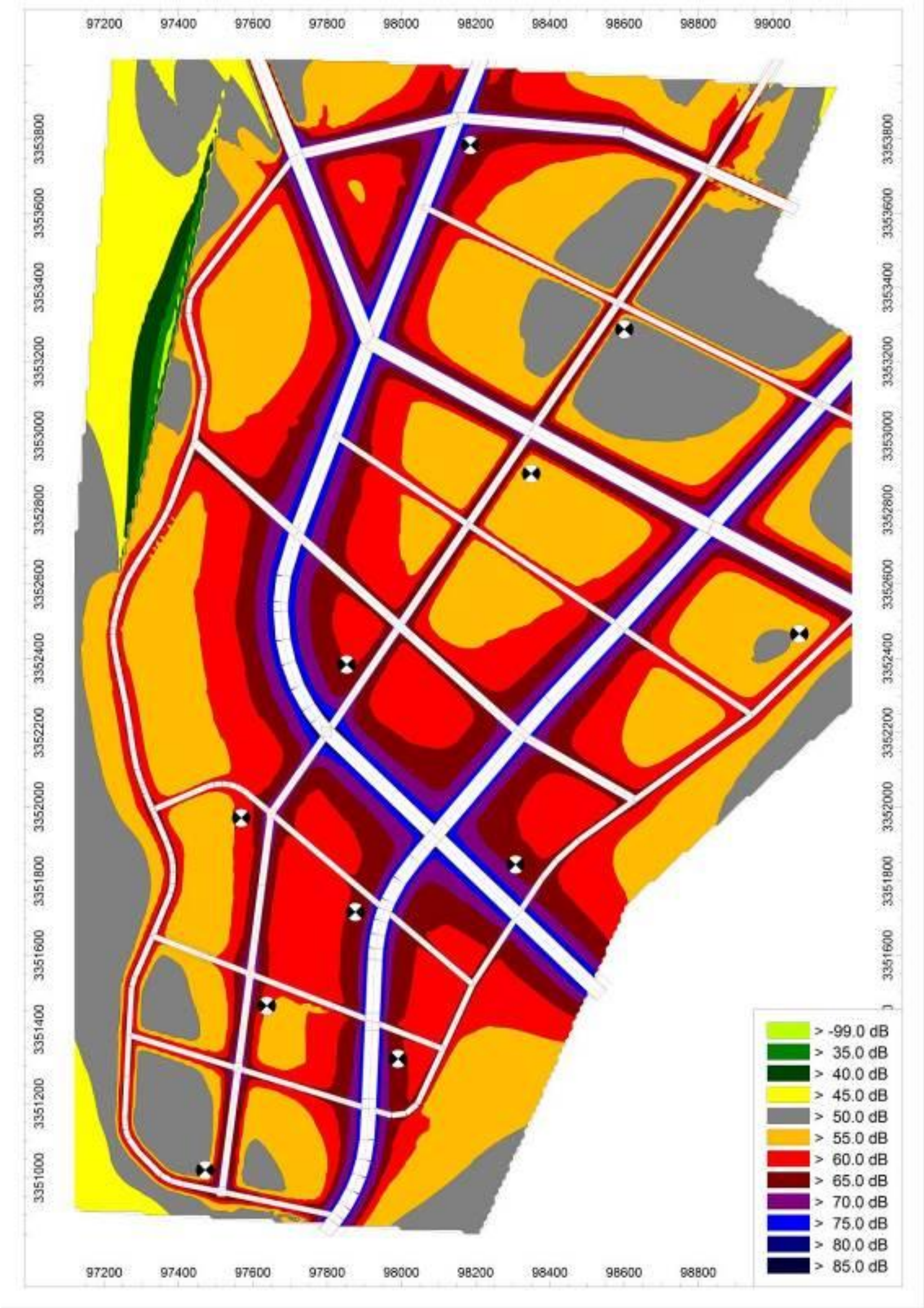
Regional Noise Prediction Results (Nighttime in the Short Term)



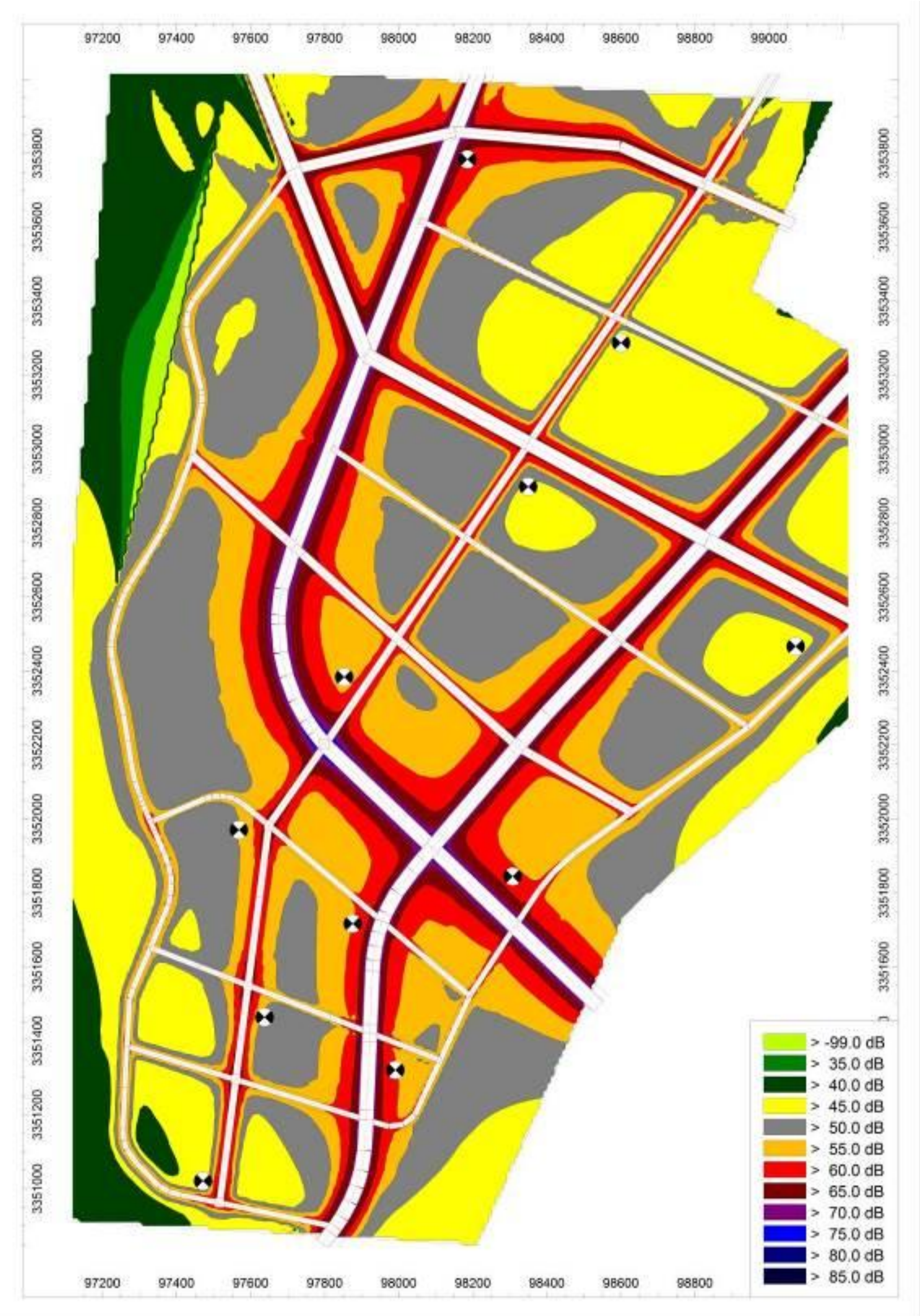
Regional Noise Prediction Results (Daytime in the Medium Term)



Regional Noise Prediction Results (Nighttime in the Medium Term)



Regional Noise Prediction Results (Daytime in the Long Term)



Regional Noise Prediction Results (Nighttime in the Long Term)

(2) Standard distance analysis

Standard distance of Class IVa and Class III in the short term after the operation of roads of the Project is predicted in the table below.

Table 6.2.2-8 Standard Distance of Traffic Noise Unit: m

Section	Period	Day		Night	
		Class IVa	Class III	Class IVa	Class III
Truck road	Short term	＜16	35	50	50
Sub-trunk road	Short term	＜10	＜15	22	22
Branch road	Short term	＜10	＜10	＜15	＜15

2. WWTP component

(1) Noise source intensity of main equipment

Noise producing equipment of WWTP includes blower for grit chamber, sewage pumps, wastewater pump, sludge pump, grit removing machine and grit-water separator as well as vehicle noise inside and outside the plant. This kind of noise belongs to mechanical noise and aerodynamic noise, featuring stable and continuity. According to the survey, the noise source intensity of main equipment during WWTP operation is shown in the table below.

Table 6.2.2-9 Noise Source Intensity of Main Equipment in WWTP Unit: dB(A)

SN	Description	Qty.	Noise Value [dB(A)]
1	Wastewater pump	11	80～90
2	Blower	1	85～95
3	Sludge pump	4	80～90
4	Air compressor	1	90～100
5	Integrative belt thickening and dewatering machine	2	85～90

(2) Prediction mode

According to the characteristics of noise pollution sources of the Project and features of the surrounding acoustic environment, the acoustic sources are all non-directional and stable mechanical acoustic sources in a half-free space. Based on the provisions in the *Technical Guidelines for Environmental Impact Assessment* (Acoustic Environment) (HJ2.4~2009), the geometric divergence attenuation mode of the selected non-directional point source is calculated as follows:

$LA_{(r)} = LW_A – 20\lg(r)- 8$

Where: $LA_{(r)}$ — sound level A of the predicton point where is r meters away from the noise source, dB(A)

LW_A — sound level A of point source, dB(A)

r — distance from the point source to the prediction point, m.

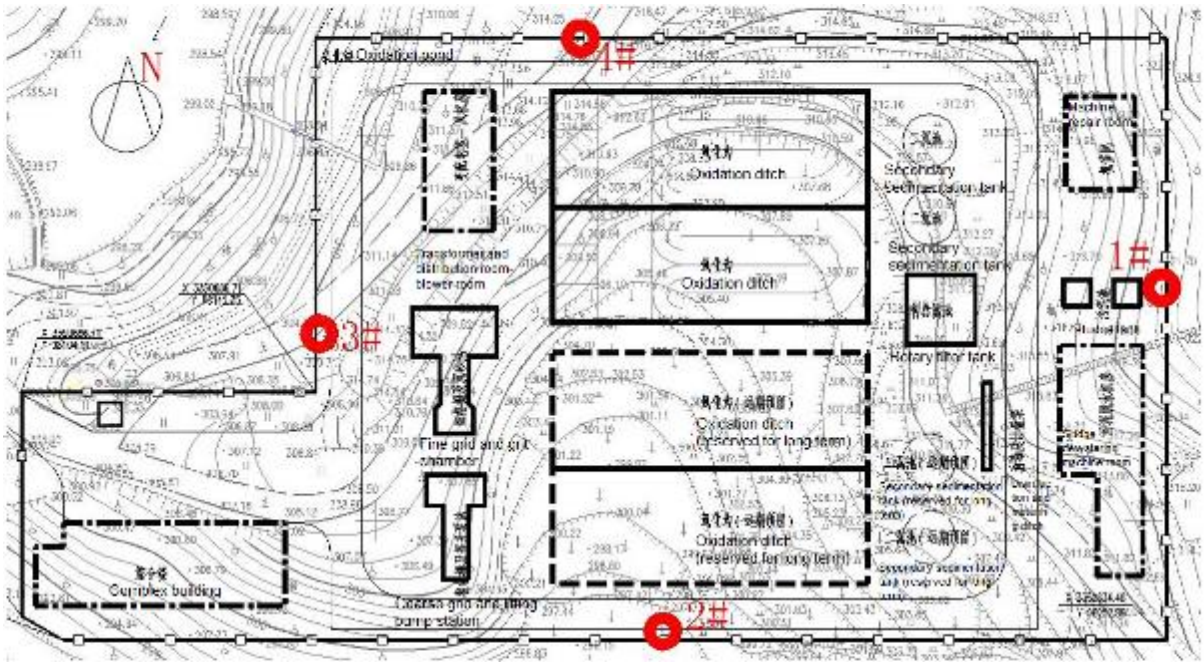
(3) Assessment method and prediction results

Noise superposed value at the boundary (the boundary with maximum noise impact) of each noise source is calculated with the above-mentioned prediction mode based on the analysis results of emission time and intensity of each major source of noise when the Project is completed, as well as specific factors like the position of each major source of noise, retaining structure and environmental conditions between the acoustic source and the prediction points, and comprehensive treatment measures for each noise source such as noise elimination, sound insulation, vibration attenuation and sound absorption on the basis of the project design document are considered. The noise superposed value is used to calculate the noise contribution value of WWTP and assess the impact of noise on acoustic environmental quality when the project is completed.

Table 6.2.2-1 Results of Source Intensity of Main Noises after Taking Measures

Unit: dB(A)

SN	Description	Noise Value [dB(A)]	Noise Reduction Measures to be Taken	Noise after Noise Reduction [dB(A)]
1	Wastewater pump	80～90	Vibration reduction	65～75
2	Blower	85～95	Vibration reduction and noise elimination	70～80
3	Sludge pump	80～90	Vibration reduction	65～75
4	Air compressor	90～100	Vibration reduction and sound absorption	75～85
5	Thickening and dewatering machine	85～90	Vibration reduction and sound absorption	70～75



See the table below for noise prediction results of each direction of WWTP boundary.

Table 6.2.2-11 Noise Contribution Value at Each Direction of the Plant Boundary

Unit: dB(A)

No. of Monitoring Point	Location of Monitoring Point	Contribution Value
1#	East boundary of the plant	43.5
2#	South boundary of the plant	40.7
3#	West boundary of the plant	45.8
4#	North boundary of the plant	48.5

(4) Conclusions

The prediction results of noise value at each plant boundary shown in the above table indicate that: when the main noise source intensity in the project area is under the condition that all noise devices are simultaneously operated at full load, the noise contribution value of WWTP is 40.7~48.5dB

(A), meeting the Class II standard specified in the *Emission Standard for Industrial Enterprises Noise at Boundary* (GB12348-2008).

6.2.3 Air environment impact prediction and assessment during the operation period

1. Basic meteorological conditions of Linshui County

Linshui County belongs to subtropical humid monsoon climate which is affected by solar radiation, general atmospheric circulation and topography, featuring early spring, hot summer and warm winter, long spring and short autumn, long frost-free season, abundant rain, small wind, high humidity, more clouds, less sunshine and much gentle rain in autumn. The annual average temperature is 17.1°C and inter-annual temperature change is 1.2°C.

The annual average precipitation here is 1170.1mm, with total rainfall over 1000mm in 70% of the years and that greater than 970mm in 80% of the years.

2. Meteorological statistics of pollutants

In order to understand the pollution meteorological conditions in project area and predict the impact of construction and operation of roads, pipelines and WWTP on the ambient air quality of the place where road residents are concerned, meteorological data of Linshui County is collected to obtain the wind direction, wind speed and wind-rose diagram of the project area, as shown below.

(1) Wind speed characteristics

The meteorological data shows that the average wind speed in 2013 is 1.584m/s. See the table below for statistics of average wind speed at each wind direction of the project area in each month, quarter and the whole year.

Table 6.2.3 -1 Statistics of Wind Speed at Each Wind Direction of the Project Area Unit: m/s

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Average
January	1.98	1.92	2.4	1.26	1.7	0.55	1.6	1.5	1.1	1.68	1.6	1.6	1.96	1.57	1	1.3	1.67
February	2.35	3.37	1.76	1.33	1.35	1.31	0	2.3	1.27	1.86	1.7	2.55	2.03	1.67	1.3	1.38	1.95
March	2.4	3.48	2.73	2.52	1.98	2.13	2.45	1.76	2.33	1.98	1.67	1.34	1.64	1.83	1.75	1.92	2.33
April	2.63	2.58	2.38	2.5	2.98	1.45	2.3	1.55	0	2.01	1.7	1.98	1.15	2.5	1.62	2.34	2.23
May	1.95	2.47	1.74	2.26	1.78	2.67	1.1	2	1.75	1.62	1.72	1.7	1.67	1.3	1.68	0.87	1.8
June	2.32	2.95	2.77	1.88	2.12	1.08	1.84	1.4	1.6	2.08	1.58	1.05	1.46	1.3	2.8	3.22	2.04
July	2.26	2.35	2.24	1.98	1.68	1.8	1.1	1.59	0	1.99	1.95	2.7	2.6	0.92	1.35	1.98	1.99
August	2.01	2.33	2.1	2.58	1.63	1.7	2.2	2.48	2.17	2.28	2.1	3.3	1.4	1.43	2.01	1.79	2.09
September	2.09	2.39	3.12	0.8	1.6	1.68	2.35	1.3	0	1.76	1.8	1.25	1.95	1.15	1.57	2.3	1.98
October	1.26	1.5	1.35	1.74	0.78	1.8	1.5	1.27	1.67	1.2	1.82	0.8	1.7	1.43	1.4	1.54	1.36
November	2.76	2.21	1.54	1.2	1.35	1	1.72	1.4	0	1	1.95	1.64	1.39	1.12	0.8	2.09	1.67
December	1.96	1.97	1.45	1.35	1.8	1.52	1.7	1.73	1.6	2.2	1.17	1.7	1.43	1.14	1.23	1.27	1.58
Yearly	2.18	2.46	2.2	1.87	1.8	1.54	1.85	1.67	1.74	1.84	1.71	1.68	1.66	1.38	1.65	1.82	1.89
Spring	2.27	2.97	2.39	2.41	2.26	2.16	2.13	1.74	1.94	1.89	1.7	1.69	1.61	1.95	1.67	1.83	2.12
Summer	2.2	2.56	2.3	2.07	1.82	1.5	1.91	1.81	2.06	2.1	1.84	2.08	1.79	1.16	1.99	2.2	2.04
Autumn	2.14	2.13	2.08	1.32	1.12	1.48	1.75	1.32	1.67	1.48	1.84	1.26	1.56	1.27	1.4	1.9	1.67
Winter	2.11	2.35	1.96	1.3	1.67	1.27	1.64	1.71	1.31	1.8	1.37	1.82	1.73	1.34	1.23	1.32	1.73

According to the statistical processing result of meteorological observation data in 2013, NNE wind speed, 2.46m/s, is the largest while WNW wind speed, 1.38m / s, is the smallest. See the table below for annual average wind speed curve at each wind direction of the project area in 2013.

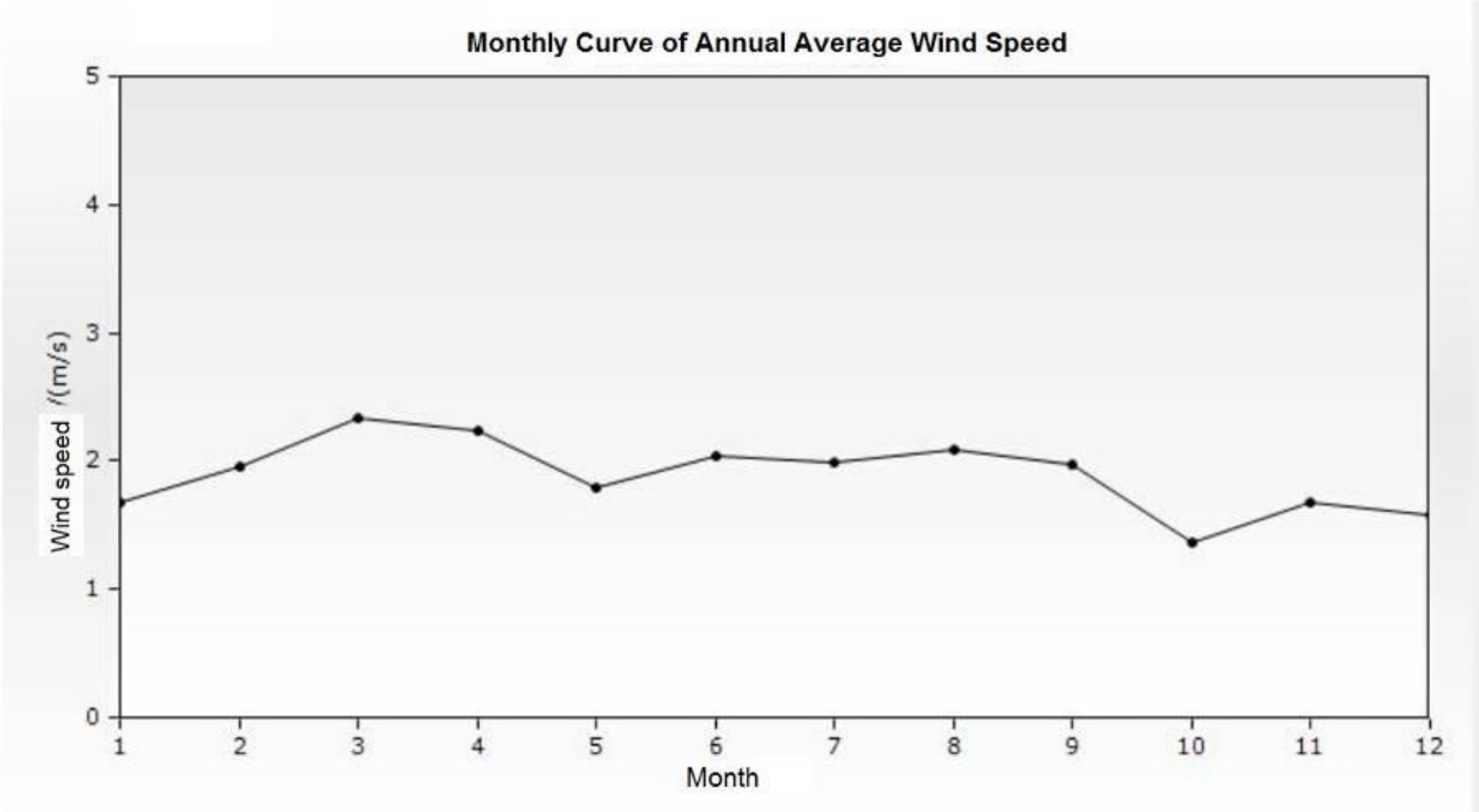


Figure 6.2.3-1 Annual Average Wind Speed Curve at Each Wind Direction in 2013

(2) Wind direction characteristics

See Table 5.2.3-2 for frequency of four-season and annual average wind direction of the project area in 2013 and Table 5.2.3-2 for rose diagram of wind frequency of the year in the project area.

Table 6.2.3-2 Statistics for Frequency of Year-round and Four-season Wind Direction of the Project Area Unit: %

Month	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Calm Wind
January	12.9	20.43	9.68	8.6	4.3	2.15	6.45	3.23	2.15	6.45	1.08	4.3	5.38	3.23	1.08	4.3	4.3
February	14.29	17.86	11.9	3.57	2.38	10.71	0	1.19	3.57	5.95	3.57	2.38	3.57	3.57	3.57	7.14	4.76
March	7.53	17.2	15.05	4.3	4.3	3.23	6.45	5.38	3.23	5.38	3.23	5.38	8.6	3.23	2.15	4.3	1.08
April	12.22	10	15.56	10	5.56	2.22	1.11	2.22	0	7.78	10	6.67	2.22	3.33	4.44	5.56	1.11
May	16.13	9.68	7.53	8.6	5.38	3.23	2.15	1.08	6.45	5.38	5.38	3.23	11.83	2.15	5.38	3.23	3.23
June	10	13.33	6.67	8.89	6.67	4.44	5.56	2.22	1.11	5.56	8.89	6.67	5.56	3.33	3.33	5.56	2.22
July	8.6	15.05	17.2	5.38	8.6	3.23	1.08	8.6	0	7.53	2.15	2.15	4.3	5.38	4.3	6.45	0
August	9.68	8.6	9.68	4.3	3.23	4.3	4.3	4.3	4.3	5.38	7.53	4.3	4.3	3.23	12.9	9.68	0
September	13.33	18.89	13.33	3.33	2.22	4.44	2.22	2.22	0	8.89	4.44	6.67	2.22	2.22	7.78	4.44	3.33
October	5.38	9.68	10.75	5.38	4.3	2.15	4.3	3.23	6.45	3.23	5.38	4.3	6.45	7.53	7.53	8.6	5.38
November	8.89	18.89	11.11	4.44	2.22	3.33	6.67	3.33	0	3.33	2.22	5.56	10	6.67	2.22	7.78	3.33
December	10.75	20.43	4.3	4.3	4.3	4.3	4.3	3.23	2.15	1.08	6.45	5.38	7.53	8.6	3.23	8.6	1.08
Yearly	10.78	14.98	11.05	5.94	4.47	3.93	3.74	3.38	2.47	5.48	5.02	4.75	6.03	4.38	4.84	6.3	2.47
Spring	11.96	12.32	12.68	7.61	5.07	2.9	3.26	2.9	3.26	6.16	6.16	5.07	7.61	2.9	3.99	4.35	1.81
Summer	9.42	12.32	11.23	6.16	6.16	3.99	3.62	5.07	1.81	6.16	6.16	4.35	4.71	3.99	6.88	7.25	0.72
Autumn	9.16	15.75	11.72	4.4	2.93	3.3	4.4	2.93	2.2	5.13	4.03	5.49	6.23	5.49	5.86	6.96	4.03
Winter	12.59	19.63	8.52	5.56	3.7	5.56	3.7	2.59	2.59	4.44	3.7	4.07	5.56	5.19	2.59	6.67	3.33

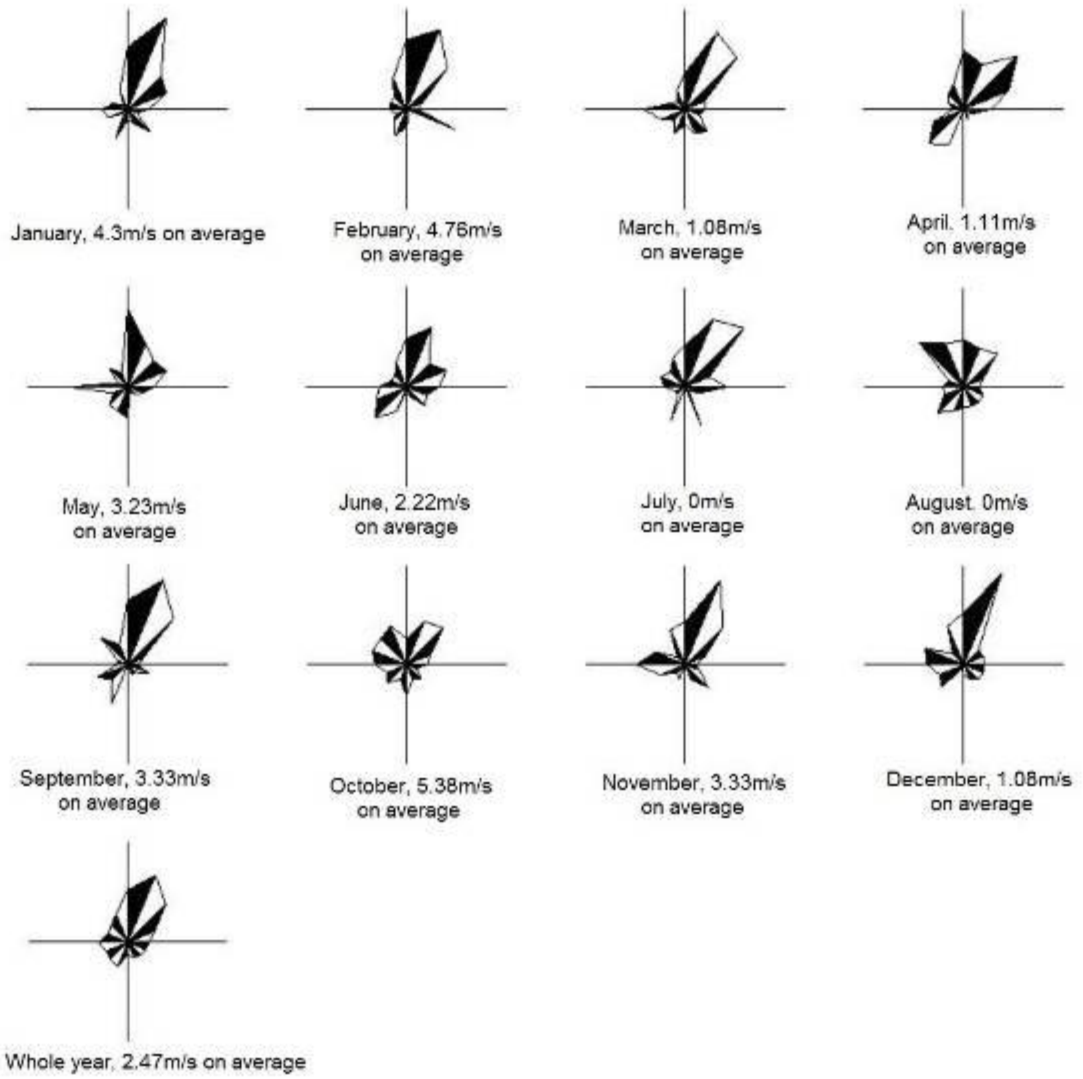


Figure 6.2.3-2 Whole-year Wind Direction and Wind Speed Rose Diagram of the Project Area

From the above table and figure, we can know that the dominant wind direction in the project area in four seasons or the whole year is NNE and calm wind frequency in autumn is higher than that in other seasons.

(3) Temperature characteristics

See Table 6.2.3-3 for temperature changes of the project area in each month of 2013 and Table 6.2.3-3 for temperature curve of the year.

Table 6.2.3 -3 Temperature Change of the Project Area in the Whole year Unit: (°C)

Month	January	February	March	April	May	June	July	August	September	October	November	December	Yearly
Temperature (°C)	7.21	10.46	17.16	19.99	21.95	27.26	29.95	29.43	22.54	19.02	13.08	7.12	18.81

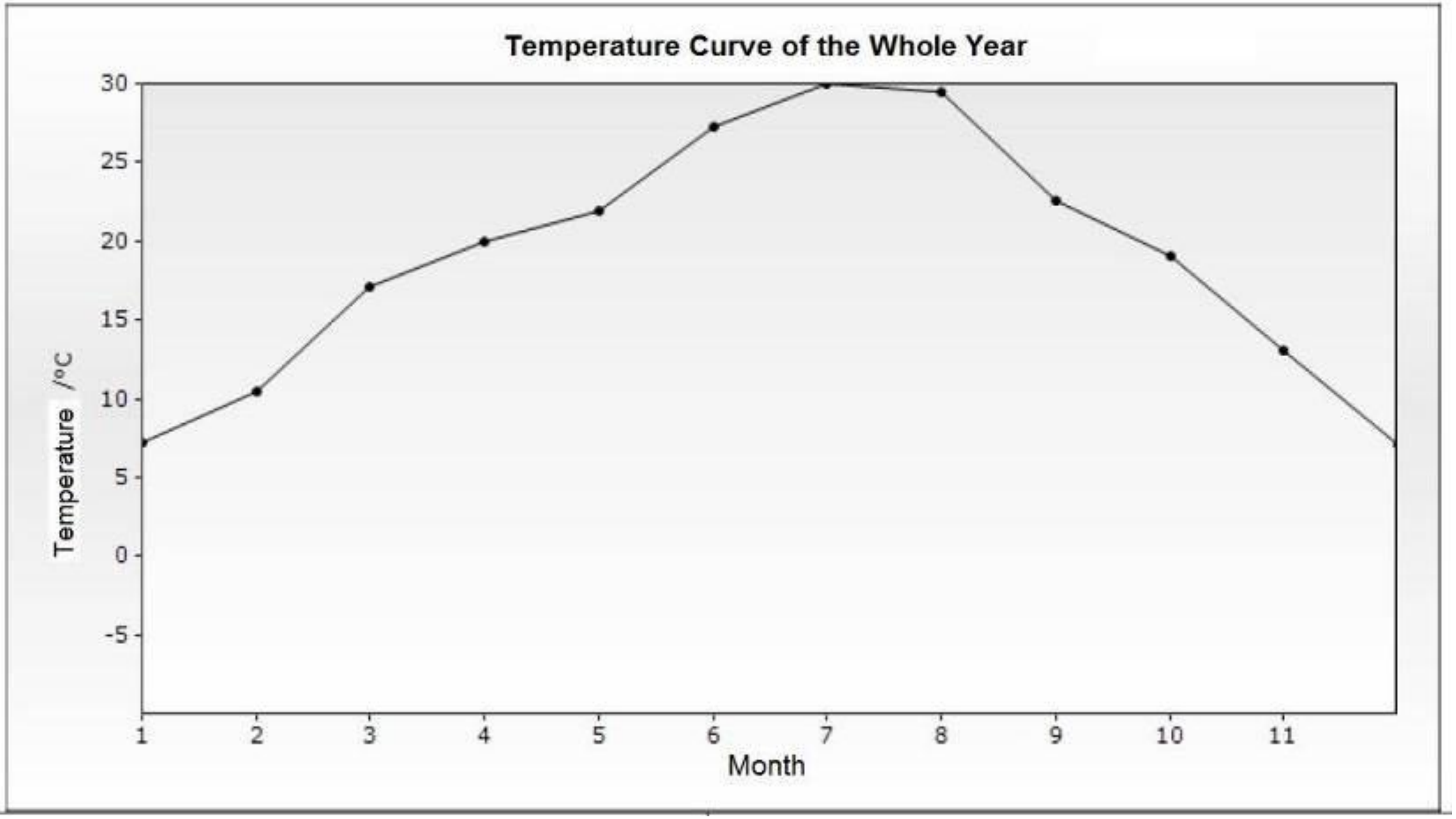


Figure 6.2.3-3 Temperature Curve of 2013

3. Road works component

According to the design of the project, the project road asphalt concrete is applied for pavement of the roads of the Project, so the vehicles generate little fugitive dust when traveling on the road. This assessment focuses on the impact of automobile exhaust produced during travelling. Based on engineering analysis, CO and NO_2 are major pollutants in the automobile exhaust.

- Prediction and assessment of impacts on ambient air of Road 1

(1) Predicators

According to the characteristics of exhaust emission of the proposed project, NO_2 and CO are predictors of the ambient air.

(2) Prediction range

For line source-based road works, 200m from each side of the center line of the line source belongs to the assessment range.

(3) Prediction mode

1) Prediction mode

According to the requirements in *Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment*, line source mode is applied for air impact prediction of the Project and the air environment assessment system software developed by Shijiazhuang Huanan Technology Co., Ltd. for calculation and drawing. The calculation is for ground concentration of the ambient air at each grid point and specific calculation for each ambient air sensitive point.

2) Source intensity prediction

Pollution emission source intensity of vehicle exhaust is calculated by continuous line source, which is calculated as follows:

$$Q_j = \sum_{i=1}^{3} 3600^{-1} A_i E_{ij}$$

Where: *Qj*— emission source intensity of j-type gaseous pollutants, mg/s.m

Ai— hourly traffic volume of i-type vehicles in the predicted years, vehicle/h

Eij— single motor vehicle emission factor of i-type vehicles and j-type emissions under operation conditions in the predicted years, mg/(vehicle. m)

See the table below for source intensity of exhausts discharged during the construction period of trunk road of the Project.

Table 6.2.3-4 Pollutant Emission Coefficients of Single Motor Vehicles (National IV Standard) Unit: g/km per vehicle

Vehicle Model and Pollutant Type		Discharge Coefficient
Small vehicle	CO	1
	NO_2	0.1
Medium-sized vehicle	CO	1

	NO_2	0.2
Large vehicle	CO	1.5
	NO_2	3.5

See the table below for source intensity of automobile exhaust of the Project calculated based on the traffic volume of the Project.

Table 6.2.3-5 Source Intensity of Automobile Exhaust Discharge Unit: mg/s.m

Vehicle Model and Pollutant Type		Year 2020 (Short Term)	Year 2026 (Medium Term)	Year 2034 (Long Term)
All kinds of vehicles	CO	0.18	0.20	0.23
	NO_2	0.0363	0.0404	0.0467

(4) Prediction results

1) Maximum concentration prediction results for the short term

Based on the meteorological data in 2013, predictions for the concentration of CO and NO_2 at ambient air sensitive points which are caused by the operation of the proposed project in the short term are as shown below.

Table 6.2.3-6 Predictions for NO_2 Concentration in the Short Term

	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value (mg/m^3)	Ratio to the standard value [%]
Hourly Value	1	NO_2	N1-1 Xujiawan	0.02052	0.02052	0.2	10.26
	2	NO_2	N1-2 Dongguawan	0.02522	0.02522	0.2	12.61
	3	NO_2	N1-3 Xinwuzui	0.02631	0.02631	0.2	13.16
	4	NO_2	N1-4 Wangjiawan	0.03103	0.03103	0.2	15.51
	5	NO_2	N1-5 Xinfangzi	0.02298	0.02298	0.2	11.49
	6	NO_2	Maximum value in the area	0.0443	0.0443	0.2	22.15
	7	NO_2	N1-6 Group 6, Poshi Village	0.02021	0.02021	0.2	10.10
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.02219	0.02219	0.2	11.10
	9	NO_2	Maximum value in the area	0.03538	0.03538	0.2	17.69
	10	NO_2	N1-8 Liujiawan	0.02792	0.02792	0.2	13.96
	11	NO_2	N1-9 Hejiayakou	0.02598	0.02598	0.2	12.99
	12	NO_2	Maximum value in the area	0.04632	0.04632	0.2	23.16
Daily average value	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the standard value [%]
	1	NO_2	N1-1 Xujiawan	0.0014	0.0014	0.08	1.74
	2	NO_2	N1-2 Dongguawan	0.0017	0.0017	0.08	2.13

	3	NO_2	N1-3 Xinwuzui	0.00172	0.00172	0.08	2.15
	4	NO_2	N1-4 Wangjiawan	0.00221	0.00221	0.08	2.76
	5	NO_2	N1-5 Xinfangzi	0.00194	0.00194	0.08	2.43
	6	NO2	Maximum value in the area	0.00413	0.00413	0.08	5.16
	7	NO2	N1-6 Group 6, Poshi Village	0.00172	0.00172	0.08	2.14
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.00162	0.00162	0.08	2.03
	9	NO_2	Maximum value in the area	0.00269	0.00269	0.08	3.36
	10	NO_2	N1-8 Liujiawan	0.0021	0.0021	0.08	2.62
	11	NO_2	N1-9 Hejiayakou	0.00202	0.00202	0.08	2.53
	12	NO_2	Maximum value in the area	0.00425	0.00425	0.08	5.31
Annual average value	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value (mg/m^3)	Ratio to the standard value [%]
	1	NO_2	N1-1 Xujiawan	0.00231	0.00231	0.04	5.77
	2	NO_2	N1-2 Dongguawan	0.00266	0.00266	0.04	6.64
	3	NO_2	N1-3 Xinwuzui	0.00262	0.00262	0.04	6.56
	4	NO_2	N1-4 Wangjiawan	0.00372	0.00372	0.04	9.31
	5	NO_2	N1-5 Xinfangzi	0.00291	0.00291	0.04	7.29
	6	NO_2	Maximum value in the area	0.00627	0.00627	0.04	15.68
	7	NO_2	N1-6 Group 6, Poshi Village	0.00235	0.00235	0.04	5.87
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.00284	0.00284	0.04	7.11
	9	NO_2	Maximum value in the area	0.00554	0.00554	0.04	13.85
	10	NO_2	N1-8 Liujiawan	0.00331	0.00331	0.04	8.28
	11	NO_2	N1-9 Hejiayakou	0.00355	0.00355	0.04	8.88
	12	NO_2	Maximum value in the area	0.00736	0.00736	0.04	18.40

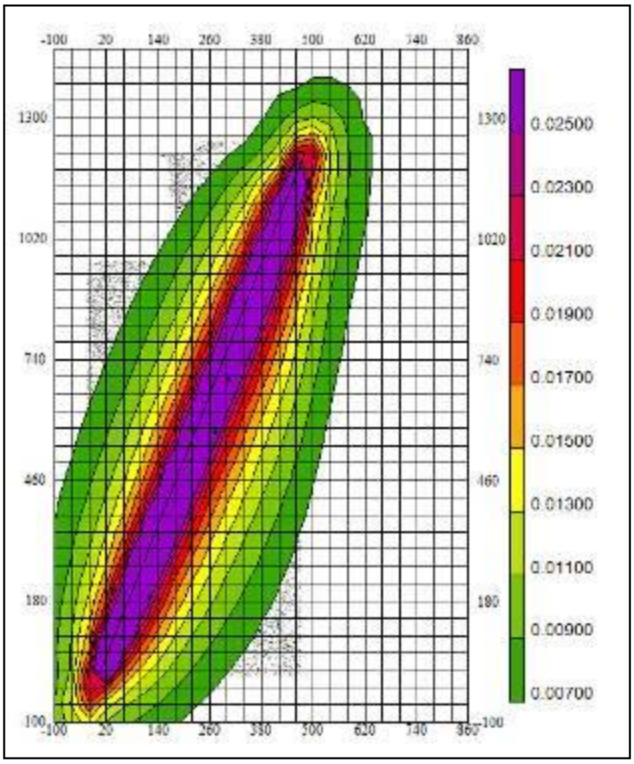


Figure 6.2.3-4 Hourly Average Value of NO_2 of Points 1~5 (Short term)

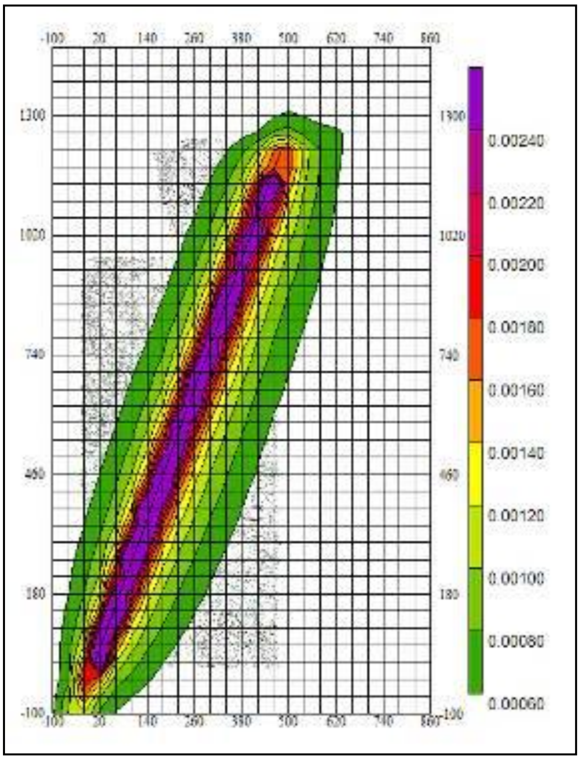


Figure 6.2.3-5 Daily Daily Average Value of NO_2 of Points 1~5 (Short term)

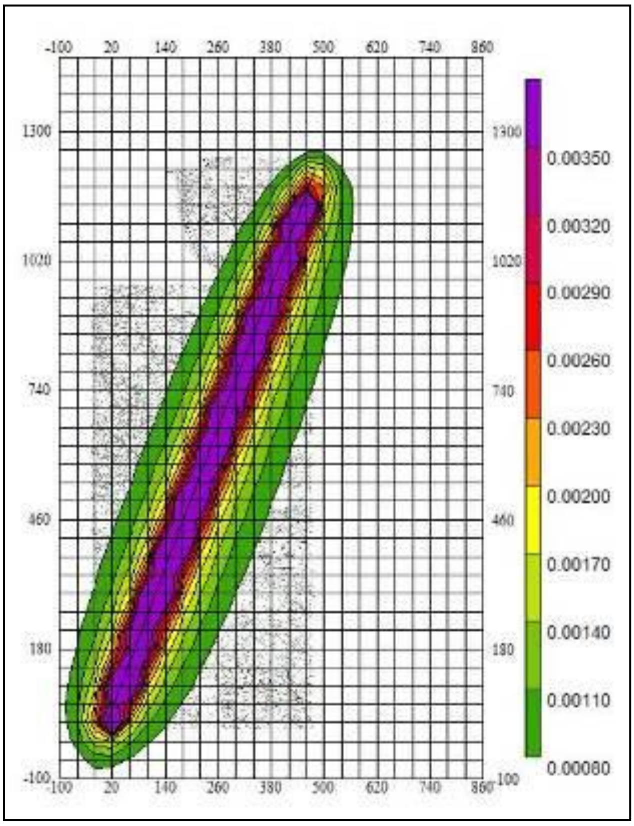


Figure 6.2.3-6 Annual Average Value of NO_2 of Points 1~5 (Short Term)

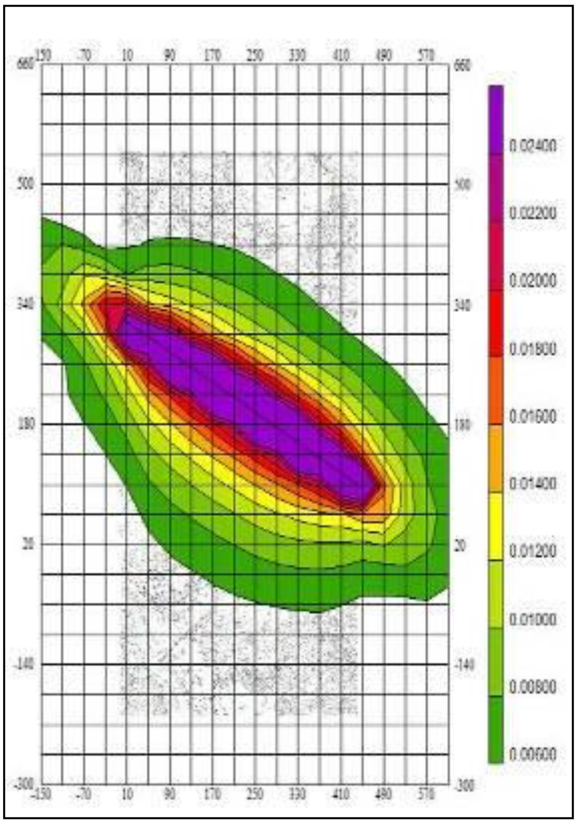


Figure 6.2.3-7 Hourly Average Value of NO_2 of Points 6~7 (Short Tem)

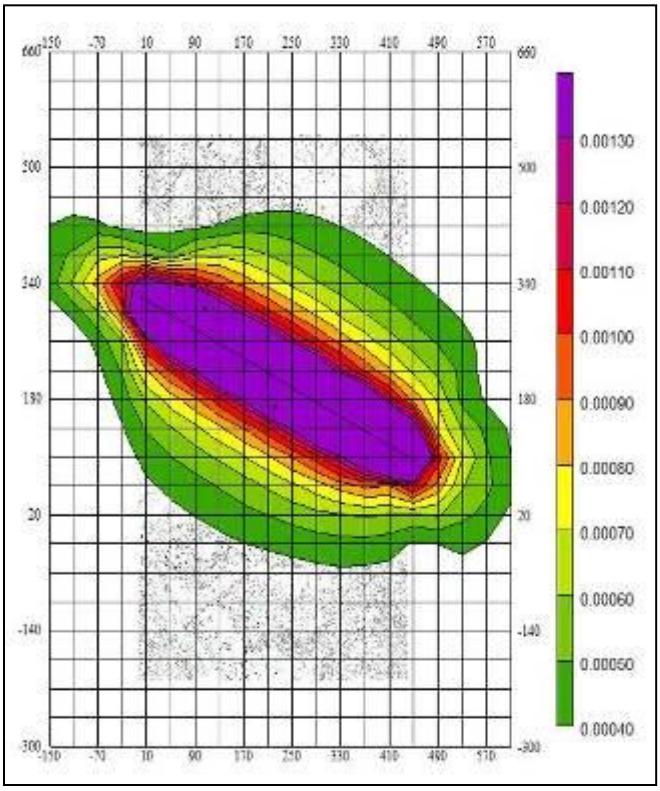


Figure 6.2.3-8 Daily Average Value of NO_2 of Points 6~7 (Short Tntatmebntks nearth and Stone

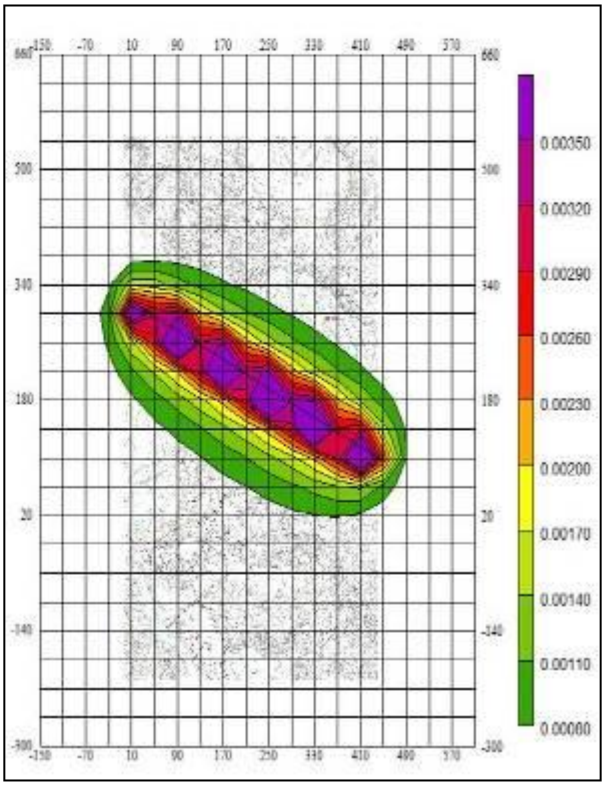


Figure 6.2.3-9 Annual Average Value of NO_2 of Points 6~7 (Short Term)

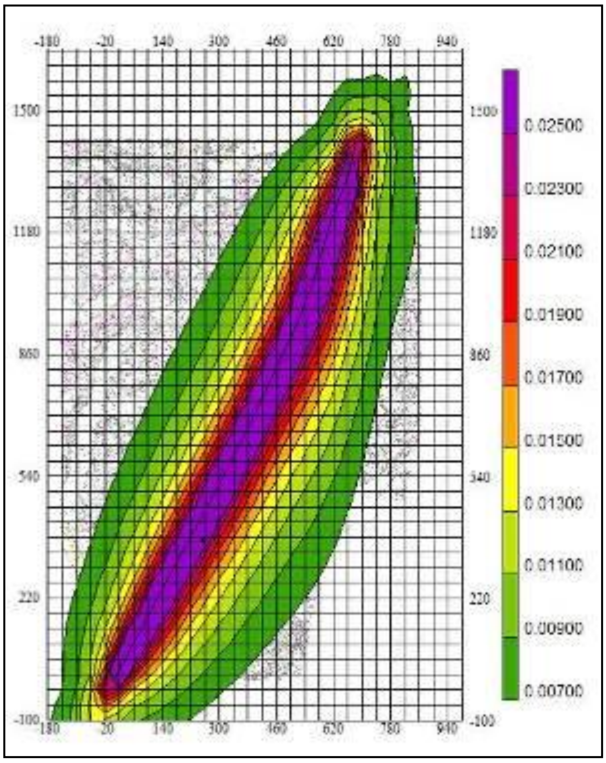


Figure 6.2.3-10 Hourly Average Value of NO_2 of Points 8~9 (Short Term)

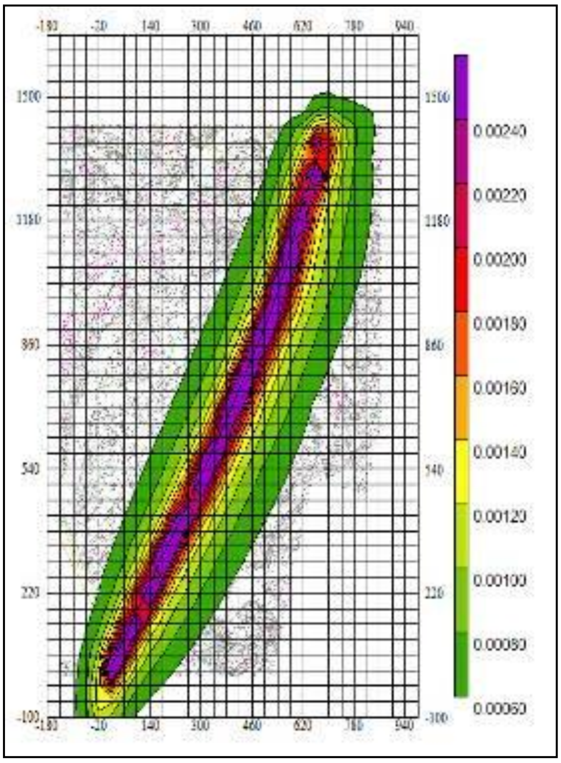


Figure 6.2.3-11 Daily Average Value of NO_2 of Points 8~9 (Short Term)

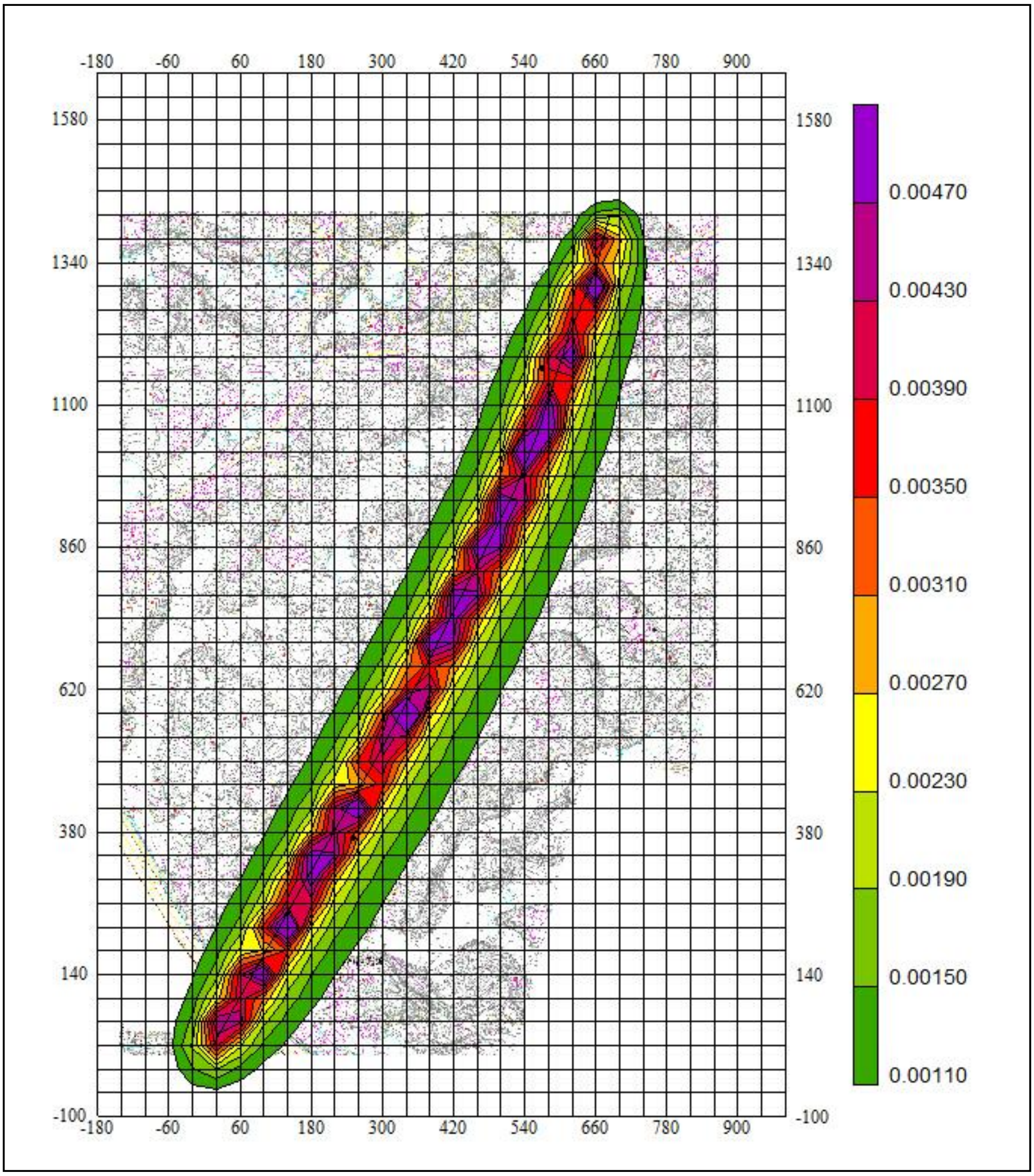


Figure 6.2.3-9 Annual Average Value of NO_2 of Points 8~9 (Short Term)

Table 6.2.3-7 Predictions for CO Concentration in the Short Term

	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Hourly Average value	1	CO	N1-1 Xujiawan	0.10176	0.10176	10	1.02
	2	CO	N1-2 Dongguawan	0.12508	0.12508	10	1.25
	3	CO	N1-3 Xinwuzui	0.13048	0.13048	10	1.30
	4	CO	N1-4 Wangjiawan	0.15385	0.15385	10	1.54
	5	CO	N1-5	0.11397	0.11397	10	1.14

			Xinfangzi				
	6	CO	Maximum value in the area	0	0	10	0.00
	7h	CO	N1-6 Group 6, Poshi Village	0.10021	0.10021	10	1.00
	8	CO	N1-7 Meijiawan, Shiba Village	0.11004	0.11004	10	1.10
	9	CO	Maximum value in the area	0.17543	0.17543	10	1.75
	10	CO	N1-8 Liujiawan	0.13847	0.13847	10	1.38
	11	CO	N1-9 Hejiayakou	0.12882	0.12882	10	1.29
	12	CO	Maximum value in the area	0.22967	0.22967	10	2.30
	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Daily average value	1	CO	N1-1 Xujiawan	0.00692	0.00692	4	0.17
	2	CO	N1-2 Dongguawan	0.00844	0.00844	4	0.21
	3	CO	N1-3 Xinwuzui	0.00855	0.00855	4	0.21
	4	CO	N1-4 Wangjiawan	0.01096	0.01096	4	0.27
	5	CO	N1-5 Xinfangzi	0.00963	0.00963	4	0.24
	6	CO	Maximum value in the area	0	0	4	0.00
	7	CO	N1-6 Group 6, Poshi Village	0.00851	0.00851	4	0.21
	8	CO	N1-7 Meijiawan, Shiba Village	0.00805	0.00805	4	0.20
	9	CO	Maximum value in the area	0.01335	0.01335	4	0.33
	10	CO	N1-8 Liujiawan	0.01039	0.01039	4	0.26
	11	CO	N1-9 Hejiayakou	0.01002	0.01002	4	0.25

	12	CO	Maximum value in the area	0.02105	0.02105	4	0.53

The prediction results show that the ratio of hourly concentration, daily concentration and annual average value of NO_2 and CO at each sensitive point to the standard value is less than 100% during the short term of project operation, which may meet Class II standard requirements specified in the *Ambient Air Quality Standard* (GB3095-2012) and has little impact on the surrounding air environment.

2) Maximum concentration prediction results in the medium term

Based on the meteorological data in 2013, predictions for the concentration of CO and NO_2 at ambient air sensitive points which are caused by the operation of the proposed project in the medium term are as shown below.

Table 6.2.3-8 Predictions for NO_2 Concentration in the Medium Term

SN		Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Hourly Average value	1	NO_2	N1-1 Xujiawan	0.02284	0.02284	0.2	11.42
	2	NO_2	N1-2 Dongguawan	0.02807	0.02807	0.2	14.04
	3	NO_2	N1-3 Xinwuzui	0.02929	0.02929	0.2	14.64
	4	NO_2	N1-4 Wangjiawan	0.03453	0.03453	0.2	17.27
	5	NO_2	N1-5 Xinfangzi	0.02558	0.02558	0.2	12.79
	6	NO_2	Maximum value in the area	0.0493	0.0493	0.2	24.65
	7	NO_2	N1-6 Group 6, Poshi Village	0.02249	0.02249	0.2	11.25
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.0247	0.0247	0.2	12.35
	9	NO_2	Maximum value in the area	0.03937	0.03937	0.2	19.69
	10	NO_2	N1-8 Liujiawan	0.03108	0.03108	0.2	15.54
	11	NO_2	N1-9 Hejiayakou	0.02891	0.02891	0.2	14.46
	12	NO_2	Maximum value in the area	0.05155	0.05155	0.2	25.77
Daily average value	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
	1	NO_2	N1-1 Xujiawan	0.00155	0.00155	0.08	1.94
	2	NO_2	N1-2 Dongguawan	0.00189	0.00189	0.08	2.37
	3	NO_2	N1-3 Xinwuzui	0.00192	0.00192	0.08	2.40
	4	NO_2	N1-4 Wangjiawan	0.00246	0.00246	0.08	3.07
	5	NO_2	N1-5 Xinfangzi	0.00216	0.00216	0.08	2.70
	6	NO_2	Maximum value in the area	0.00459	0.00459	0.08	5.74
	7	NO_2	N1-6 Group 6, Poshi Village	0.00191	0.00191	0.08	2.39
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.00181	0.00181	0.08	2.26
	9	NO_2	Maximum value in the area	0.003	0.003	0.08	3.74
	10	NO_2	N1-8 Liujiawan	0.00233	0.00233	0.08	2.91

SN		Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
	11	NO_2	N1-9 Hejiayakou	0.00225	0.00225	0.08	2.81
	12	NO_2	Maximum value in the area	0.00473	0.00473	0.08	5.91
Yearly average value	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
	1	NO_2	N1-1 Xujiawan	0.00257	0.00257	0.04	6.42
	2	NO_2	N1-2 Dongguawan	0.00296	0.00296	0.04	7.39
	3	NO_2	N1-3 Xinwuzui	0.00292	0.00292	0.04	7.30
	4	NO_2	N1-4 Wangjiawan	0.00415	0.00415	0.04	10.36
	5	NO_2	N1-5 Xinfangzi	0.00324	0.00324	0.04	8.11
	6	NO_2	Maximum value in the area	0.00698	0.00698	0.04	17.45
	7	NO_2	N1-6 Group 6, Poshi Village	0.00261	0.00261	0.04	6.53
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.00316	0.00316	0.04	7.91
	9	NO_2	Maximum value in the area	0.00617	0.00617	0.04	15.41
	10	NO_2	N1-8 Liujiawan	0.00368	0.00368	0.04	9.21
	11	NO_2	N1-9 Hejiayakou	0.00395	0.00395	0.04	9.88
	12	NO_2	Maximum value in the area	0.00819	0.00819	0.04	20.48

Table 6.2.3-9 Predictions for CO Concentration in the Medium Term

	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Hourly Average value	1	CO	N1-1 Xujiawan	0.11307	0.11307	10	1.13
	2	CO	N1-2 Dongguawan	0.13898	0.13898	10	1.39
	3	CO	N1-3 Xinwuzui	0.14498	0.14498	10	1.45
	4	CO	N1-4 Wangjiawan	0.17095	0.17095	10	1.71
	5	CO	N1-5 Xinfangzi	0.12663	0.12663	10	1.27
	6	CO	Maximum value in the area	0	0	10	0.00
	7	CO	N1-6 Group 6, Poshi Village	0.11134	0.11134	10	1.11
	8	CO	N1-7 Meijiawan, Shiba Village	0.12227	0.12227	10	1.22
	9	CO	Maximum value in the area	0.19492	0.19492	10	1.95
	10	CO	N1-8 Liujiawan	0.15385	0.15385	10	1.54
	11	CO	N1-9 Hejiayakou	0.14313	0.14313	10	1.43
	12	CO	Maximum value in the area	0.25519	0.25519	10	2.55
	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Daily average value	1	CO	N1-1 Xujiawan	0.00769	0.00769	4	0.19
	2	CO	N1-2 Dongguawan	0.00938	0.00938	4	0.23

	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
	3	CO	N1-3 Xinwuzui	0.0095	0.0095	4	0.24
	4	CO	N1-4 Wangjiawan	0.01218	0.01218	4	0.30
	5	CO	N1-5 Xinfangzi	0.0107	0.0107	4	0.27
	6	CO	Maximum value in the area	0	0	4	0.00
	7	CO	N1-6 Group 6, Poshi Village	0.00945	0.00945	4	0.24
	8	CO	N1-7 Meijiawan, Shiba Village	0.00895	0.00895	4	0.22
	9	CO	Maximum value in the area	0.01483	0.01483	4	0.37
	10	CO	N1-8 Liujiawan	0.01154	0.01154	4	0.29
	11	CO	N1-9 Hejiayakou	0.01114	0.01114	4	0.28
	12	CO	Maximum value in the area	0.02339	0.02339	4	0.58

The prediction results show that the ratio of hourly concentration, daily concentration and annual average value of NO_2 and CO at each sensitive point to the standard value is less than 100% during the medium term of project operation, which may meet Class II standard requirements specified in the *Ambient Air Quality Standard* (GB3095-2012) and has little impact on the surrounding air environment.

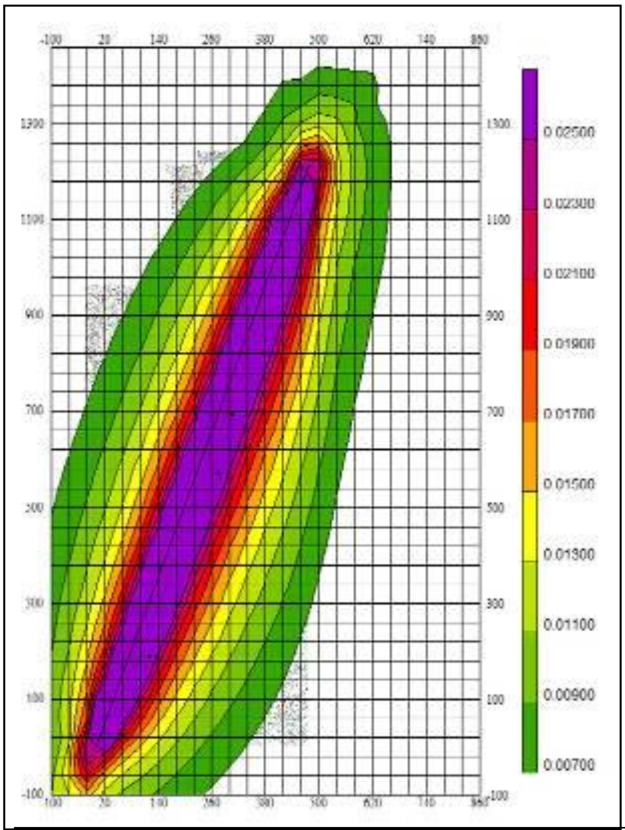


Figure 6.2.3-10 Hourly Average Value of NO_2 of Points 1~5 (Medium Term)

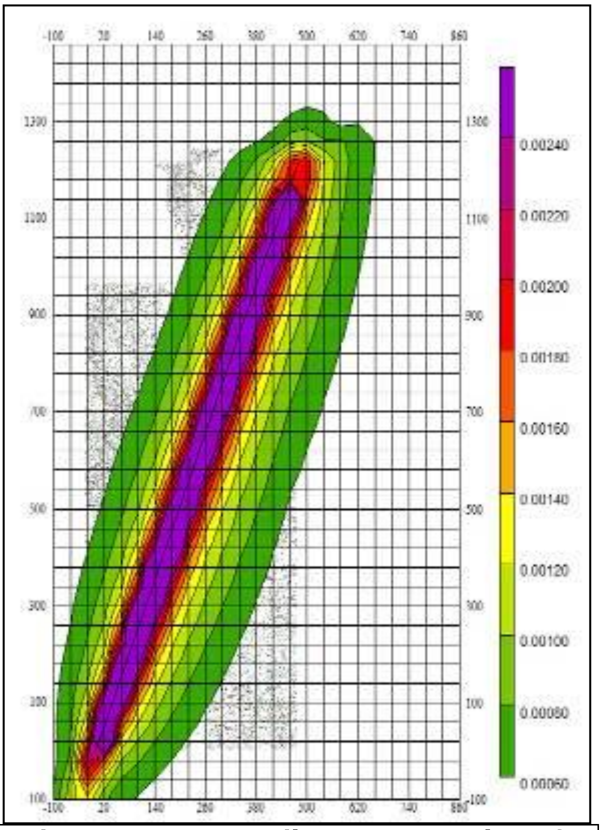


Figure 6.2.3-11 Daily Average Value of NO_2 of Points 1~5 (Medium Term)

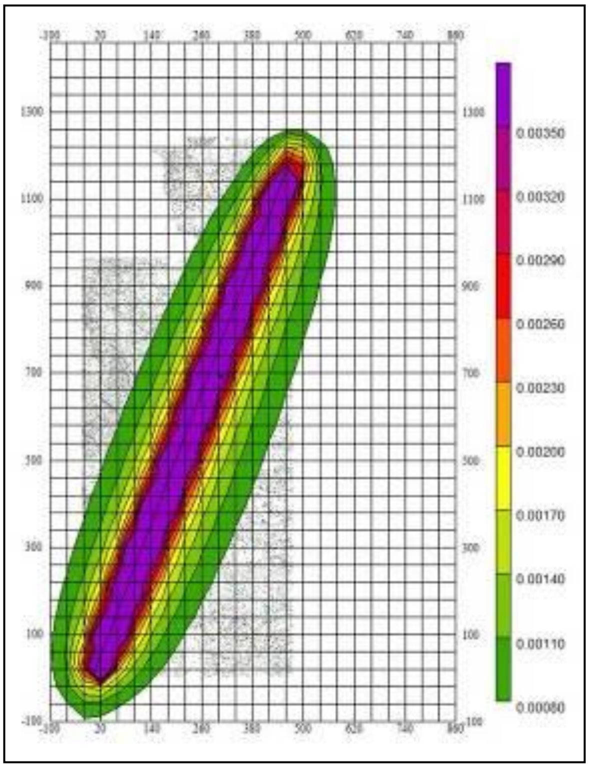


Figure 6.2.3-12 Annual Average Value of NO_2 of Points 1~5 (Medium Term)

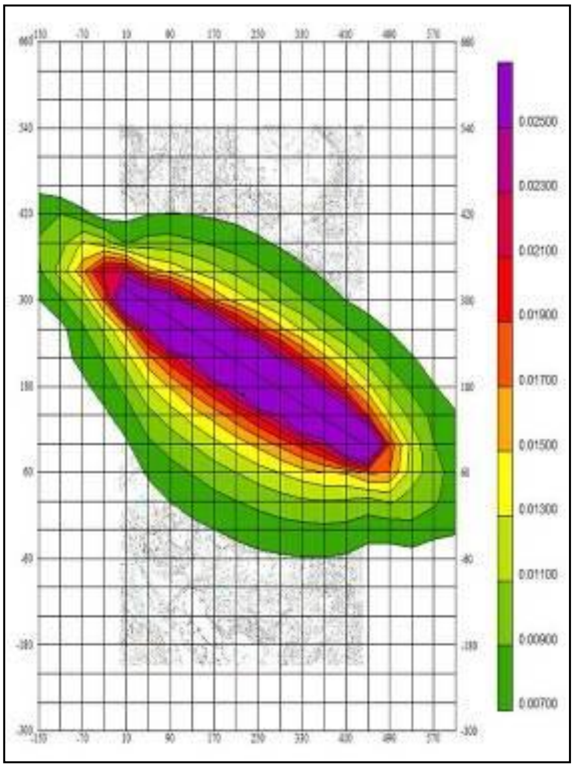


Figure 6.2.3-13 Hourly Average Value of NO_2 of Points 6~7 (Medium Term)

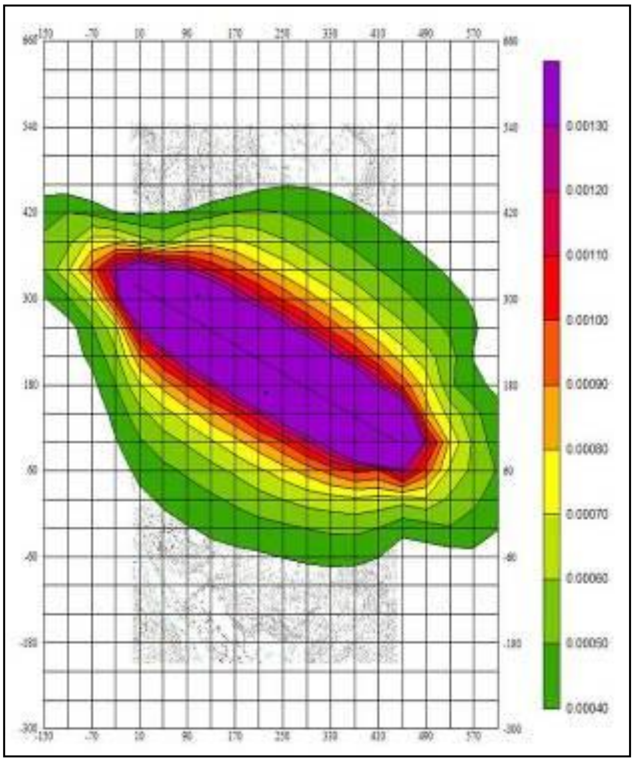


Figure 6.2.3-14 Daily Average Value of NO_2 of Points 6~7 (Medium Term)

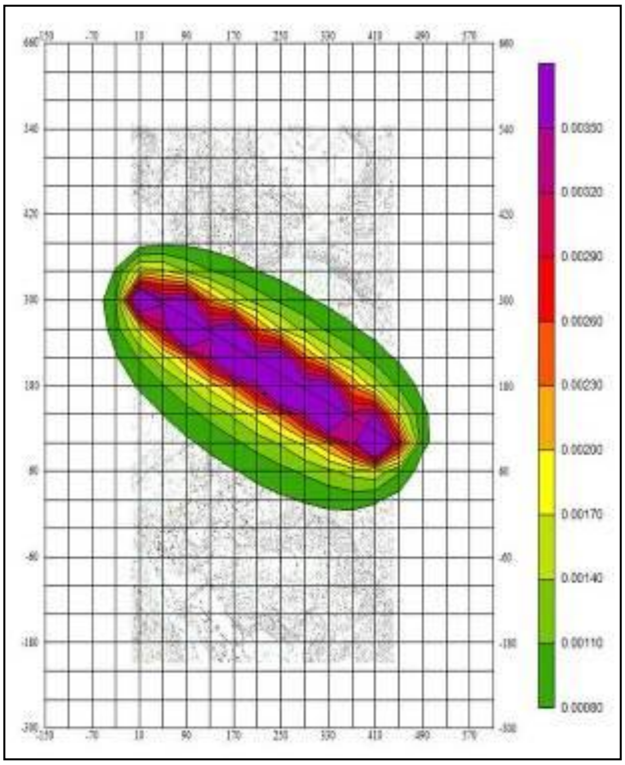


Figure 6.2.3-14 Annual Average Value of NO_2 of Points 6~7 (Medium Term)

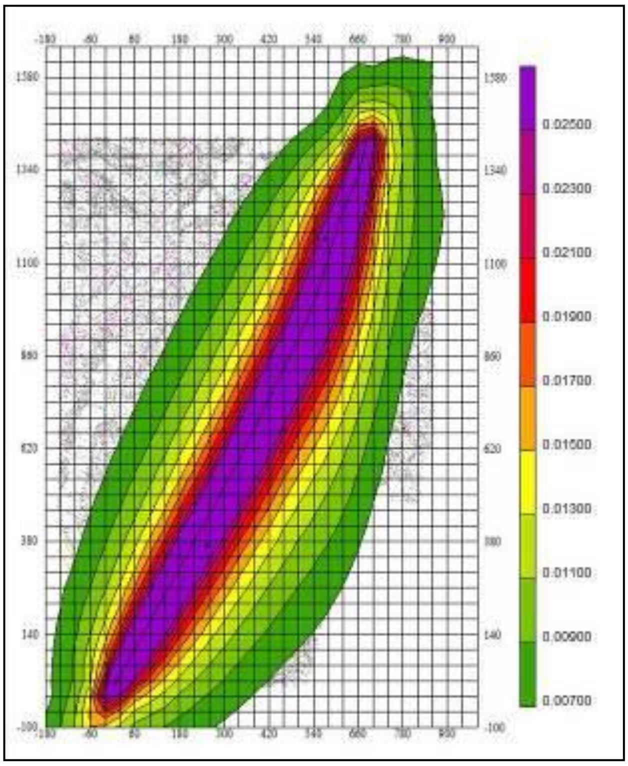


Figure 6.2.3-15 Hourly Average Value of NO_2 of Points 8~9 (Medium Term)

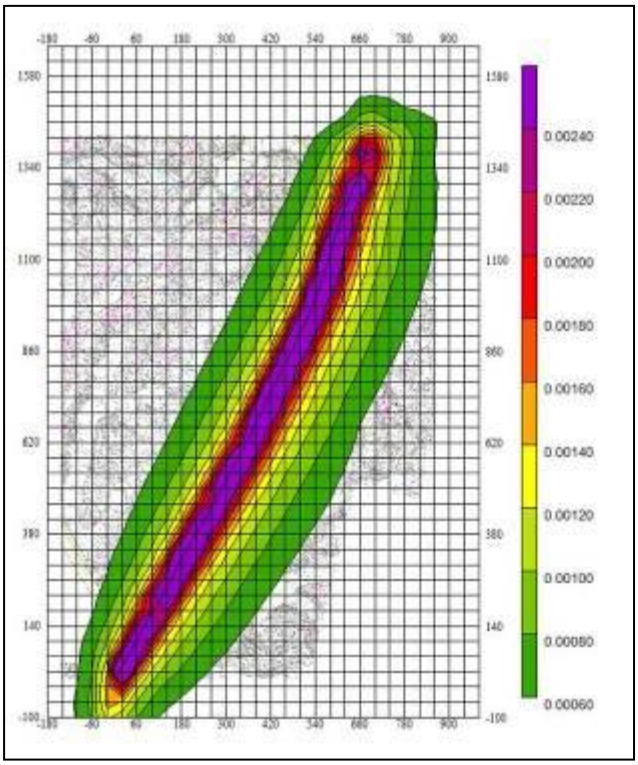


Figure 6.2.3-16 Daily Average Value of NO_2 of Points 8~9 (Medium Term)

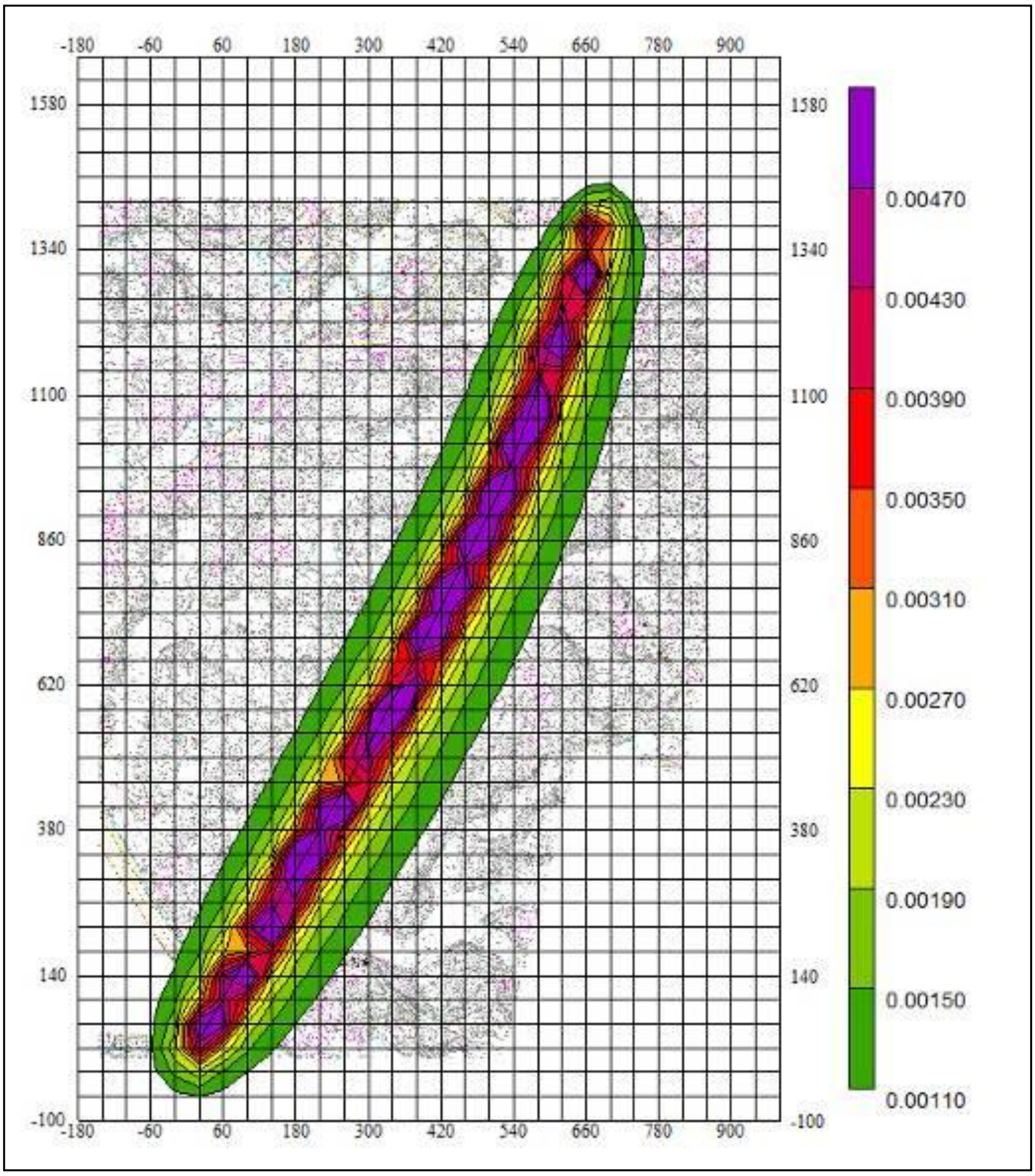


Figure 6.2.3-17 Annual Average Value of NO_2 of Points 8~9 (Medium Term)

2) Maximum concentration prediction results in the long term

Based on the meteorological data in 2013, predictions for the concentration of CO and NO_2 at ambient air sensitive points which are caused by the operation of the proposed project in the long term are as shown below.

Table 6.2.3-10 Predictions for NO_2 Concentration in the Long Term

	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Hourly Average value	1	NO_2	N1-1 Xujiawan	0.0264	0.0264	0.2	13.20
	2	NO_2	N1-2 Dongguawan	0.03245	0.03245	0.2	16.23
	3	NO_2	N1-3 Xinwuzui	0.03385	0.03385	0.2	16.93
	4	NO_2	N1-4 Wangjiawan	0.03992	0.03992	0.2	19.96
	5	NO_2	N1-5 Xinfangzi	0.02957	0.02957	0.2	14.78
	6	NO_2	Maximum value in the area	0.05699	0.05699	0.2	28.49
	7	NO_2	N1-6 Group 6, Poshi Village	0.026	0.026	0.2	13.00
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.02855	0.02855	0.2	14.28
	9	NO_2	Maximum value in the area	0.04551	0.04551	0.2	22.76
	10	NO_2	N1-8 Liujiawan	0.03592	0.03592	0.2	17.96
	11	NO_2	N1-9 Hejiayakou	0.03342	0.03342	0.2	16.71
	12	NO_2	Maximum value in the area	0.05959	0.05959	0.2	29.79
Daily average value	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
	1	NO_2	N1-1 Xujiawan	0.0018	0.0018	0.08	2.24
	2	NO_2	N1-2 Dongguawan	0.00219	0.00219	0.08	2.74
	3	NO_2	N1-3 Xinwuzui	0.00222	0.00222	0.08	2.77
	4	NO_2	N1-4 Wangjiawan	0.00284	0.00284	0.08	3.55
	5	NO_2	N1-5 Xinfangzi	0.0025	0.0025	0.08	3.12
	6	NO_2	Maximum value in the area	0.00531	0.00531	0.08	6.64
	7	NO_2	N1-6 Group 6, Poshi Village	0.00221	0.00221	0.08	2.76
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.00209	0.00209	0.08	2.61

	9	NO_2	Maximum value in the area	0.00346	0.00346	0.08	4.33
	10	NO_2	N1-8 Liujiawan	0.0027	0.0027	0.08	3.37
	11	NO_2	N1-9 Hejiayakou	0.0026	0.0026	0.08	3.25
	12	NO_2	Maximum value in the area	0.00546	0.00546	0.08	6.83
Yearly average value	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
	1	NO_2	N1-1 Xujiawan	0.00297	0.00297	0.04	7.42
	2	NO_2	N1-2 Dongguawan	0.00342	0.00342	0.04	8.54
	3	NO_2	N1-3 Xinwuzui	0.00337	0.00337	0.04	8.44
	4	NO_2	N1-4 Wangjiawan	0.00479	0.00479	0.04	11.98
	5	NO_2	N1-5 Xinfangzi	0.00375	0.00375	0.04	9.37
	6	NO_2	Maximum value in the area	0.00807	0.00807	0.04	20.17
	7	NO_2	N1-6 Group 6, Poshi Village	0.00302	0.00302	0.04	7.55
	8	NO_2	N1-7 Meijiawan, Shiba Village	0.00366	0.00366	0.04	9.14
	9	NO_2	Maximum value in the area	0.00713	0.00713	0.04	17.82
	10	NO_2	N1-8 Liujiawan	0.00426	0.00426	0.04	10.65
	11	NO_2	N1-9 Hejiayakou	0.00457	0.00457	0.04	11.42
	12	NO_2	Maximum value in the area	0.00947	0.00947	0.04	23.68

Table 6.2.3-11 Predictions for CO Concentration in the Long Term

	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Hourly Average value	1	CO	N1-1 Xujiawan	0.13003	0.13003	10	1.30
	2	CO	N1-2 Dongguawan	0.15983	0.15983	10	1.60
	3	CO	N1-3 Xinwuzui	0.16673	0.16673	10	1.67
	4	CO	N1-4 Wangjiawan	0.19659	0.19659	10	1.97
	5	CO	N1-5 Xinfangzi	0.14563	0.14563	10	1.46
	6	CO	Maximum value in the area	0	0	10	0.00
	7	CO	N1-6 Group 6, Poshi Village	0.12804	0.12804	10	1.28
	8	CO	N1-7 Meijiawan, Shiba Village	0.14061	0.14061	10	1.41

	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
	9	CO	Maximum value in the area	0.22416	0.22416	10	2.24
	10	CO	N1-8 Liujiawan	0.17693	0.17693	10	1.77
	11	CO	N1-9 Hejiayakou	0.1646	0.1646	10	1.65
	12	CO	Maximum value in the area	0.29347	0.29347	10	2.93
	SN	Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the Standard Value [%]
Daily average value	1	CO	N1-1 Xujiawan	0.00884	0.00884	4	0.22
	2	CO	N1-2 Dongguawan	0.01078	0.01078	4	0.27
	3	CO	N1-3 Xinwuzui	0.01092	0.01092	4	0.27
	4	CO	N1-4 Wangjiawan	0.014	0.014	4	0.35
	5	CO	N1-5 Xinfangzi	0.01231	0.01231	4	0.31
	6	CO	Maximum value in the area	0	0	4	0.00
	7	CO	N1-6 Group 6, Poshi Village	0.01087	0.01087	4	0.27
	8	CO	N1-7 Meijiawan, Shiba Village	0.01029	0.01029	4	0.26
	9	CO	Maximum value in the area	0.01705	0.01705	4	0.43
	10	CO	N1-8 Liujiawan	0.01328	0.01328	4	0.33
	11	CO	N1-9 Hejiayakou	0.01281	0.01281	4	0.32
	12	CO	Maximum value in the area	0.0269	0.0269	4	0.67

The prediction results show that the ratio of hourly concentration, daily concentration and annual average value of NO_2 and CO at each sensitive point to the standard value is less than 100% in the long term of project operation, which may meet Class II standard requirements specified in the *Ambient Air Quality Standard* (GB3095-2012) and has little impact on the surrounding air environment.

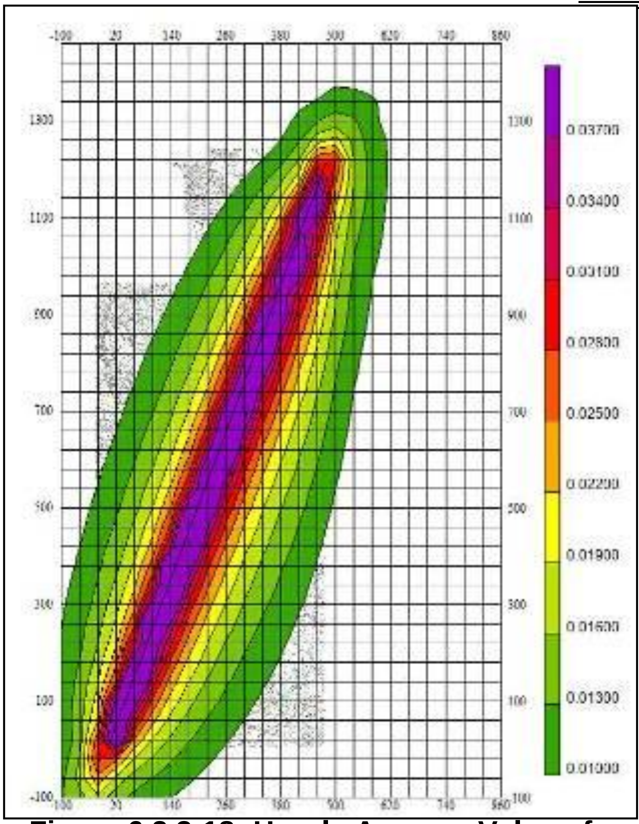


Figure 6.2.3-18 Hourly Average Value of NO_2 of Points 1~5 (Long Term)

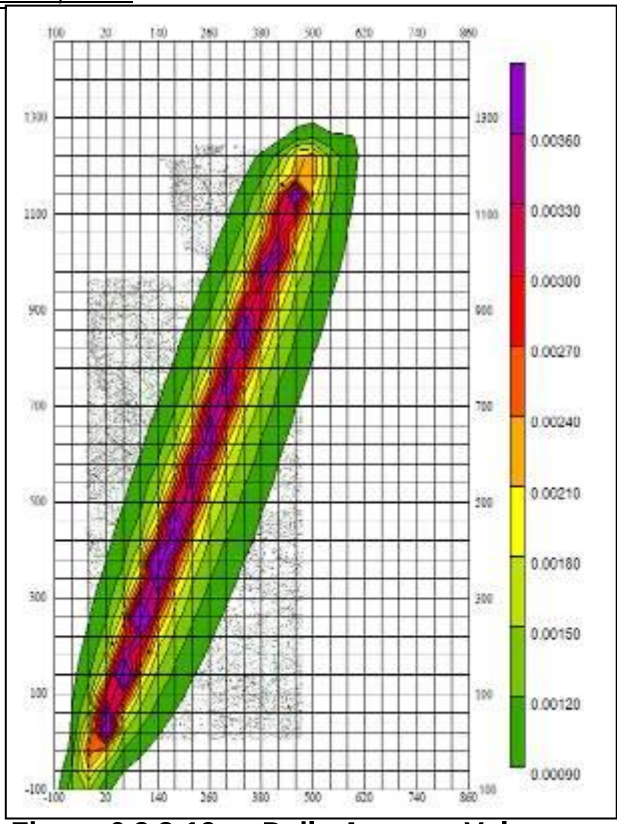


Figure 6.2.3-19 Daily Average Value of NO_2 of Points 1~5 (Long Term)

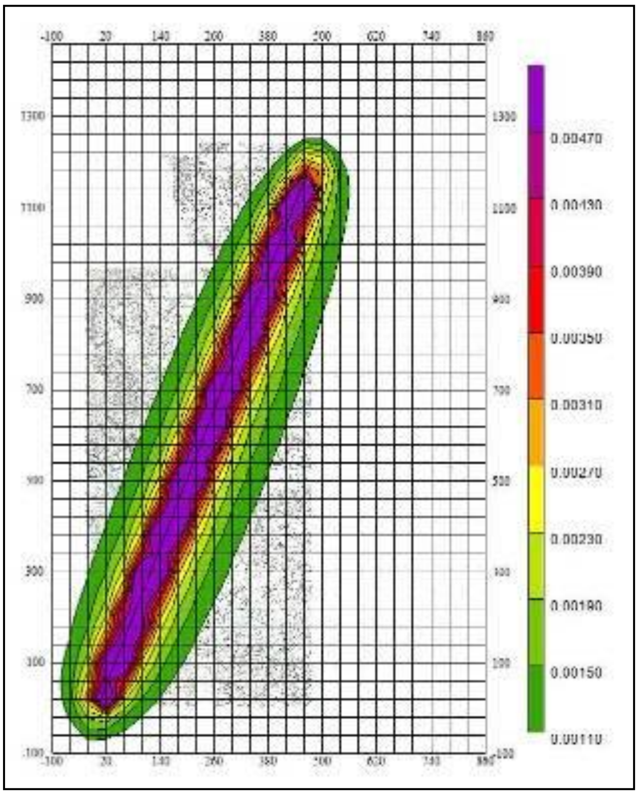


Figure 6.2.3-20 Annual Average Value of NO_2 of Points 1~5 (Long Term)

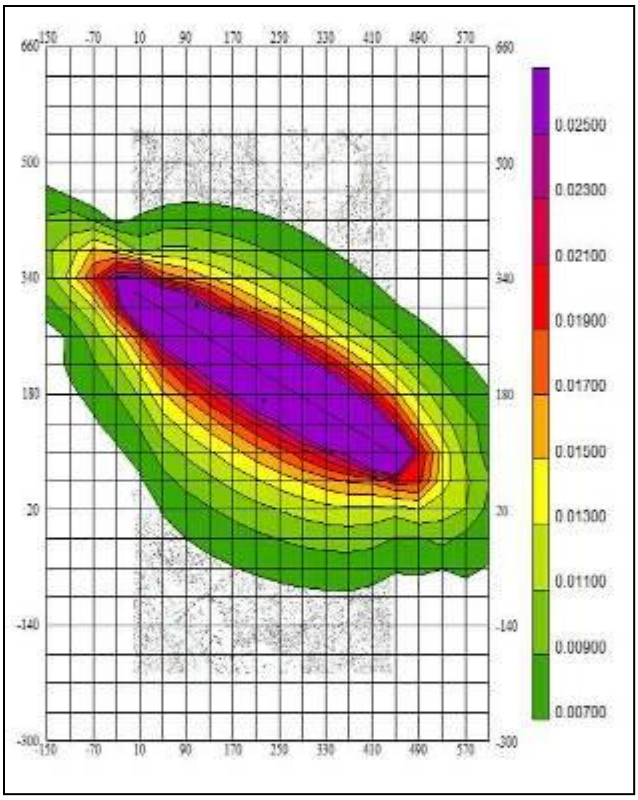


Figure 6 2.3-21 Hourly Average Value of NO_2 of Points 6~7 (Long Term)

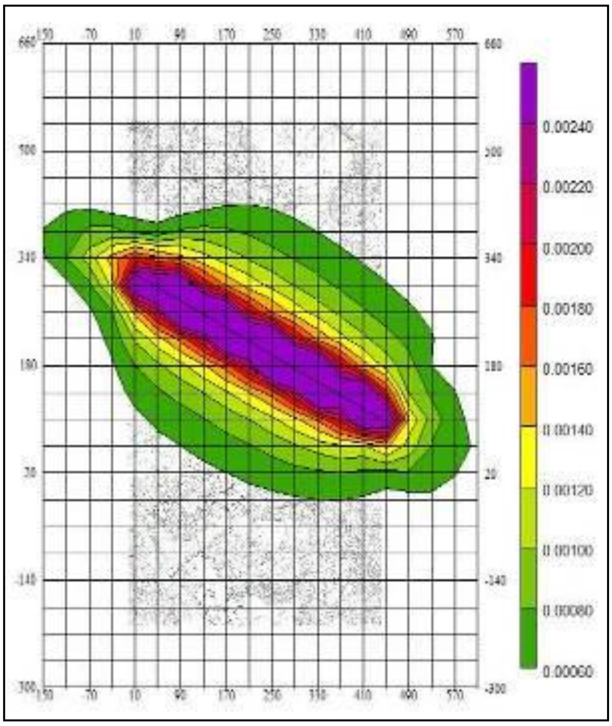


Figure 6.2.3-22 Daily Average Value of NO_2 of Points 6~7 (Long Term)

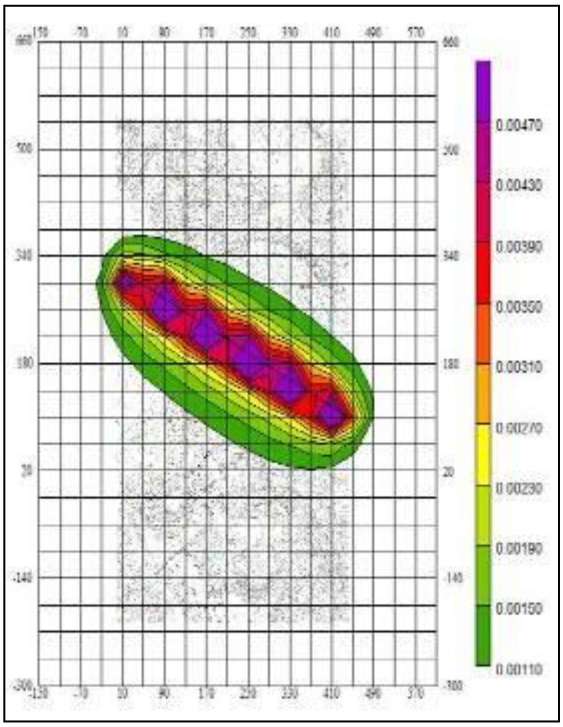


Figure 6.2.3-23 Annual Average Value of NO_2 of Points 6~7 (Long Term)

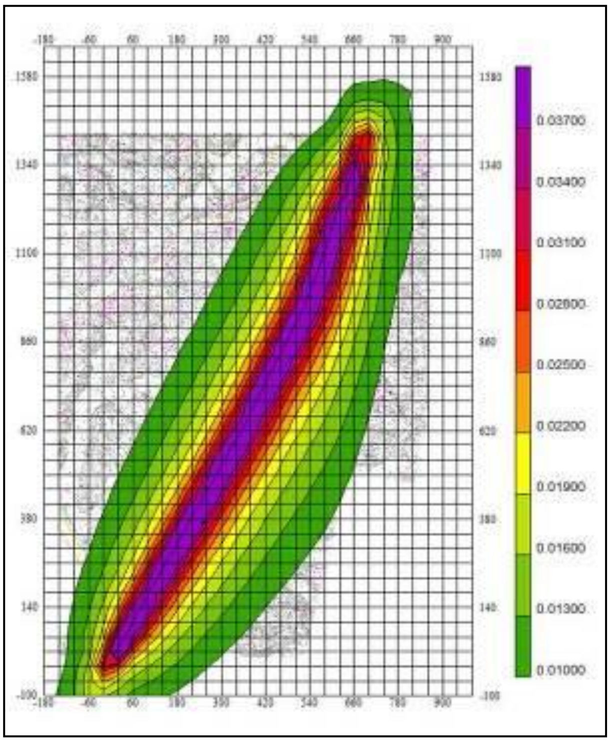


Figure 6.2.3-24 Hourly Average Value of NO_2 of Points 8~9 (Long Term)

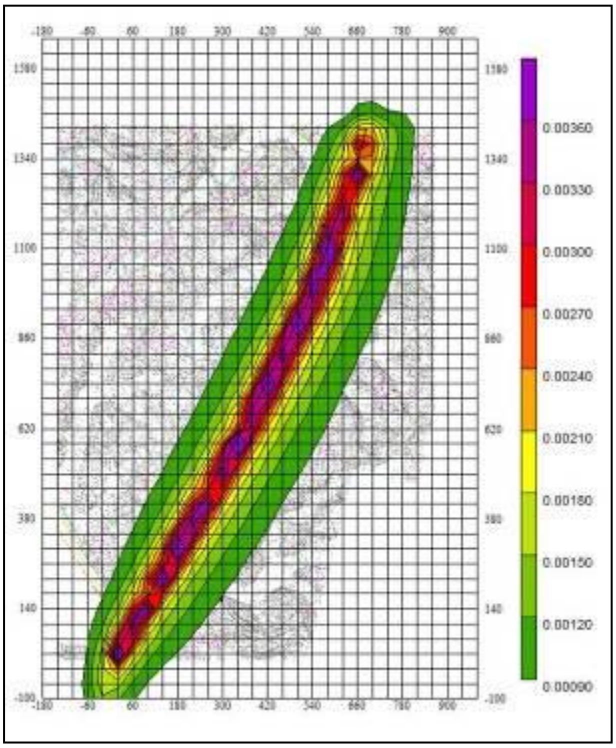


Figure 6.2.3-25 Daily Average Value of NO_2 of Points 8~9 (Long Term)

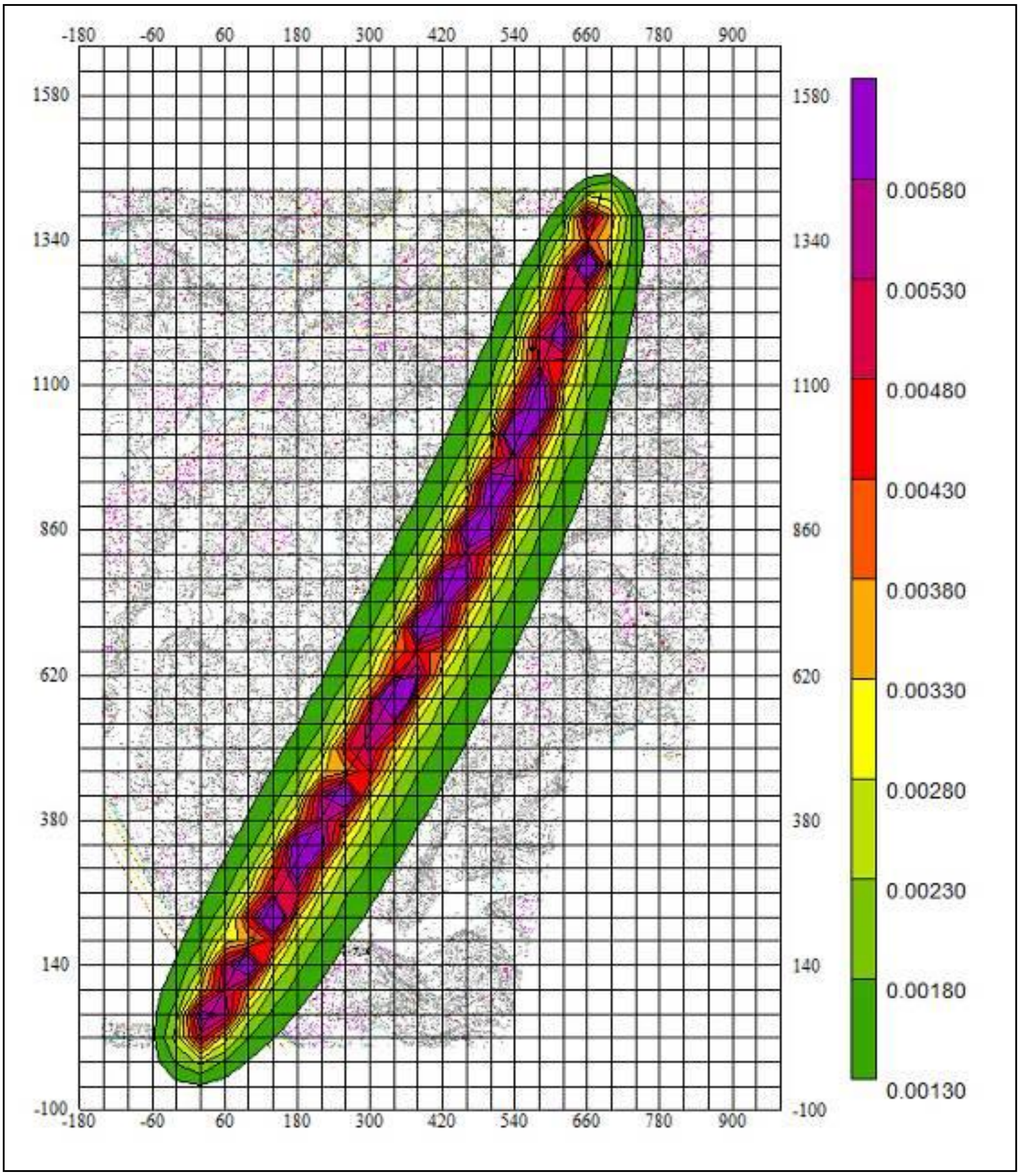


Figure 6.2.3-26 Annual Average Value of NO_2 of Points 8~9 (Long Term)

3. Prediction and assessment of the impact on ambient air of the road in assessed area

(1) Predicators

According to the characteristics of exhaust emission of the proposed project, NO_2 and CO are predictors of the ambient air.

(2) Line source intensity and emissions of the pollutants emitted by vehicles

For line source-based road works, 200m from each side of the center line of the line source belongs to the assessment range.

Pollution emission source intensity of vehicle exhaust is calculated by continuous line source, which is calculated as follows:

$$Q_j = \sum_{i=1}^{3} 3600^{-1} A_i E_{ij}$$

Where: *Qj*— emission source intensity of j-type gaseous pollutants, mg/s.m

Ai— hourly traffic volume of i-type vehicles in the predicted years, vehicle/h

Eij— single motor vehicle emission factor of i-type vehicles and j-type emissions under operation conditions in the predicted years, mg/(vehicle.m)

A number of urban roads are proposed to be built around the project area from 2014 to 2016, and the engineering design of such roads is being planned. The proposed roads are similar to the grade of the assessed road and the traffic volume is similar to that of World Bank loan funded Road 1~Road 5.

See the table below for annual total emissions of the Project in the short term base on the pollutant emission coefficient of single motor vehicles (National IV standard).

Table 6.2.3-12 Quantity of Pollutants from the World Bank Loan Funded Road in the Assessed Area

Road Name	Vehicle Type	Pollution Factor	Traffic flow (vehicle/hour)		Annual Emissions (t/a)		
			2026	2034	2020	2026	2034
Road 1	Large vehicle	CO	256	296	14.39	16.01	18.51
		NO_2	256	296	33.57	37.36	43.2
	Medium-sized vehicle	CO	205	237	7.67	8.55	9.88
		NO_2	205	237	1.53	1.71	1.98
	Small vehicle	CO	171	198	6.42	7.13	8.26
		NO_2	171	198	0.64	0.71	0.83
Road 2	Large vehicle	CO	33	39	1.2299	1.3529	1.5989
		NO_2	33	39	2.8698	3.1568	3.7307
	Medium-sized vehicle	CO	40	46	0.9839	1.0932	1.2572
		NO_2	40	46	0.1968	0.2186	0.2514
	Small vehicle	CO	50	58	1.2299	1.3666	1.5852
		NO_2	50	58	0.123	0.1367	0.1585

Road Name	Vehicle Type	Pollution Factor	Traffic flow (vehicle/hour)		Annual Emissions (t/a)		
			2026	2034	2020	2026	2034
Road 3	Large vehicle	CO	10	12	0.2188	0.2431	0.2917
		NO_2	10	12	0.5105	0.5672	0.6807
	Medium-sized vehicle	CO	12	14	0.1783	0.1945	0.2269
		NO_2	12	14	0.0357	0.0389	0.0454
	Small vehicle	CO	15	17	0.2269	0.2431	0.2755
		NO_2	15	17	0.0227	0.0243	0.0276
Road 4	Large vehicle	CO	3	3	0.0422	0.0422	0.0422
		NO_2	3	3	0.0984	0.0984	0.0984
	Medium-sized vehicle	CO	3	4	0.0281	0.0281	0.0375
		NO_2	3	4	0.0056	0.0056	0.0075
	Small vehicle	CO	4	5	0.0375	0.0375	0.0469
		NO_2	4	5	0.0037	0.0037	0.0047
Road 5	Large vehicle	CO	2	2	0.0221	0.0221	0.0221
		NO_2	2	2	0.0515	0.0515	0.0515
	Medium-sized vehicle	CO	2	3	0.0147	0.0147	0.0221
		NO_2	2	3	0.0029	0.0029	0.0044
	Small vehicle	CO	3	4	0.0221	0.0221	0.0294
		NO_2	3	4	0.0022	0.0022	0.0029
Total	/	CO	809	938	32.7144	36.3501	42.0856
		NO_2	809	938	39.6628	44.0868	51.0737

Table 6.3.3-1 Quantity of Pollutants from the Non-World Bank Loan Funded Road in the Assessed Area

Project Name		Vehicle Type	Pollutants	Analogy Traffic Flow (vehicle/hour)	Annual Emissions (t/a)
Proposed roads in 2014	Road 1	Large vehicle	CO	230	4.86
			NO_2	230	11.33
		Medium-sized vehicle	CO	180	2.53
			NO_2	180	0.51
		Small vehicle	CO	150	2.11
			NO_2	150	0.21
	Road 2	Large vehicle	CO	9	0.11
			NO_2	9	0.27
		Medium-sized vehicle	CO	11	0.09
			NO_2	11	0.02
		Small vehicle	CO	14	0.12
			NO_2	14	0.01
	Road 3	Large vehicle	CO	230	2.95
			NO_2	230	6.89
		Medium-sized vehicle	CO	180	1.54
			NO_2	180	0.31
		Small vehicle	CO	150	1.28
			NO_2	150	0.13
	Road 4	Large vehicle	CO	30	0.36
			NO_2	30	0.84
		Medium-sized vehicle	CO	36	0.29
			NO_2	36	0.06
		Small vehicle	CO	45	0.36
			NO_2	45	0.04
	Road 5	Large vehicle	CO	30	0.31
			NO_2	30	0.73

Project Name		Vehicle Type	Pollutants	Analogy Traffic Flow (vehicle/hour)	Annual Emissions (t/a)
		Medium-sized vehicle	CO	36	0.25
			NO_2	36	0.05
		Small vehicle	CO	45	0.31
			NO_2	45	0.03
	Road 6	Large vehicle	CO	30	0.65
			NO_2	30	1.51
		Medium-sized vehicle	CO	36	0.52
			NO_2	36	0.10
		Small vehicle	CO	45	0.65
			NO_2	45	0.06
Proposed roads during 2015-2016	Line A	Large vehicle	CO	30	0.45
			NO_2	30	1.06
		Medium-sized vehicle	CO	36	0.36
			NO_2	36	0.07
		Small vehicle	CO	45	0.45
			NO_2	45	0.05
	Line B	Large vehicle	CO	9	0.07
			NO_2	9	0.16
		Medium-sized vehicle	CO	11	0.06
			NO_2	11	0.01
		Small vehicle	CO	14	0.07
			NO_2	14	0.01
	Line C	Large vehicle	CO	230	1.50
			NO_2	230	3.50
		Medium-sized vehicle	CO	180	0.78
			NO_2	180	0.16
		Small vehicle	CO	150	0.65
			NO_2	150	0.07
	Line D	Large vehicle	CO	30	0.17
			NO_2	30	0.40
		Medium-sized vehicle	CO	36	0.14
			NO_2	36	0.03
		Small vehicle	CO	45	0.17
			NO_2	45	0.02
	Line E	Large vehicle	CO	30	0.29
			NO_2	30	0.68
		Medium-sized vehicle	CO	36	0.23
			NO_2	36	0.05
		Small vehicle	CO	45	0.29
			NO_2	45	0.03
	Line F	Large vehicle	CO	9	0.41
			NO_2	9	0.96
		Medium-sized vehicle	CO	11	0.33
			NO_2	11	0.07
		Small vehicle	CO	14	0.43
			NO_2	14	0.04
	West ring road	Large vehicle	CO	230	33.89
			NO_2	230	79.07
		Medium-sized vehicle	CO	180	17.68
			NO_2	180	3.54
		Small vehicle	CO	150	14.73
			NO_2	150	1.47
Total			CO		92.47
			NO_2		114.52

(2) Impact analysis

This pollution source belongs to dispersed and mobile line source, with low pollution source height and small pollutant dispersion range. Due to traffic volume variation between day and night, the pollution in the daytime is generally more serious than that at night.

When construction of rebuild roads is completed, the road surface will be changed from cement pavement into asphalt pavement, thus improving the vehicle driving environment. In addition, good running condition of vehicle engines will reduce pollutant emissions. On the whole, the project implementation does not impact the air environment; while in contrast reduce the pollution load of automobile exhaust on regional air environment.

4. Prediction and assessment of impacts on air caused by WWTP works

- Linshui No.3 WWTP

(1) Prediction and analysis of odor impacts

1) Comparing the survey example of on-site odor of WWTP in the *Training Materials for Professional Qualification Registration of Environmental Impact Assessment Engineer registered — Environmental Impact Assessment on Social Regions* (China Environmental Science Press, 2009): the surveyed WWTP applies ordinary aeration method, with water treatment of 260,000m3/d. Odor intensity is divided into six grades in the filed survey, as shown in Table 5.2.3-13. In the survey process, 10 unmarried women around 20 years old without smoking and drinking hobby are selected to smell at the locations where are 5m, 30m, 50m, 70m, 100m, 200m and 300m away from the downwind, and the upwind is used for comparison. The wind on the survey date was NE, with wind speed of 4.5m/s and temperature of 12°C. See Table 5.2.3-14 for smell survey results.

Table 6.2.3-13 Odor Intensity Grading

Class	Odor Intensity
0	Odorlessness
1	Odor that may barely smell (sensory threshold)
2	Weak odor with distinguishable nature (recognition threshold)
3	Odor that may easily smell
4	Strong odor
5	Unbearable super strong odor

Table 6.2.3-14 Smell Findings

Wind Direction	Distance (m)	Sense Ratio					
		Class 0	Class I	Class II	Class III	Class IV	Class V
Upwind	5				100		
	20		100				
Downwind	5					100	
	30				20	80	
	50				40	60	
	70			20	70	10	
	100			80	20		
	200		20	50			
	300		80	20			

Based on the above smell survey results, it is easy to smell the odor within 100m away from the downwind of WWTP odor source, not obvious to smell the odor at 200m and basically unable to smell the odor beyond 300m.

2) Based on the contents in *Odor Pollution Impact Analysis and Assessment of Municipal Wastewater Treatment Plant* (Lin Changzhi, Journal of Fujian Radio & TV University, No.4, 2009), the analysis of impacts of the odor from Fuzhou Xiangban WWTP is as follows:

Fuzhou Xiangban WWTP, with total plant scale up to 75,000m^3/d, applies A/O secondary biological treatment. The odor intensity is determined with sensory test, based on the smell of the inspectors. The reference monitoring point is located at 1m from the plant boundary (30m away from the aeration grit chamber) in the upwind (dominant wind direction: southeast by east) during monitoring, and aeration tank of Fuzhou Xiangban WWTP is set as the starting point. The downwind 1m, 50m, 100m, 200m and 300m are each arranged with a monitoring point, with seven in total. The concentration of odor pollutants is inferred in reference to Beijing odor intensity grading method (see Table 5.2.3-15). See Table 6.2.3-16 for concentration results.

Table 6.2.3-15 Odor Pollution Intensity Grading and Concentration of Corresponding Odor Pollutants

Odor intensity	Olfactory Response to Odor	Mass Concentration of Pollutants (mg/m^3)	
		NH_3	H_2S
0	No odor smelled and no response	$<$0.1	$<$0.0005
1	Odor that may barely smell, with odor nature not easy to identify	0.1	0.0005
2	Weak odor with distinguishable odor nature	0.6	0.006
3	Easy to smell the odor, being somewhat unpleasant but not without antipathy	2.5-3.5	0.02-0.2
4	Strong odor, being antipathy and want to leave	10	0.7
5	Super strong odor, being unbearable and want to leave immediately	40	0.8

Table 6.2.3-16 Sensory Measurement Results of Odor Pollutants of Fuzhou Xiangban WWTP

Pollution Source	Monitoring Point	Feeling	Concentration of Pollutants (mg/m^3)		Class of Odor Intensity
			NH_3	H_2S	
Aeration tank	Near the aeration tank	Strong odor	10	0.7	4
	1m from the plant boundary in the upwind	Weak odor that is easy to smell	0.1	0.0005	1
	1m from the downwind	Obvious odor, but acceptable	2.5-10	0.02-0.7	3-4
	50m from the downwind	Odor sensible, but acceptable	2.5-3.5	0.02-0.2	3
	100m from the downwind	Weak odor that is easy to smell	0.6	0.006	2
	200m from the downwind	Odor that may barely smell	0.1-0.6	0.0005	1-2
	300m from the downwind	Odor not smelled	$<$0.1	$<$0.0005	0-1

As can be seen from the table, the odor intensity at 1m from the plant boundary in the upwind and 100m downwind are Grade 1 and Grade 2 respectively when Fuzhou Xiangban WWTP is operated, with NH_3 concentration about 0.1~0.6mg/m3 and H_2S

concentration about 0.005~0.0006mg/m3, all of which can meet the limit requirement for Grade 1 specified in the *Emission Standards for Odor Pollutants* (GBl4554-93). Odor concentration is reduced as diffusion distance increases, the impact outside 100m is significantly weakened and almost no impact occurs at 300m away from the odor source.

3) Guangzhou Datansha WWTP is the first large urban WWTP in Guangzhou, with processing capacity of 550,000t/d. It is built by three phases, in which A2/O process is applied for Phase 1 and Phase 2 while inverted A2/O process for Phase 3. Except Phase 1, all open-air treatment facilities of Phase 2 and Phase 3 (except the secondary sedimentation tank) are added with covers for sealing, and waste gas collection opening is arranged to collect the odor in the enclosed space of each treatment facility.

Adding organic glass cover or concrete cover on the tank is applied for sealing. For all indoor facilities like influent pump station, grid room and sludge dewatering house, glass windows are applied for sealing and odor collection device is arranged. This plant has nine sets of odor processing devices and three kinds of treatment methods are used, in which biological soil method is applied for Phase 2 and bio-trickling filter and plasma deodorizing process for Phase 3.

Guangzhou Liede WWTP is the second large modern urban WWTP in Guangzhou, with processing capacity of 640,000t/d. It is built by three phases, in which adsorption biodegradation treatment process at section A and section B is applied for Phase 1, combination of alternating activated sludge treatment process for Phase 2 and A2/O process for Phase 3.

Covering adding and deodorization are not considered during Phase 2 and Phase 3. But later, covering adding and deodorization are conducted for major odor pollution sources like aeration tank section A and section B of Phase 1, UNITANK tank of Phase 2, sludge thickening tank and sludge dewatering room of Phase 1 and Phase 2. However, deodorization is considered in Phase 3 and deodorization system and WWTP are completed at the same time. Concrete cover is used to seal outdoor facilities, leaving with an observation window enclosed with organic glass.

Based on the contents in the *Discussion on the Control Measures and Environmental Impact Assessment of the Odor of Wastewater Treatment Plant* (Xue Song, et al, Journal of Qingdao Technological University, Vol. 33 No.2), field survey and study are conducted for the above-mentioned two WWTPs and the result shows that after deodorization transformation, deodorization device in the plant runs well with low operating costs and significant deodorization effect, and is well received by the surrounding residents. When measure of covering adding and deodorization is taken, the emission concentration of odor pollutants is below the standard of Grade II as specified in *Emission Standards for Odor Pollutants* (GBl4554-93), and no obvious odor may be smelled in the plant and the surrounding area.

Beyond that, in order to understand the environmental impact of

WWTP odor, the author also organized 10 unmarried men and women below 30 years old without smoking and drinking hobby to smell the odor in Nibuwan WWTP upon covering adding.

Such personnel smell the odor back and forth at the locations where are 5m, 30m, 50m, 70m, 100m, 200m and 300m away from the downwind, and the upwind is used for comparison. The wind on the survey date was S, with temperature of 12°C, and the survey is carried out in early autumn from 10 a.m. to 11 a.m. Based on the survey results, it is easy to smell the odor at 30m away from the downwind of the odor source during normal operation, not obvious to smell the odor at 50m and basically unable to smell the odor beyond 70m.

Table 5.2.3-17 Statistical Conditions of WWTP in Analogy

Item	Treatment Process	Treatment Capacity
WWTP in the training materials of EIA engineer	Ordinary aeration method	260,000m^3/d
A WWTP in Fuzhou as example	A/O process	75,000m^3/d
Guangzhou Datansha WWTP	A^2/O process	550,000m^3/d
Guangzhou Liede WWTP	Modified A^2/O process	640,000m^3/d
Linshui No.3 WWTP	Improved oxidation ditch	4,000m^3/d in short term and 8,000m^3/d in long term

4) The above related data shows that when covering adding and deodorization are not performed for WWTP structures, the range with greatest odor impact is within 100cm from the odor source; while when performed, odor impact is obviously reduced and the impact scope is significantly narrowed. WWTP treatment scale of the Project is smaller than that of the analogical. When cover is added for major structures producing odor and odor emission is conducted after centralized collection and treatment, supported by plant landscaping, the impact of odor on external environment may be greatly reduced. The sensitive point closest to the project is located at 7m from the north side of the project, upwind of the project, so no environmental sensitive point is distributed in the downwind of the project. Therefore, odor of the Project has limited impact on the surrounding environment and less impact on the surrounding residential areas.

(2) Prediction of impacts of WWTP air pollutants

1) Pollutant concentration prediction

In this assessment, H_2S and NH_3 are used as characteristic factors of air pollutants of the proposed project to assess the environmental impact of WWTP odor.

According to the feasibility study, deodorization of the Project is mainly focused on waste gas sealing in coarse grid, lifting pumping room and fine grid with larger odor. After being collected in the pipes, the odor will be processed by a set of efficient UV light odor releasing device with air volume of 15000m^3/h, by which the deodorization and purification effect may achieve more than 99%. Therefore, the concentration of H2S and NH3 in the exhaust of biological deodorization device may be ignored.

H_2S and NH_3 produced by oxidation ditch, secondary sedimentation tank, rotary filter tank and sludge tank are mainly considered as assessment factors in this assessment. Pollution source intensity is determined with analogy method and air source intensity of unorganized non-point source in the *Environmental Impact Report for Chi'an WWTP in New Wuyi District* is applied as analog source intensity. The treatment process of Chi'an WWTP is the same as that of the Project. See Table 6.2.3-19 for details and Table6.2.3-20~Table6.2.3-21 for calculation results of estimation model.

Table 6.2.3-18 Statistical Conditions of Chi'an WWTP and the Plant in Analogy

Item	Treatment Process	Treatment Capacity
Chi'an WWTP in New Wuyi District	Improved oxidation ditch	35,000m^3/d
Linshui No.3 WWTP	Improved oxidation ditch	4,000m^3/d in short term and 8,000m^3/d in long term

Table 6.2.3-19 Source Intensity List of Air Pollutants

Structures	Source Form	Source Size (m^2)	Odor Pollution Source Output	
			NH_3	H_2S
			g/h	g/h
Inorganization	Analogy non-point source	225×206	84	4.152
Oxidation ditch	Non-point source	840	1.52233	0.07525
Secondary sedimentation tank	Non-point source	76	0.13773	0.00681
Rotary filter tank	Non-point source	81	0.14680	0.00726
Sludge tank	Non-point source	24	0.04350	0.00215

Table 6.2.3-20 Pollutant Emissions at the Boundary of WWTP

Pollutants	Caring Points	Concentration [mg/m^3]	Predictive Value [mg/m^3]	Standard Value	Ratio to the standard value [%]
NH_3	North border	0.00166	0.00166	1.5	0.11072
	West border 1	0.00257	0.00257	1.5	0.17107
	West border 2	0.00215	0.00215	1.5	0.143
	East border	0.00256	0.00256	1.5	0.17038
	South border	0.00235	0.00235	1.5	0.15682
H_2S	North border	0.00008	0.00008	0.06	0.13683
	West border 1	0.00013	0.00013	0.06	0.21142
	West border 2	0.00011	0.00011	0.06	0.17673
	East border	0.00013	0.00013	0.06	0.21057
	South border	0.00012	0.00012	0.06	0.1938

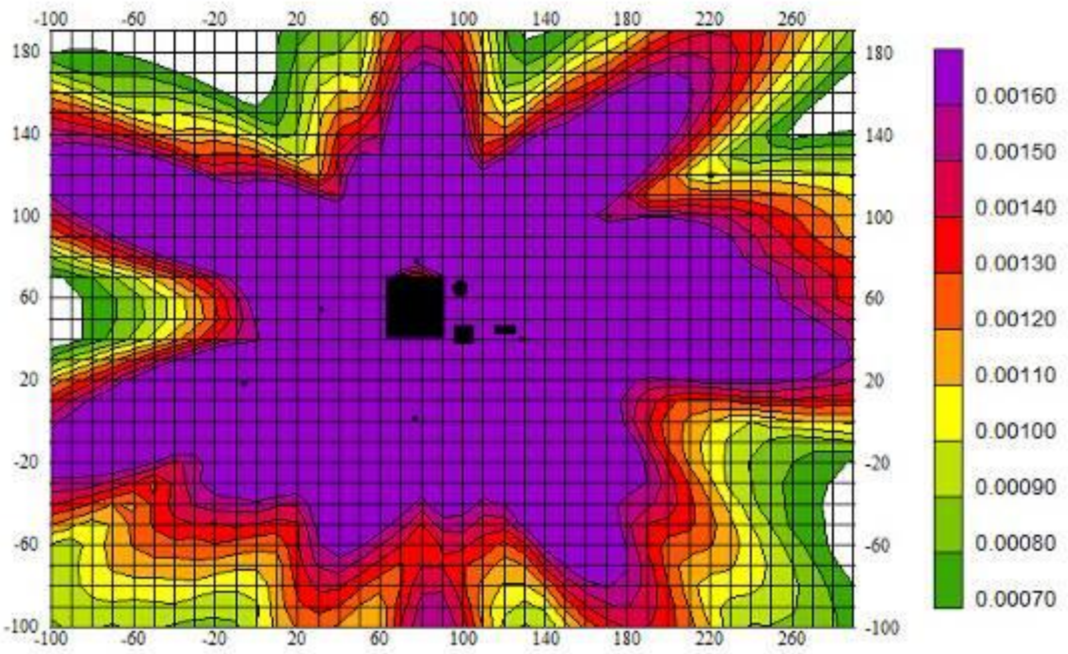
The above table shows that the emission of H_2S and NH_3 pollutants of WWTP is below the standard of Grade II as specified in the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002).

Table 6.2.3-21 Prediction for Sections of Pollutant Discharge in the Downwind of WWTP

Pollutant	SN	Distance	Concentration (mg/m^3)	Ratio to the Standard Concentration Value (%)

		(m)		
NH_3	1	10	0.005305	0.35367
	2	100	0.001483	0.09887
	3	200	0.000434	0.02895
	4	300	0.000211	0.01403
	5	400	0.000127	0.00848
	6	500	8.69E-05	0.00579
	7	600	6.40E-05	0.00427
	8	700	4.96E-05	0.00331
	9	800	4.00E-05	0.00267
	10	900	3.32E-05	0.00221
	11	1000	2.81E-05	0.00187
H_2S	1	10	0.000248	0.41267
	2	100	6.92E-05	0.11533
	3	200	2.03E-05	0.03383
	4	300	9.80E-06	0.01633
	5	400	5.90E-06	0.00983
	6	500	4.10E-06	0.00683
	7	600	3.00E-06	0.005
	8	700	2.30E-06	0.00383
	9	800	1.90E-06	0.00317
	10	900	1.50E-06	0.0025
	11	1000	1.30E-06	0.00217

The above table shows that the concentration of H_2S and NH_3 pollutants in the downwind of WWTP is far below the standard of Grade II as specified in the *Ambient Air Quality Standard* (GB3095-2012).



Pollutant Emissions at the Boundary of WWTP (NH_3)

2) Air environment protection distance

Environment protection distance is calculated by the air environmental protection distance standard calculation software (VER1.1) released by key laboratory for environment simulation of the Environmental & Engineering Appraisal Center of the Ministry of Environmental Protection. See the table below for statistics of calculation results.

Table 6.2.3-22 Calculation Results of Air Environment Protection Distance Mode

Unit	Pollutant	Environment Quality Standard (mg/m^3)	Excessive Distance (m)
Box	NH_3	0.20	Without excessive point
	H_2S	0.01	Without excessive point

There is no excessive point for unorganized odor pollutants based on the calculation results under air environment protection distance mode, so air environment protection distance is not arranged for the Project.

3) Health protection distance

At present, no standards on national health protection distance of WWTP have been issued. In accordance with relevant provisions in *Technical Methods for Making Local Emission Standards of Air Pollutants* (GB/T13201-91), the formula to determine the health protection distance is as follows:

$$\frac{Qc}{Cm} = \frac{1}{A}\left(BL^{C} + 0.25r^{2}\right)^{0.5} L^{D}$$

Where: Q_m— Standard concentration limit (mg/m^3);

Q_c — available control level for unorganized emission volume of harmful gas from industrial enterprises (kg/h);

r— equivalent radius of the production unit containing unorganized emission source of harmful gas (m), which is calculated based on the floor area S(m^2) of the production unit, $r=(S/\pi)^{0.5}$;

L— health protection distance required by industrial enterprises (m);

A, B, C, D— health protection distance calculation coefficient, as shown in Table **6.2.3-23**.

Table 6.2.3-23 Health Protection Distance Calculation Coefficients

Calculation Coefficient	**Average Wind Speed in 5 Years (m/s)**	**Health Protection Distance L (m)**								
		L≤1000			1000＜L≤2000			L＞2000		
		Constitution Category of Industrial Air Pollution Sources								
		I	II	III	I	II	III	I	II	III
A	＜2	400	400	400	400	400	400	400	400	400
	2~4	700	470	350	700	470	350	380	250	190
	＞4	530	350	260	530	350	260	290	190	140
B	＜2	0.01			0.015			0.015		
	＞2	0.021			0.036			0.036		
C	＜2	1.85			1.79			1.79		

	＞2	1.85	1.77	1.77
D	＜2	0.78	0.78	0.57
	＞2	0.84	0.84	0.76

According to the land use situation of each production unit provided by the Designer of the project, the required health protection distance is calculated by the maximum value (NH3) of Q_c/Q_m for industrial enterprises with unorganized emissions of a variety of harmful gases based on GB/T13201-91 regulations. According to GB/T13201-91 regulations, when the health protection distance calculated by the Qc/Qm value of two or more kinds of harmful gases is at the same level, the health protection distance of such kind of industrial enterprises shall be one level higher. When L is less than 100m, the grade difference is 50m; when over 100m but less than or equal to 1000m, the grade difference is 100m; and when over 1000m, the grade difference is 200m. Therefore, according to the calculation that the required health protection distances are all less than 50m, 100m health protection zone is arranged with the boundaries of odor sources (oxidation ditch, secondary sedimentation tank, rotary filtering chamber and sludge thickening tank) as centers.

Due to low olfactory threshold of odor pollution sources, the Owner shall do control odor pollutants, with concrete measures as follows: build greening isolation belt with a certain width at the boundary of the plant, plant trees and grasses in the isolation belt, and form a three-dimensional protection forest system for grasses, shrubs and trees, clean up the sludge every day; consider adopting the way of mechanical ventilation to accelerate the dilution and diffusion of odor gases in the sludge dewatering room; and do not plan or build new facilities for living, education, health, and three production industries within the designated 100m health protection zone. The introduction of enterprises with strict demand on the air like food enterprises and pharmaceutical enterprises is inadvisable.

- Linshui No.2 WWTP

Due to the ongoing preliminary work for project design of Linshui No.2 WWTP, currently no detailed design document is available, and only analog prediction is conducted based on the impact assessment results of WWTP of the Project. When covering adding and deodorization are not performed for WWTP structures, the range with greatest odor impact is within 100m from the odor source; while when performed, odor impact is obviously reduced and the impact scope is significantly narrowed. Therefore, the impact of odor of No.2 WWTP on the surrounding environment is limited.

The emission of H_2S and NH_3 pollutants of WWTP is below the standard of Grade II as specified in the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002). Moreover, in accordance with relevant provisions in the *Technical Methods for Making Local Emission Standards of Air Pollutants* (GB/T13201-91), 100m health protection zone shall be arranged.

New facilities for living, education, health, and three production industries shall not be planned or built in the designated 100m health protection zone. The introduction of enterprises with strict demand on the air like food enterprises and pharmaceutical enterprises is inadvisable.

6.2.4 Prediction and assessment of impacts on surface water environment during the operation period

1. Road transport component

When the roads are put into operation, deposited pollutants carried by various types of vehicle exhausts on the road, tire wear particles, dirt of adhesive tape on carframe, scattered pollutants during vehicle braking and leaked oil under poor vehicle operating conditions will enter into the road drainage system and eventually into surface waters rainfall along with the road runoff produced by rainfall. The followings are brief analysis of impacts on road runoff.

Impacts on road runoff pollution are from many factors, including rainfall, rainfall duration, extent of road and air pollution related to traffic flow, interval between two rains, road width, dust settlement, early drought time and length of the road section accepting pollutants. Therefore, the factors impacting the concentration of road runoff pollutions are diversified. Because of the large variability of impact factors, strong randomness of a variety of factors and big chance, yet no universally applicable unified means has been available.

South China Institute of Environmental Sciences, MEP tested the road runoff pollution situations in South China, with method as follows: form road runoff with artificial rainfall method, with time period of two artificial rainfall for 20 days, known traffic flow and rainfall, one-hour rain duration and rainfall intensity of 81.6mm, collect water samples at different times within one hour, and at last measure and analyze the changes of road pollutants, as shown in the table below.

Table 6.2.4-1 Measurements for Concentration of Pollutants in Road Runoff

Item	5~20 Minutes	20~40 Minutes	40~60 Minutes	Average Value
SS (mg/L)	231.42-158.52	185.52-90.36	90.36-18.71	100
BOD (mg/L)	7.34-7.30	7.30-4.15	4.15-1.26	5.08
Petroleum (mg/L)	22.30-19.74	19.74-3.12	3.12-0.21	11.25

It is thus clear that the concentration of suspended solids and oils in the rainfall is relatively high usually within 30 minutes from the early rains to runoff formation, after which the concentration decreases rapidly as rainfall duration extends. When the rain lasts for 40-60 minutes, the road surface is basically cleaned and the concentration of road runoff pollutants is relatively stable at a low level.

2. Wastewater interceptor component

When the project is completed and put into operation, no wastewater is generated and discharged, which almost has no impact on the quality of local surface water environment. Since domestic sewage and production wastewater from the north area of the LETDZ and part of Linshui Western New City are effectively collected during the construction, it plays a positive role to improve the waters quality and function of Shiba River and Bajiao River, with positive environmental benefits.

According to the design, wastewater interceptors of the Project are respectively laid along the south and north side of Shiba River. The wastewater interceptors on the north side is located at about 360m from the upstream of intersection of Shiba River and Hucheng River, while those crossing Shiba River and those on the south side are converged and finally introduced into Linshui No.2 WWTP for treatment.

Based on the documents provided by the Housing and Urban-Rural Construction Bureau of Linshui County, No.2 WWTP is planned to be built and Hongdian

Village in Chengnan Town, Linshui County is preliminarily selected as the plant site. According to the feasibility study, the treatment capacity is 30,000m^3/d, CASS treatment technology is applied and the effluent quality may meet the requirement for standard A of Grade 1 as specified in the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002). WWTP and wastewater interceptors are constructed at the same stage, which may ensure that wastewater from the wastewater interceptors enters into WWTP for effectively treatment and has a positive environmental benefits for improving the waters quality of Shiba River and Bajiao River.

3. WWTP component

World Bank loan funded No.3 WWTP and non-World Bank loan funded No.2 WWTP are included in the scope of assessment.

The impact of WWTP component on water environment is mainly from the impact of tail water discharged by WWTP on the receiving waters. The domestic sewage produced by WWTP staff, equipment washing water and initial rainwater in plant area are treated together in WWTP.

Due to the ongoing preliminary work for project design of Linshui No.2 WWTP, currently no design document is available and detailed assessment on No.2 WWTP is unavailable, and only key analysis on Linshui No.3 WWTP is conducted in this assessment.

- **Wastewater discharge prediction**

According to the *General Planning of Linshui County Downtown* and the investigation to enterprises currently resided or proposed to be resided in the industrial park, the population of the industrial park will reach 20,000 persons in 2020, 53,000 persons in 2030 and 94,000 persons in 2040.

The domestic water shall be predicated by the comprehensive domestic water consumption according to the “municipal comprehensive domestic water consumption quota” specified in *Code for Design of Outdoor Water Supply Engineering* (GB50013－2006).

Table 6.2.4-2 Municipal Comprehensive Domestic Water Consumption Quota (L/(person/day))

Region	Mega City		Large City		Small and Medium-Sized City	
	The maximum daily consumption	The average daily consumption	The maximum daily consumption	The average daily consumption	The maximum daily consumption	The average daily consumption
Region 1	260～410	210～340	240～390	190～310	220～370	170～280
Region 2	190～280	150～240	170～260	130～210	150～240	110～180
Region 3	170～270	140～230	150～250	120～200	130～230	100～170

Note: Region 1 contains Hubei, Hunan, Jiangxi, Zhejiang, Fujian, Guangdong, Guangxi, Hainan, Shanghai, Jiangsu, Anhui and Chongqing; Region 2 contains Sichuan, Guizhou, Yunnan, Heilongjiang, Jilin, Liaoning, Beijing, Tianjin, Hebei, Shanxi, Henan, Shandong, Ningxia, Shanxi, the east of Hetao Plain of Inner Mongolia and the east of the Yellow River in Gansu; Region 3 contains Xinjiang, Qinghai, Xizang, the west of Hetao Plain of Inner Mongolia and the west of the Yellow River in Gansu. Linshui County is classified as a small and medium-sized city in Region 2, with a domestic water consumption quota of 110~180. Through the existing water consumption investigation of Linshui downtown, the per capita comprehensive domestic water consumption quota for residents in the downtown of Linshui shall be controlled at 170L/person/day in a short term and about 160L/person/day in a long term.

Table 6.2.4-3 Comprehensive Domestic Water Consumption Prediction of the Industrial Park

Year	Domestic Sewage Quota	Number of People (10,000 persons)	Water Supply Penetration Rate	Domestic Water Consumption (10,000m^3/d)
2020	170	2.0	95	0.3
2030	160	5.3	98	0.8
2040	160	9.4	98	1.5

Through the water consumption investigation of enterprises already resided in, the number of enterprises resided and proposed to reside in the industrial park shall be counted and the industrial wastewater output of the industrial park in each planning year shall be predicated. The industrial waste generated is expected in the following table:

Table 6.2.4-4 Industrial Water Consumption Prediction of the Industrial Park at Each Planning Year

Year	Area of Industrial Land (ha)	Total Industrial Water Consumption (10,000m^3/d)	Actual Production Capacity/Expected Production Capacity	Actual Water Consumption (10,000m^3/d)
2020	262.3	0.6	0.9	0.5
2030	419.7	0.9	0.95	0.9
2040	524.6	1.1	1.0	1.1

Table 6.2.4-5 Wastewater Discharge Prediction of the Industrial Park

Time	⑥-④-③	Wastewater Discharge Rate	Wastewater Discharge	Collection Rate	Treatment Capacity
2020	0.9	0.8	0.9	0.7	0.9
2030	1.9	0.85	0.95	1.5	1.9
2040	2.9	0.85	0.95	2.4	2.9

According to the service area division of Linshui WWTPs, Linshui No. 3 WWTP only serves the south area of the industrial park; according to the development planning time sequence of LETDZ, the wastewater discharge of the south area will take up 38% of the total wastewater discharge of the industrial park by the year 2020. Such proportion will reach 50% by the year 2030. The wastewater discharge distributed to the Linshui No. 3 WWTP is 4000m^3/d in the short term and 8000m^3/d in the long term.

- **Linshui No.3 WWTP**

(1) Quality requirements on WWTP inflow

The analogy in feasible study report is performed for the inflow water quality of Linshui No.1 WWTP through the investigation on existing enterprises in LETDZ and in combination with the *Code for Design of*

Outdoor Sewerage Engineering; in consideration of the allowance for treating future inflow water of WWTP, it is determined in the final feasibility study that the inflow water quality indicators of WWTP satisfy the requirements as follows:

Table 6.2.4-2 Predictions on Designed Inflow and Effluent Wastewater Quality

Water Quality Index	pH	CODcr (mg/l)	BOD_5 (mg/l)	SS (mg/l)	NH_3-N (mg/l)	TP (mg/l)	TN (mg/l)
Domestic sewage	6.5-8.5	300	165	200	26	4.4	36.5
Production wastewater	6.5-8.5	189	97	164	20	2.3	25

With Linshui No.3 WWTP to treat the domestic wastewater and production wastewater from LETDZ, which has complex composition, the enterprises settled in LETDZ are required to strengthen wastewater treatment by themselves, discharge wastewater in the wastewater pipe networks as per the inflow water quality requirements of proposed works. Wastewater from such enterprises must be pre-treated up to the Class III standard in *Integrated Wastewater Discharge Standard* (GB8978-1996) (i.e., CODcr ≤ 500mg/l; BOD_5 ≤ 300 mg/l; SS ≤ 400 mg/l; NH_3-N ≤ 30mg/l) before entering into the WWTP. First category toxic and harmful pollutants (total Hg, total Cd, total Cr, total As, total Pb, total Ni, total Ag, etc.) shall be uniformly pre-treated in plant (or shop) and discharged when they are up to standard, so as to ensure the effective operation of WWTP and efficient treatment of wastewater.

(2) Analysis on WWTP wastewater discharge standards

According to the project design, when No.3 WWTP is completed and put into operation, the total wastewater will be 4,000t/d (in the short term). The wastewater is discharged into Bajiao River through pipe network upon treatment by WWTP, and the effluent quality needs to meet the requirements for standard A of Grade 1 as specified in the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002). See the table below for discharge concentration of WWTP.

Table 6.2.4-4 Discharge Concentration of Wastewater from WWTP Unit: mg/L

Item	pH	COD_{Cr}	BOD_5	NH_3-N	TN	SS	TP
Standard	6-9	≤50	≤10	≤5(8)	≤15	≤10	≤0.5

(3) Analysis of water pollution source intensity

When near-term project of Linshui No.3 WWTP is completed, tail water of 4,000m^3/d will be discharged into Bajiao River and tail water discharge in long term be 8,000m^3/d. Prediction is conducted under two working conditions, i.e., normal discharge in the short term and long term (treatment meets standard A of Grade 1 as specified in GB18918-2002) and accidental discharge (direct wastewater discharge without any treatment). See the table below for source intensity of construction water pollutant based on engineering analysis.

Table 6.2.4-5 List of Source Intensity of Water Pollutants

Wastewater Volume (10,000m^3/d)	Pollutant	Normal Discharge	Accidental Discharge

		kg/d	g/s	kg/d	g/s
0.4	COD_{cr}	200	2.31	1200	13.89
	NH3-N	20	0.23	104	1.20
0.8	COD_{cr}	400	4.63	2400	27.78
	NH3-N	40	0.46	208	2.41

(4) WWTP discharge direction

Bajiao River is selected by the Project to be the receiving waters for the No. 3 WWTP. WWTP tail water is discharged into Bajiao River when flowing into tail water discharge pipes, which are laid along the Danshuitan River, ultimately into the Bajiao River, with pipe length of 2650m and pipe diameter of DN600.

(5) Assessment of impacts of normal drainage on surface water environment

WWTP tail water is discharged into Bajiao River according to the design. The report will analyze and predict the extent and scope of impacts of tail water on the quality of receiving waters when No.3 WWTP is completed.

The water of the assessed section of Bajiao River is for irrigation and other ordinary industrial and agricultural uses. Bajiao River has the average width of about 50m, and the assessed river section has the average flow over years of 28.3m^3/s, the average monthly flow in dry season with 90% guaranteed rate of 4.38m^3/s, width of about 50m, average depth of 1.2m and the slope factor of 1.29‰.

1) Predicators

CODcr and NH3-N are predicators.

2) Prediction mode

a Formula for the length of mixing process section recommended by the Guideline

$$l = \frac{(0.4B - 0.6a)Bu}{(0.058H + 0.0065B)|(gHI)^{0.5}}$$

Where:

H—mixing water depth, m;

U— mean velocity, m/s;

B-river width;

I—river slope coefficient, dimensionless;

g—acceleration of gravity, 9.81m/s^2.

Upon calculation, the mixing process section of the project is 1,801m long.

b Bajiao River, the receiving waters of the Project, has river-type features, and discharge on the river bank is applied. The assessed river section has some bend, but the bending coefficient is less than 1.3, so two-dimensional steady-state mixed-decay mode of straight river recommended in HJ/T2.3-1993 may be applied:

$$c(x,y) = \exp(-K_1 \frac{x}{86400u})\{c_h + \frac{c_p Q_p}{H(\pi M_y xu)^{1/2}}[\exp(-\frac{uy^2}{4M_y x})$$
$$+\exp(-\frac{u(2B-y)^2}{4M_y x})]\}$$

Where: C(x,y)—vertical average pollutant concentration at (x,y);

H—water depth of the river;

u—velocity of the river;

C_h—existing concentration of pollutants in the river;

C_p—Pollutant discharge concentration;

Q_p—wastewater discharge;

B—river width;

My—Lateral mixing coefficient;

K1— pollutant degradation coefficient.

c. Determination of lateral mixing coefficient M_y:

My=(0.058H+0.0065B) (gHI) 1/2 (B/H≤100, B/H for Bajiao River=20.8, applicable)

M_y—lateral mixing coefficient of the river;

B—river width, m;

H—average water depth, m;

I—river slope coefficient, dimensionless;

g—acceleration of gravity, 9.81m/s^2.

Upon calculation, lateral mixing coefficient of the river My is 0.05.

According to the Environmental Impact Report of Linshui Economic Technology Development Zone in Sichuan, 0.2/d is taken for pollutant degradation coefficient of COD and 0.1/d for NH3-N for the inner segment of Bajiao River in Linshui County.

3) Prediction methods and parameters

See the table below for designed flow and degradation coefficient selected for water quality prediction.

Table 6.2.4-5 Model Parameters

Item	Bajiao River
Flow velocity (m/s)	With flow of 4.38m^3/s and flow velocity of 0.09m/s in dry season
River depth and width	With average water depth of 1.2m and river width of 50m
M_y	0.05
Wastewater discharge (m^3/d)	0.046
COD background concentration (mg/l)	9.16
NH3-N background concentration (mg/l)	0.08
COD degradation coefficient K (Day-1)	0.2

Item	Bajiao River
NH3-N degradation coefficient K (Day-1)	0.1

4) Prediction results and assessment conclusions

According to Table 6.2.4-7 and Table 6.2.4-8, the water quality at the downstream of Bajiao River will be less affected when the wastewater of WWTP under normal conditions is discharged after reaching the Class 1A discharge standard as specified in *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002). The COD of water quality beyond 3m from the downstream of the discharge outlet of the assessed river section may reach the standard, and the NH_3-N of water quality beyond 10m from the downstream of the discharge outlet of the assessed river section and 1m from the bank at the discharge outlet side may reach the standard.

According to Table 6.2.4-9 and Table 6.2.4-10, the quality of receiving water may be affected under the accident condition. The COD of water quality beyond 60m from the downstream of the discharge outlet of the assessed river section and 5m from the bank at the discharge outlet side may reach the standard, and the NH_3-N of water quality beyond 100m from the downstream of the discharge outlet of the assessed river section and 10m from the bank at the discharge outlet side may reach the standard.

Table 6.2.4-6 Predictions of Impact of COD Discharge under Normal Condition on Water Quality of Bajiao River (in Short Term)

Y＼X	1	2	3	5	10	20	40	60	80	100	200	300	400	600	800	1000	1200	1400	1600	1800	2000
0	25.28	20.56	18.47	16.37	14.25	12.76	11.70	11.22	10.94	10.74	10.25	10.01	9.86	9.67	9.53	9.43	9.34	9.27	9.20	9.14	9.08
1	19.44	18.26	17.17	15.75	14.03	12.68	11.67	10.93	10.74	10.74	10.24	10.01	9.86	9.67	9.53	9.43	9.34	9.27	9.20	9.14	9.08
3	9.44	10.66	11.57	12.37	12.56	12.10	11.45	11.09	10.85	10.68	10.22	10.00	9.86	9.66	9.53	9.43	9.34	9.27	9.20	9.14	9.08
5	9.16	9.20	9.38	9.92	10.81	11.21	11.07	10.87	10.70	10.57	10.19	9.98	9.84	9.66	9.53	9.43	9.34	9.27	9.21	9.14	9.09
10	9.16	9.16	9.16	9.16	9.21	9.54	9.98	10.13	10.17	10.16	10.02	9.88	9.78	9.62	9.51	9.42	9.34	9.27	9.21	9.15	9.09
15	9.16	9.16	9.16	9.16	9.16	9.18	9.35	9.53	9.65	9.72	9.80	9.75	9.69	9.57	9.48	9.40	9.33	9.26	9.20	9.15	9.09
20	9.16	9.16	9.16	9.16	9.16	9.16	9.18	9.25	9.33	9.40	9.57	9.60	9.58	9.51	9.43	9.37	9.31	9.25	9.20	9.15	9.09
25	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.17	9.19	9.23	9.39	9.45	9.46	9.43	9.39	9.34	9.29	9.24	9.19	9.14	9.09
30	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.15	9.16	9.26	9.33	9.36	9.37	9.35	9.31	9.28	9.23	9.19	9.14	9.09
35	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.14	9.14	9.19	9.24	9.27	9.31	9.31	9.29	9.26	9.22	9.18	9.14	9.09
40	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.14	9.14	9.14	9.18	9.21	9.26	9.27	9.27	9.25	9.22	9.18	9.14	9.09
45	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.14	9.14	9.13	9.14	9.17	9.23	9.25	9.25	9.24	9.21	9.17	9.13	9.09
50	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.14	9.14	9.12	9.13	9.16	9.22	9.25	9.25	9.24	9.21	9.17	9.13	9.09

Table 6.2.4-7 Predictions of Impact of NH_3-N Discharge under Normal Condition on Water Quality of Bajiao River (in Short Term)

Y＼X	1	2	3	5	10	20	40	60	80	100	200	300	400	600	800	1000	1200	1400	1600	1800	2000
0	2.66	1.90	1.57	1.23	0.90	0.66	0.49	0.41	0.37	0.34	0.26	0.23	0.21	0.18	0.17	0.16	0.15	0.15	0.15	0.14	0.14
1	1.72	1.54	1.36	1.14	0.86	0.64	0.48	0.41	0.37	0.34	0.26	0.23	0.21	0.18	0.17	0.16	0.15	0.15	0.15	0.14	0.14
3	0.12	0.32	0.47	0.59	0.62	0.55	0.45	0.39	0.35	0.33	0.26	0.23	0.21	0.18	0.17	0.16	0.15	0.15	0.15	0.14	0.14
5	0.08	0.09	0.12	0.20	0.34	0.41	0.39	0.36	0.33	0.31	0.25	0.22	0.20	0.18	0.17	0.16	0.15	0.15	0.15	0.14	0.14
10	0.08	0.08	0.08	0.08	0.09	0.14	0.21	0.24	0.24	0.24	0.23	0.21	0.19	0.18	0.17	0.16	0.15	0.15	0.15	0.14	0.14
15	0.08	0.08	0.08	0.08	0.08	0.08	0.11	0.14	0.16	0.17	0.19	0.19	0.18	0.17	0.16	0.15	0.15	0.15	0.15	0.14	0.14
20	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.10	0.11	0.12	0.15	0.16	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.14	0.14
25	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.10	0.12	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14
30	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.10	0.12	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
35	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.10	0.11	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14
40	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.10	0.12	0.13	0.13	0.14	0.14	0.14	0.14	0.14
45	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.14	0.14	0.14	0.14
50	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.14	0.14	0.14	0.14

Table 6.2.4-8 Predictions of Impact of COD Discharge under Accident Condition on Water Quality of Bajiao River (in Short Term)

Y＼X	1	2	3	5	10	20	40	60	70	80	100	200	300	400	600	800	1000	1200	1400	1600	1800	2000
0	88.40	65.19	54.91	44.59	34.21	26.87	21.67	19.36	18.60	17.98	17.04	14.69	13.63	12.99	12.21	11.73	11.40	11.15	10.96	10.81	10.68	10.56
1	59.69	53.90	48.54	41.54	33.11	26.47	23.39	21.53	19.28	17.93	17.01	14.68	13.62	12.98	12.21	11.73	11.40	11.16	10.97	10.81	10.68	10.57
3	10.54	16.56	21.02	24.92	25.87	23.62	21.78	20.46	18.69	17.55	16.73	14.58	13.57	12.95	12.19	11.72	11.40	11.16	10.97	10.82	10.69	10.58
5	9.16	9.36	10.24	12.89	17.29	19.25	18.60	17.61	17.19	16.82	16.20	14.38	13.46	12.88	12.15	11.70	11.38	11.15	10.98	10.83	10.70	10.60

10	9.16	9.16	9.16	9.16	9.44	11.02	13.21	13.97	14.11	14.18	14.18	13.56	13.00	12.57	11.98	11.60	11.33	11.12	10.97	10.83	10.72	10.62
15	9.16	9.16	9.16	9.16	9.16	9.27	10.15	11.04	11.37	11.64	12.01	12.47	12.33	12.11	11.72	11.44	11.23	11.07	10.94	10.82	10.72	10.63
20	9.16	9.16	9.16	9.16	9.16	9.16	9.29	9.65	9.87	10.07	10.44	11.38	11.58	11.57	11.41	11.24	11.10	10.99	10.89	10.80	10.72	10.64
25	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.24	9.31	9.40	9.61	10.48	10.87	11.01	11.06	11.02	10.97	10.91	10.84	10.78	10.71	10.64
30	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.16	9.17	9.20	9.27	9.85	10.27	10.51	10.72	10.80	10.83	10.82	10.79	10.75	10.69	10.63
35	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.15	9.15	9.17	9.47	9.82	10.09	10.42	10.61	10.70	10.74	10.74	10.72	10.68	10.63
40	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.14	9.14	9.14	9.27	9.52	9.78	10.19	10.45	10.60	10.67	10.70	10.69	10.67	10.62
45	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.14	9.14	9.14	9.18	9.36	9.60	10.05	10.35	10.54	10.63	10.67	10.68	10.66	10.62
50	9.16	9.16	9.16	9.16	9.16	9.16	9.15	9.15	9.14	9.14	9.14	9.15	9.30	9.54	10.00	10.32	10.51	10.62	10.67	10.67	10.65	10.62

Table 6.2.4-9 Predictions of Impact of NH_3-N Discharge under Accident Condition on Water Quality of Bajiao River (in Short Term)

Y\X	1	2	3	5	10	20	30	40	60	80	100	200	300	400	600	800	1000	1200	1400	1600	1800	2000
0	8.40	5.96	4.88	3.80	2.71	1.94	1.60	1.39	1.15	1.01	0.91	0.67	0.56	0.49	0.42	0.37	0.34	0.32	0.31	0.29	0.29	0.28
1	5.38	4.78	4.21	3.48	2.59	1.90	1.58	1.38	1.14	1.00	0.91	0.67	0.56	0.49	0.42	0.37	0.34	0.32	0.31	0.30	0.29	0.28
3	0.22	0.86	1.32	1.73	1.83	1.60	1.41	1.27	1.08	0.96	0.88	0.65	0.55	0.49	0.41	0.37	0.34	0.32	0.31	0.30	0.29	0.28
5	0.08	0.10	0.19	0.47	0.93	1.14	1.12	1.07	0.97	0.89	0.82	0.63	0.54	0.48	0.41	0.37	0.34	0.32	0.31	0.30	0.29	0.28
10	0.08	0.08	0.08	0.08	0.11	0.28	0.42	0.51	0.59	0.61	0.61	0.55	0.49	0.45	0.39	0.36	0.33	0.32	0.31	0.30	0.29	0.28
15	0.08	0.08	0.08	0.08	0.08	0.09	0.13	0.18	0.28	0.34	0.38	0.43	0.42	0.40	0.37	0.34	0.32	0.31	0.30	0.30	0.29	0.29
20	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.13	0.18	0.22	0.32	0.34	0.34	0.33	0.32	0.31	0.30	0.30	0.29	0.29	0.29
25	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.11	0.13	0.22	0.27	0.29	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.29
30	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.09	0.16	0.20	0.23	0.26	0.27	0.28	0.29	0.29	0.29	0.29	0.29
35	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.12	0.16	0.19	0.23	0.25	0.27	0.28	0.28	0.28	0.29	0.29
40	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.10	0.13	0.16	0.20	0.24	0.26	0.27	0.28	0.28	0.28	0.29
45	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.11	0.14	0.19	0.23	0.25	0.27	0.28	0.28	0.28	0.28
50	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.10	0.13	0.18	0.22	0.25	0.26	0.27	0.28	0.28	0.28

- **Linshui No.2 WWTP**

1. WWTP site

Hongdian Village in Chengnan Town, Linshui County is preliminarily selected as the site for Linshui No.2 WWTP according to the design.

2. Service scope of WWTP

Linshui No.2 WWTP receives wastewater collected by the wastewater interceptors along Shiba River, with scope of service consistent with that of the wastewater interceptors along Shiba River, i.e., north area of the Industrial Park and part of Linshui Western New City.

4. Wastewater treatment capacity

According to the feasibility study report and the *Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown*, the proposed capacity of the WWTP is 30,000m^3/d.

(1) Quality requirements on WWTP inflow and effluent

The wastewater disposed by Linshui No.2 WWTP mainly includes industrial wastewater and domestic sewage. The enterprises introduced in the LETDZ are mainly mechanical processing enterprises and electronic enterprises. The following table shows inflow and effluent wastewater quality index of wastewater treatment plants by reference to Linshui No.3 WWTP:

Table 6.2.4-11 Predictions on Designed Inflow and Effluent Wastewater Quality

Water quality index		pH	CODcr (mg/l)	BOD_5 (mg/l)	NH_3-N (mg/l)	TN (mg/l)	SS (mg/l)	TP (mg/l)
Inflow quality	Domestic sewage	6.5-8.5	300	165	200	26	4.4	36.5
	Production wastewater	6.5-8.5	189	97	164	20	2.3	25
Effluent quality		6-9	≤50	≤10	≤5 (8)	≤15	≤10	≤0.5

(2) Treatment capacity and service scope of WWTP

According to the capacity predicted in the feasibility study report and that mentioned in *Regulatory Plan of City-production Integration Demonstration Zone in Southern Linshui County Downtown*, the treatment capacity of WWTP is 30,000m^3/d, and its service scope involves the north area of the Industrial Park and part of Linshui Western New City.

(3) WWTP inflow and drainage scheme

The wastewater interceptors on the north side along Shiba River cross the Shiba River to converge with those on the south side at Node 35, eventually into the No.2 Wastewater Treatment Plant in Linshui County.

The tail water discharge pipes of No.2 WWTP are laid along the Danshuitan River, ultimately into the Bajiao River.

(2) Process and scale

Linshui No.2 WWTP applies CASS (Cyclic Activated Sludge System, CASS for short) technology. CASS process is a variant of sequencing batch reactor (SBR) process. CASS reactor is divided into biological selection area, and facultative anaerobic zone and main reaction zone, and inflow, aeration, sedimentation, drainage, sludge discharge are all performed in intermittent cycle, so the process is an intermittent reactor, in which the process is constantly repeated as per aeration stage and non-aeration stage, and biological reaction process and sludge-water separation process are combined in a tank. Unlike the traditional SBR reactor, water filling process or anoxic inflow mixing process is not simply arranged in the inflow stage, and in addition, biological selection area is arranged at the inlet.

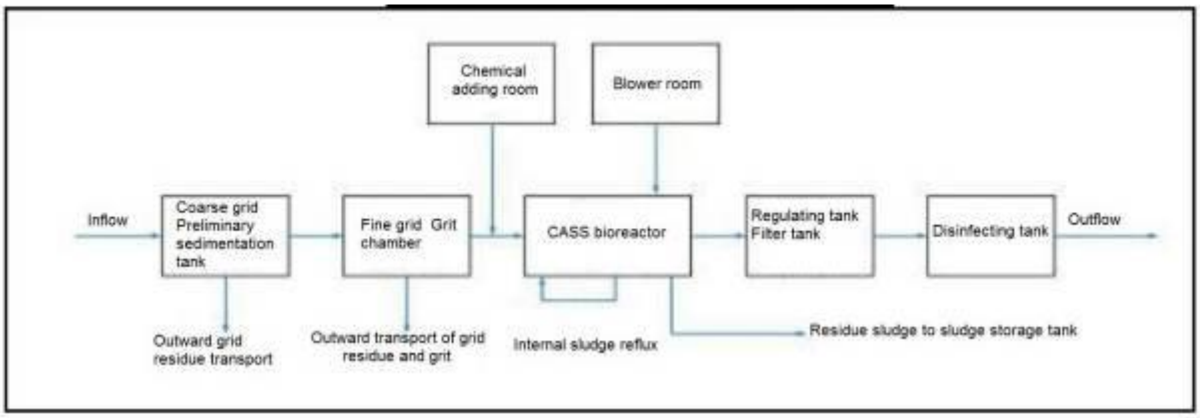


Figure 6.2.4-1 CASS Process Flow Chart

4. Impacts of project construction on the drainage of natural rivers in Linshui County

Natural river near the project mainly includes Bajiao River, Hucheng River, Danshuitan River and Shiba River.

(1) No water course is occupied for land development, so the natural width, flow direction and width of the river will not be changed. Land leveling is required to be carried out prior to the land development. It will change the topography of the county to a certain extent and have some impact on the natural runoff in the county.

(2) Rain and wastewater separate system is applied for rain and wastewater pipe network planned to be built in the assessed area and rainfall runoff on the road surface in the Park may still be flow into the river course after being collected by rainwater pipe network for sedimentation. The wastewater is still discharged into the nature waters when meeting the standard upon treatment in WWTP. Therefore, the development of Linshui County has limited impact on the water quantity of natural waters.

6.2.5 Prediction and assessment of impacts on groundwater environment

during the operation period

The impact on groundwater during the operation period of the Project is mainly from WWTP wastewater leakage or excessive discharge as well as leakage of wastewater interceptors and wastewater pipelines.

1. Wastewater interceptors and wastewater pipeline works

   Wastewater interceptors and wastewater pipe network will not impact the environment under normal operating conditions. When the wastewater interceptors and wastewater pipe network are completed, the domestic sewage within the LETDZ will be effectively collected to avoid or reduce the domestic sewage permeating into the groundwaters. As such, the operation of the Project has a positive impact on groundwater quality within the project affected area.

   If leakage of wastewater interceptors and wastewater pipe network occurs, the wastewater may seep into the ground to pollute the groundwater. According to analogy investigation, if the pipeline breaks, the wastewater may seep into the ground and gradually spread to pollute the groundwater under normal circumstances. The rule is that the closer to the pipe damage location, the longer and more severe the leakage will be. Therefore, early discovery and early actions are the key to prevent environmental risks.

2. WWTP works

   Groundwater level will not be changed during the operation period, and drainage and groundwater will not be directly connected. The groundwater quality may only be impacted due to wastewater infiltration.

6.2.6 Prediction and assessment of impacts on solid waste environment during the operation period

Solid waste during the construction period of the Project mainly includes transport materials being thrown to the ground during vehicle driving, sludge, grid residue and grit produced by WWTP and domestic waste produced by the staff.

1. Road works

   The solid waste during road operation refers to a small quantity of transport materials being thrown to the ground during vehicle driving. Street cleaning shall be strengthened during road operation.

2. WWTP works

   (1) No.3 WWTP

   Combined process of “coarse grid + fine grid + grit + amended oxidation ditch + rotary filter tank” is adopted for process design of No.3 WWTP. Solid waste of the WWTP mainly includes sludge, grid residue and grit. Since grid residue and grit belong to large particles and suspended substances, which has no toxic and harmful substances and almost cause no harm to the environment, the grid residue may be collected directly, together with municipal waste, for landfill or treatment and grit may be used as paving material.

   Residue sludge of the Project features high moisture content, large volume, perishableness, small proportion, fine particle and easy odor generation. Sludge contains some toxic substances like bacteria, pathogenic microorganism and a small amount of heavy metal ions, and also nutrient elements such as nitrogen, phosphorus and potassium, so it must be properly handled and comprehensively utilized.

Grid residue has complex composition, mainly including foamed plastic, plastic bag, fiber, paper, peel, outer leaf, wood chips and plant and animal residues, in which waste plastic products generally take up a large proportion. Domestic waste like peel and outer leaf and plant and animal residues are easy perishable and decomposing to produce wastewater and odor. If not properly cleaned, it will seriously impact and pollute the stack yard, breed mosquitoes, impact the health environment, block wastewater pipe network and influence the normal operation of WWTP.

Inorganic residues like muddy sand are the main components of the grit, which adsorbs some organic pollution bacteria and produces odor at the same time. If collection and transport are not promptly conducted for the stack yard, the pollutants will dissolve out after rain wash.

Grid residue and grit are proposed to be sent to the landfill, with piling, transport and other processes in strict accordance with relevant regulations. The production amount is small, but if ignored, they will cause harm to the environment. Packaging wastes like light plastic bags in the grid residue will be carried by the wind to the surrounding area of the WWTP, and grid residue and grit residue shall be promptly cleaned and carried away, or deterioration, mosquitoes and odor will be produced.

Grid residue is intercepted from the coarse grid and fine grid, with major components including foamed plastic, discarded plastic bag, film, fiber, peel, leaves, paper, wood chip and so on. The grid residue amount is $0.2m^3/d$ and unit weight is $187.2kg/m^3$, with an output of 37.4kg/d and an annual output of 13.7t/a.

Muddy sand is the main component of the grit. Its proportion is larger than that of inorganic residue of water, but moreover, it also adsorbs some organic dirt. The grit amount is $0.08m^3/d$ and unit weight is $1500kg/m^3$, with an output of 120kg/d and an annual output of 43.8t/a.

When taking 11 WWTP staff and 0.8kg/d of domestic waste discharge factor, the domestic waste produced by WWTP staff will be 8.8kg/d, with an annual output of 3.2t/a.

Table 6.2.6-1 Solid Waste Production Amount and Disposal/Treatment Method

SN	Discharging Source	Category	Discharge amount	Discharge Direction
1	Coarse and fine grid	Grid residue	37.4kg/d, with an annual output of 13.7t/a	Municipal unified collection and transport to Linshui landfill for treatment
2	Grit chamber	Sand	120kg/d, with an annual output of 43.8t/a	
3	Residue sludge	Residue sludge	0.4 t/d (146t/a) Moisture content of 60%	
4	Office life	Domestic waste	8.8kg/d, with an annual output of 3.2t/a	

(2) No.2 WWTP

The No.2 WWTP applies CASS technology. Solid waste of WWTP mainly includes grid residue produced by coarse grid and fine grid, grit residue produced by the grit chamber, sludge produced by the sludge dewatering room and domestic waste as well as grid residue produced by coarse grid and fine grid of the lifting pump station.

Grid residue has complex composition, mainly including foamed plastic, plastic bag, fiber, paper, peel, outer leaf, wood chips and plant and animal residues, in which waste plastic products generally take up a large proportion. Inorganic residues like muddy sand are the main components of the grit, which adsorbs some organic pollution bacteria and produces odor at the same time. If collection and transport are not promptly conducted for the stack yard, the pollutants will dissolve out after rain wash.

Grid residue and grit are proposed to be sent to the landfill, with piling, transport and other processes in strict accordance with relevant regulations. The production amount is small, but if ignored, they will cause harm to the environment. Packaging wastes like light plastic bags in the grid residue will be carried by the wind to the surrounding area of the WWTP, and grid residue and grit residue shall be promptly cleaned and carried away, or deterioration, mosquitoes and odor will be produced.

Grid residue is intercepted from the coarse grid and fine grid, with major components including foamed plastic, discarded plastic bag, film, fiber, peel, leaves, paper, wood chip and so on. The grid residue amount is about 1.5m^3/d and unit weight is about 200kg/m^3, with an output of 300kg/d and an annual output of 109.5t/a.

Muddy sand is the main component of the grit. Its proportion is larger than that of inorganic residue of water, but moreover, it also adsorbs some organic dirt. The grit amount is 1m^3/d and unit weight is 12,000kg/m^3, with an output of 12t/d and an annual output of 4,380t/a.

According to the analogy, the domestic waste produced by WWTP staff amounts to 10kg/d, with an annual output of 3.65t/a.

Table 6.2.6-2 Solid Waste Production Amount and Disposal/Treatment Method

SN	Discharging Source	Category	Discharge Amount	Discharge Direction
1	Coarse and fine grid	Grid residue	300kg/d, with an annual output of 109.5t/a	Municipal unified collection to Linshui landfill for treatment
2	Grit chamber	Sand	12t/d, with an annual output of 4,380t/a	
3	WWTP staff	Domestic waste	10kg/d, with an annual output of 3.65t/a	

6.2.7 Prediction and analysis of impacts on social environmental during the operation period

1. **Impact on local economic development**When the Project is completed, traffic and wastewater treatment status of LETDZ will be improved, a variety of transportation costs be reduced, commercial value of the district will be enhanced and living standards of urban residents will be raised, which are

specifically reflected as follows:

(1) New roads and wastewater interceptor works will promote economic development, and simultaneously provide a large number of direct and indirect jobs and expand employment.

(2) When new roads are open to traffic, it may strengthen internal and external economic ties, complement each other's advantages, reduce transportation costs of materials getting in and out of the Zone, improve product competitiveness, and provide transport corridor for products of the Zone to enter into domestic and international markets, which will bring business opportunities for the development of Linshui County and its surrounding markets.

(3) Economic development and social progress will be promoted, investment environment be improved, introduction of advanced technology, talents, capital and management experience be accelerated, and development and construction of the West be boosted.

(4) When wastewater interceptors are completed, water pollution is controlled, environmental health is safeguarded, roads are spacious and regular and land use function and layout are clear.

2. Impact on traffic

When the project is completed, the regional traffic conditions will be greatly improved, which has a positive impact on improving road network layout in the district, travel conditions of urban residents and transport conditions.

3. Impacts of construction on living standards and quality of local residents

With the completion of municipal infrastructures, the community environment will be beautified, traffic conditions be improved, people's living standards be gradually raised, and accordingly, communication, entertainment, education and health services be rapidly developed, which in return will improve people's cultural and living standards, thereby promoting the construction of material and spiritual civilization.

The residents involved in land acquisition, demolition and relocation of the Project will receive a total of about CNY 1871 million for land acquisition and resettlement. Farmers lost some land due to the implementation of the Project, but with subsidy and job opportunities offered during urbanization, their annual income level will be increased. The basis for the implementation of economic structural adjustment in the project area will be formed when the project is completed, thereby improving the living standards of residents. Moreover, the living quality of residents will be improved by improving the living environment in the project area.

4. Job opportunities increase for local residents

Land occupation and house demolition are inevitably required for urban construction, which will lead to relocation of the population in the construction region, labor force resettlement and other issues alike. Some land is required to be occupied for infrastructure construction of Linshui County, and thus the lives of farmers will be impacted due to the loss of land and traffic block during the construction will also impact the lives of farmers. But with the development of urban construction, the land-use nature will be changed from agricultural land into urban land and farmers will be transformed from agricultural laborers to service providers, workers and businessmen, from which the social impact is acceptable. In the long term, commercial and tourism development in the project area will provide new job opportunities for local residents.

In conclusion, the construction of urban infrastructure projects will significantly improve regional traffic conditions, fundamentally improve the dirty, chaotic, and poor phenomenon in surrounding areas, drive regional economic development, bring direct economic benefits, fundamentally improve the backward status of municipal pipe network in the district, and meet the requirements for public facilities due to regional development, which will be bring direct economic benefits at a greater width and depth and exert significant economic impact on the entire Linshui County.

2. Analysis of impacts on the lives of residents

At present, due to outdated infrastructure in the project area, the construction of the project will improve the transport conditions and living environment for residents in Linshui County.

Road construction of the Project aims to improve local road transport network and facilitate residents travel. When the project is completed, it will not only shorten the travel time directly, but also reduce transport costs. Therefore we can say that road construction will reduce transport costs, and there is no need to consider the public willingness to pay and the ability to pay.

The survey shows that wastewater discharge fee, CNY 5 per month (water fee included), is charged in Nanya Village, Chengnan Town, Linshui County, and such fee is also required to be charged in Dafosi Village and Sanhe Community near three pollutants for CNY 5 per month. If charging is needed after the completion of WWTP, 87.5% of the interviewees are willing to pay wastewater discharge fee upon the completion of WWTP, and the amount that residents may accept is CNY 5.1 per month.

In addition, with regard to Linshui Public Training Center, free training is provided to farmers from the current planning, so there is no need to consider the public willingness to pay and the ability to pay.

With the completion of municipal infrastructures like roads and WWTP, the wastewater in the district will be collected for centralized treatment, traffic conditions be improved, people's living standards be gradually raised, and accordingly, communication, entertainment, education and health services be rapidly developed, which in return will improve people's cultural and living standards, thereby promoting the construction of material and spiritual civilization.

3. Analysis of impacts on land use

Through the implementation of the Project, the function of the land in the district is improved for collective arrangement to replace the original part of the land. When the land meets the requirements for municipal supporting functions, the remaining land is listed for auction in accordance with relevant regulations and procedures, so as to improve land utilization rate and optimize land resource efficiency. As the step of urbanization speeds up, the surrounding geographical and human environment will be rapidly improved. Therefore, the land in the district has huge development potential and value, which will help improve land utilization rate and, optimize the efficiency of valuable land resources.

4. Analysis of impacts on urban traffic

When the project is completed, the regional traffic conditions will be greatly improved, which has a positive impact on improving road network layout in the district, travel conditions of urban residents and transport conditions.

5. Analysis of impacts on the landscape

Upon the laying of wastewater interceptors of the Project, the wastewater produced in the project area is sent to WWTP for treatment in a unified manner, and then discharged when reaching the standards, which solves the original dispersed discharge issue, controls water pollution and guarantees the environmental health. When the project is completed, roads are spacious and regular and land use function and layout are clear. Linshui County will present a scene of prosperity.

6. Impacts on the living standards and quality of local residents

With the completion of municipal infrastructures, the community environment will be beautified, traffic conditions be improved, people's living standards be gradually raised, and accordingly, communication, entertainment, education and health services be rapidly developed, which in return will improve people's cultural and living standards, thereby promoting the construction of material and spiritual civilization.

The residents involved in land acquisition, demolition and relocation of the Project will receive a total of about CNY 1871 million for land acquisition and resettlement. Farmers lost some land due to the implementation of the Project, but with subsidy and job opportunities offered during urbanization, their annual income level will be increased. The basis for the implementation of economic structural adjustment in the project area will be formed when the project is completed, thereby improving the living standards of residents. Moreover, the living quality of residents will be improved by improving the living environment in the project area.

7. Attraction for more migrant workers to return to their homes for work

When the project is completed, more migrant workers may be attracted to return to their homes for work, so that they may take better care of the family and play a role to solve the social issues like "left-behind children", "empty nesters" and "leave the land uncultivated".

Economic development within the LETDZ and increase of settled enterprises may attract more local labors to work in such enterprises, including returning migrant workers. According to the information provided by LETDZ Administrative Committee, 14,554 jobs are provided by 92 enterprises firstly settled in the LETDZ, with 11,195 local works, accounting for 76.9% of total employees. Sichuan is a large migrant workers exporting province in China. Large numbers of labor forces here leave their homes, go to work in big cities, and leave parents or children in the rural home, which led to many social issues. But the implementation of the Project may play a role in solving such social issues. As regards the present issues like "left-behind children" and "empty nesters", the returning migrant workers may take better care of the family and give more care for the elderly and children. They not only may work in the Park, but also may go home for farming in busy farming seasons, thereby reducing idle lands in rural China.

8 Analysis on environmental cost-benefit

The project belongs to industrial park infrastructure construction, which has an impact on local ecological environment, acoustic environment, air environment and socio-economic environment during the construction period. But when the project is completed, it will produce positive environmental benefits. Therefore, the construction brings limited impact on the time and extent to the environment. The construction of the Project may accelerate infrastructure construction in the Park, facilitate travel, improve living conditions, beautify the environment and promote the rapid economic development of Linshui County. From the point of social, economic and environmental benefits, the beneficial impact of the project is much larger than negative impact.

7 Water and Soil Conservation Plan

7.1 Assessment Scope for Water and Soil Conservation

In accordance with the Technical Code on Soil and Water Conservation of Development and Construction Projects and the principle of "the person who develops shall be responsible for environmental protection and who causes water and soil loss shall be responsible for its prevention and control", through site survey and investigation and in combination with the possible soil and water loss scope caused by the construction and operation of the Project, the responsible area for water and soil loss prevention and control of the Project is determined.

Statistics shows that the responsible area for water and soil loss prevention and control of the Project consists of Project construction area 77.28hm^2 and directly affected area 36.07hm^2, the total responsible area is 113.35hm^2.

Table 7.1-1 Estimated Responsible Area for Water and Soil Prevention and Control of the Proposed Project Unit: hm^2

Prevention and Control Zoning		Responsible Area		
		Construction Area	Directly affected area	Subtotal
Prevention and control area of road works	Subgrade area	57.44	23.28	80.72
	Bridge area	0.31	0.10	0.41
	Construction access area	1.16	1.16	2.32
	Construction site area	0.46	0.11	0.57
	Construction camp area	0.50	0.13	0.63
	Temporary soil storage yard	1.09	0	1.09
	Subtotal	60.96	24.78	85.74
Prevention and control area of wastewater interceptor works	Pipe area	5.77	7.12	12.89
	Construction access area	1.66	1.11	2.77
	Temporary construction area	2.72	0.16	2.88
	Subtotal	10.15	8.39	18.54
Prevention and control area of Linshui No.3 WWTP:	Plant area	0.83	0.09	0.92
	Wastewater pipe Area	1.66	1.08	2.74
	Off-plant drainage pipe area	2.72	1.59	4.31
	Temporary construction area	0.96	0.14	1.10
	Subtotal	6.17	2.90	9.07
Total		77.28	36.07	113.35

7.2 Prediction on Water and Soil Loss

The scope for the prediction on water and soil loss by the water and soil loss conservation plan includes the entire Project construction area and the permanent and temporary land occupation within the disturbed area. The prediction units are basically consistent with the water and soil prevention and control subarea, namely, including road works area, wastewater interceptor works area, and WWTP.

Prediction units and time division of the Project are shown in the table below.

Table 7.2-1 Prediction Units and Time Division for Water and Soil Loss

Prediction units		Construction Preparation Period		Construction Period		Natural Recovery Period	
		Area (hm2)	Time (a)	Area (hm2)	Time (a)	Area (hm2)	Time (a)
Road works area	Subgrade area	52.29	0.5	52.29	1	28.36	1
	Bridge area	0.31	0.5	0.31	1	0.18	1
	Construction access	1.16	0.5	1.16	1	1.16	1
	Construction site area	0.46	0.5	0.46	2	0.46	1
	Construction camp area	0.5	0.5	0.5	2	0.5	1
	Temporary soil storage yard	1.09	0.5	1.09	2	1.09	1
Wastewater interceptor works area	Pipe area	5.24	0.5	5.24	2	5.24	1
	Construction access	1.66	0.5	1.66	2	1.66	1
	Temporary construction area	1.42	0.5	1.42	2	5.09	1
WWTP	Plant area	0.83	0.5	0.83	1.3	0.35	1
	Wastewater pipe Area	1.66	0.5	1.66	1.3	1.66	1
	Off-plant drainage pipe area	2.72	0.5	2.72	2	2.71	1
	Temporary construction area	0.96	0.5	0.96	2	0.96	1
Total		70.30		70.30		49.42	

Prediction shows that the Project will produce a total water and soil loss amount of 26,607t, including 6,598t in construction preparation period, 18,863t in construction preparation period and 1,147t in natural recovery period.

Table 7.2-2 Summary of Prediction on Water and Soil Loss

Prediction units		Soil erosion modulus before disturbance ($t/km^2 \cdot a$)	Soil Loss Amount (t)								
			Before disturbance	After disturbance				New water and soil loss (t)			
				Construction Preparation period	Construction period	Natural recovery period	Total	Construction preparation period	Construction period	Natural recovery period	Total
Road works area	Subgrade area	2243	636	5177	12654	686	18517	4541	12018	50	16609
	Bridge area	1839	3	31	75	5	110	27	72	2	101
	Construction access	2416	28	93	248	29	370	65	220	1	286
	Construction site area	1317	6	41	202	11	255	35	196	5	237
	Construction camp area	2472	12	34	165	14	213	21	153	1	176
	Temporary soil storage yard	2439	27	74	360	28	462	47	334	1	382
Waste water interceptor works area	Pipe area	2474	130	519	2536	138	3193	389	2407	9	2804
	Construction access	2395	40	133	650	42	825	93	610	2	706
	Temporary construction area	2328	63	125	500	72	697	62	437	8	507
WWTP	Plant area	2448	9	52	166	10	228	44	158	1	202
	Wastewater pipe Area	2445	41	149	475	42	666	109	434	1	544
	Off-plant drainage pipe area	1649	45	122	598	46	766	78	554	3	634
	Temporary construction area	2269	22	48	232	24	304	26	211	3	239
Total			1061	6598	18863	1147	26607	5537	17802	88	23427

7.3 Prevention and Control Plan for Water and Soil Loss

7.3.1 Prevention and Control Standards of Water and Soil Loss

In accordance with the general rules of Technical Code on Soil and Water Conservation of Development and Construction Projects and the Control Standards for Soil and Water Loss on Development and Construction Projects, Linshui County of Guang´an City along the Project is classified as a provincial key rehabilitation region Linshui County of Guang´an City along the Project is classified as a provincial key rehabilitation region and the Grade I standards for construction projects apply to the Project.

Indicators of standard and code are based on precipitation of 400~600mm and moderate current soil erosion intensity; these are modified correspondingly according to the actual conditions of the Project. Annual precipitation in the Project area is above 800mm, the current soil erosion intensity is mild and the geomorphic type is of shallow hill; of which the soil and water erosion control rate, vegetation recovery rate and the forestry and grass coverage rate shall be increased by 2~3 percent, soil erosion control rate shall be greater than or equal to 1.0, and the percentage of dammed slag or ashes shall not decreased. See table below for Project objectives for prevention and control of water and soil loss.

Table 7.3.1-1 Control Standards for Soil and Water Loss Applied by the Project

Item	Standards and Specifications		Correction by the Precipitation		Correction by Soil Erosion Intensity		Correction by Landform		Criterion Applied	
Period	Construction	Trial operation	Construction	Trial operation	Construction	Trial operation	Construction	Trial operation	Construction	Trial operation
Treatment percentage of disturbed land (%)	*	95	*	*	*	*	*	*	*	95
Control rate of water and soil erosion modulus (%)	*	95 85	*	+3 +3	*	*	*	*	*	98 88
Controlled ratio of soil erosion modulus (%)	0.7	0.8	*	*	+0.1	+0.2	*	*	0.8	1
Percentage of dammed slag or ashes (%)	95	95	*	*	*	*	90	95	90	95
Recovery percentage of forestry and grass (%)	*	97	*	+2	*	*	*	*	*	99

Percentage of the forestry and grass coverage (%)	*	25	*	+3	*	*	*	*	*	28

7.3.2 Prevention and Control Subareas for Water and Soil Loss and General Layout of Water and Soil Conservation Measures

In order to effectively prevent and control water and soil erosion, according to the general layout of the Project, terrain, geological conditions and the characteristics and status of water and soil erosion in each construction subarea, the water and soil conservation measures of the Project are planned according to the principle of comprehensive prevention and control to determine the key prevention and control task and corresponding measures of each subarea. Water and soil conservation measures consist of engineering measures, vegetation measures and temporary protective measures.

1) Road Works

① Subgrade: the water and soil conservation plan will, based on the existing water and soil conservation measures adopted by the main works in this particular subarea, the engineering design and the characteristics of soil and water loss, employ supplementary design on temporary measures like temporary blocking protection, drainage, overlap, topsoil stripping, etc.; on engineering measures like overburden, laying drainage ditch, etc; and vegetation measures, at the same time strengthen construction management.

② Bridge: corresponding temporary measures of soil and water conservation shall be supplemented.

③ Construction site: temporary protection and drainage measures, land reclamation, vegetation restoration and land rehabilitation measures for the precast yard and mixing station area shall be supplemented in the water and soil conservation plan.

④ Construction camp: land reclamation, vegetation restoration and temporary protective measures for the construction camp area during the construction period shall be supplemented in the water and soil conservation plan.

⑤ Temporary storage yard: temporary protective and drainage measures, temporary overlap, land reclamation, vegetation restoration and land rehabilitation measures for the temporary storage yard shall be supplemented in the water and soil conservation plan.

⑥ Construction road: temporary protective and drainage measures, temporary overlap, land reclamation, vegetation restoration and land rehabilitation measures for construction road shall be supplemented in the water and soil conservation plan.

2) Wastewater Interceptor Works

① Pipe area: topsoil stripping, vegetation restoration and land rehabilitation measures for pipe area as well as temporary protective measures for pipeline excavation shall be supplemented in the water and soil conservation plan.

② Temporary construction area: according to the engineering design and characteristics of soil and water loss, temporarily overlap, land reclamation and vegetation restoration measures shall be designed supplementally.

③ Construction road: temporary protective and drainage measures, temporary overlap, land reclamation, vegetation restoration and land rehabilitation measures for construction road shall be supplemented in the water and soil conservation plan.

3) Linshui No.3 WWTP

① Plant area: topsoil stripping, overburden and vegetation restoration measures for WWTP area shall be supplemented in the water and soil conservation plan.

② Sewage pipe area: topsoil stripping, overburden, vegetation restoration and land rehabilitation measures for sewage pipe area as well as temporary protective measures for pipeline excavation shall be supplemented in the water and soil conservation plan.

③ Off-plant Drainage pipe area: topsoil stripping, overburden, vegetation restoration and land rehabilitation measures for Off-plant Drainage pipe area as well as temporary protective measures for pipeline excavation shall be supplemented in the water and soil conservation plan.

④ Temporary construction area: temporary protective and drainage measures, temporary overlap, land reclamation, vegetation restoration measures for the temporary construction area shall be supplemented in the water and soil conservation plan.

See table below for system of water and soil conservation measure of the Project.

Table 7.3.2-1 System of Water and Soil Conservation Measure

Prevention and Control Zoning		Type of measures	Prevention and Control Measures	Remarks
Prevention and control area of road works	Subgrade area	Temporary measures	Topsoil stripping	Newly added in plan
			Raincloth	Newly added in plan
			Temporary soil drainage ditch	Newly added in plan
			Desilting culvert	Newly added in plan
			Woven bag packed soil	Newly added in plan
			Dense screen	Newly added in plan
		Engineering measures	5cm thick C25 color concrete brick	Already listed in the main works
			Side slope intercepting ditch, drainage ditch	Already listed in the main works
			Road rainwater pipeline works	Already listed in the main works
			Comprehensive skeleton slope protection	Already listed in the main works
			Overburden	Newly added in plan
		Vegetation measures	Spray-seeding grassing on net-hanging side slope	Already listed in the main works
			Landscaping of median separator, outer separator and sidewalk	Already listed in the main works
	Bridge area	Temporary measures	Temporary soil drainage ditch	Newly added in plan
			Desilting culvert	Newly added in plan
	Construction access area	Temporary measures	Topsoil stripping	Newly added in plan
			Raincloth	Newly added in plan
			Drainage ditch	Newly added in plan

Prevention and Control Zoning		Type of measures	Prevention and Control Measures	Remarks
		Engineering measures	Overburden	Newly added in plan
			Land reclamation	Newly added in plan
			Land rehabilitation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
	Construction site area	Temporary measures	Drainage ditch	Newly added in plan
			Desilting culvert	Newly added in plan
			Raincloth	Newly added in plan
		Engineering measures	Land reclamation	Newly added in plan
			Land rehabilitation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
	Construction camp area	Temporary measures	Drainage ditch	Newly added in plan
			Desilting culvert	Newly added in plan
		Engineering measures	Land reclamation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
	Temporary soil storage yard	Temporary measures	Temporary soil drainage ditch	Newly added in plan
			Desilting culvert	Newly added in plan
			Woven bag packed soil	Newly added in plan
			Dense screen	Newly added in plan
		Engineering measures	Land reclamation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
Prevention and control area of wastewater interceptor works	Pipe area	Temporary measures	Topsoil stripping	Newly added in plan
			Temporary soil drainage ditch	Newly added in plan
			Woven bag packed soil	Newly added in plan
			Dense screen	Newly added in plan
			Temporary protection of side slope	Newly added in plan

Prevention and Control Zoning		Type of measures	Prevention and Control Measures	Remarks
		Engineering measures	Overburden	Newly added in plan
			Land reclamation	Newly added in plan
			Land rehabilitation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
	Construction access area	Temporary measures	Topsoil stripping	Newly added in plan
			Raincloth	Newly added in plan
			Drainage ditch	Newly added in plan
			Woven bag packed soil	Newly added in plan
		Engineering measures	Overburden	Newly added in plan
			Land reclamation	Newly added in plan
			Land rehabilitation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
	Temporary construction area	Temporary measures	Cofferdam filling and demolition	Already listed in the main works
			Raincloth	Newly added in plan
		Engineering measures	Land reclamation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
Prevention and control area of Linshui No.3 WWTP:	Plant area	Temporary measures	Topsoil stripping	Newly added in plan
			Temporary soil drainage ditch	Newly added in plan
			Woven bag packed soil	Newly added in plan
			Dense screen	Newly added in plan
		Engineering measures	Slope protection and retaining wall	Already listed in the main works
			Overburden	Newly added in plan
			Drainage ditch	Newly added in plan
			Desilting culvert	Newly added in plan
		Vegetation measures	Planting trees	Newly added in plan
			Planting shrubs	Newly added in plan

Prevention and Control Zoning		Type of measures	Prevention and Control Measures	Remarks
			Grass seed sowing	Newly added in plan
	Wastewater pipe Area	Temporary measures	Topsoil stripping	Newly added in plan
			Temporary soil drainage ditch	Newly added in plan
			Woven bag packed soil	Newly added in plan
			Dense screen	Newly added in plan
			Temporary protection of side slope	Newly added in plan
		Engineering measures	Overburden	Newly added in plan
			Land reclamation	Newly added in plan
			Land rehabilitation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
	Off-plant drainage pipe area	Temporary measures	Topsoil stripping	Newly added in plan
			Temporary soil drainage ditch	Newly added in plan
			Woven bag packed soil	Newly added in plan
			Dense screen	Newly added in plan
		Engineering measures	Overburden	Newly added in plan
			Land reclamation	Newly added in plan
			Land rehabilitation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan
	Temporary construction area	Temporary measures	Raincloth	Newly added in plan
			Drainage ditch	Newly added in plan
			Woven bag packed soil	Newly added in plan
			Dense screen	Newly added in plan
		Engineering measures	Land reclamation	Newly added in plan
		Vegetation measures	Planting shrubs	Newly added in plan
			Grass seed sowing	Newly added in plan

7.3.3 Water and Soil Conservation Measures

Part works in the Project main work design have water and soil conservation function. These are largely engineering measures and vegetation measures; relevant quantities and investment are shown in table below. See Table 7.3.3-3 for newly added measures of water and soil conservation plan.

Table 7.3.3-2 Quantities and Investments of Water and Soil Conservation Measures in the Project Main Work Design

<table>
<tr><th>Prevention and Control Zoning</th><th>Type of measures</th><th colspan="2">Prevention and Control Measures</th><th>Unit</th><th>Quantities</th><th>Investment (CNY 10,000)</th></tr>
<tr><td rowspan="10">Prevention and control area of road works</td><td rowspan="4">Engineering measures</td><td colspan="2">5cm thick C25 color concrete brick</td><td>m<cf superscript="on">2</cf></td><td>102764</td><td>486.89</td></tr>
<tr><td rowspan="2">Side slope intercepting ditch, drainage ditch</td><td>Excavation</td><td>m3</td><td>5991</td><td rowspan="2">66.71</td></tr>
<tr><td>Cement laid stone masonry</td><td>m3</td><td>2793</td></tr>
<tr><td colspan="2">Road rainwater pipeline works</td><td>m</td><td>25233</td><td>4090.38</td></tr>
<tr><td>Comprehensive measures</td><td colspan="2">Comprehensive slope protection by cement laid stone masonry skeleton plus spray-seeding grassing</td><td>m<cf superscript="on">2</cf></td><td>81647</td><td>355.41</td></tr>
<tr><td>Vegetation measures</td><td colspan="2">Spray-seeding grassing on net-hanging side slope</td><td>m<cf superscript="on">2</cf></td><td>50381</td><td>112.25</td></tr>
<tr><td rowspan="4">Vegetation measures</td><td rowspan="4">Landscaping of median separator, outer separator and sidewalk</td><td>Planting trees</td><td>Plant</td><td>6828</td><td rowspan="4">872.55</td></tr>
<tr><td>Tree pool</td><td>Pieces</td><td>6828</td></tr>
<tr><td>Planting shrubs</td><td>Plant</td><td>381120</td></tr>
<tr><td>Grass seed sowing</td><td>kg</td><td>392.7</td></tr>
<tr><td rowspan="5">Prevention and control area of wastewater interceptor works</td><td rowspan="5">Temporary measures</td><td rowspan="2">Woven bag packed soil</td><td>Earth volume</td><td>m3</td><td>1554</td><td rowspan="5">255.49</td></tr>
<tr><td>Nr.</td><td>Pieces</td><td>12690</td></tr>
<tr><td colspan="2">Earth-rock fill of cofferdam</td><td>m3</td><td>7770</td></tr>
<tr><td colspan="2">Colored strip</td><td>m<cf superscript="on">2</cf></td><td>3885</td></tr>
<tr><td colspan="2">Cofferdam demolition</td><td>m3</td><td>7770</td></tr>
<tr><td rowspan="2">WWTP</td><td rowspan="2">Engineering measures</td><td colspan="2">C25 concrete rubble slope protection</td><td>m3</td><td>1400</td><td rowspan="2">108.86</td></tr>
<tr><td colspan="2">C25 concrete rubble retaining wall</td><td>m3</td><td>840</td></tr>
<tr><td colspan="6">Total investment already listed in the main works</td><td>6348.54</td></tr>
</table>

Table 7.3.3-3 Quantities and Investments of Water and Soil Conservation Measures in the Project

Type of measures	Prevention and Control Measures		Unit	Prevention and control area of road works							Prevention and control area of wastewater interceptor works				Prevention and control area of Linshui No.3 WWTP:					Total
				Subgrade area	Bridge area	Construction access area	Construction site area	Construction camp area	Temporary soil storage yard	Subtotal	Pipe area	Construction access area	Temporary construction area	Subtotal	Plant area	Incoming wastewater pipe Area	Off-plant drainage pipe area	Temporary construction area	Subtotal	
Temporary measures	Topsoil stripping		m³	70440		4350				**74790**	13250	6090		**19340**	990	4050	6470		**11510**	**105640**
	Raincloth		m²	41700		4350	1150			**47200**		6225	2200	**8425**				2368	**2368**	**57993**
	Temporary soil drainage ditch	Length	m	13988	50	2900			929	**17867**	1775	4150		**5925**	80	1183	1884	1155	**4302**	**28094**
		Excavation	m³	2517	9	522			167	**3215**	320	747		**1067**	14	213	339	208	**774**	**5056**
		Compacted fill	m³	2014	7	418			134	**2573**	256	598		**854**	11	170	271	166	**618**	**4045**
	Drainage ditch	Length	m				542	283		**825**				**0**					**0**	**825**
		Excavation	m³				694	362		**1056**				**0**					**0**	**1056**
		Cement laid stone masonry	m³				423	221		**644**				**0**					**0**	**644**
	Desilting culvert	Nr.	Pieces	40	1		4	1	12	**58**				**0**					**0**	**58**

		Excavation	m^3	104	2		42	10	24	**182**				**0**					**0**	**182**
		Cement laid stone masonry	m^3	63	2		22	5	19	**111**				**0**					**0**	**111**
	Woven bag packed soil	Earth volume	m^3	2397					2489	**4886**	1775	6090		**7865**	80	1183	1884	447	**3594**	**16345**
		Nr.	Pieces	19570					20320	**39890**	14490	49710		**64200**	650	9660	15380	3650	**29340**	**133430**
	Dense screen		m^2	29916					26879	**56795**	2430			**2430**	396	1620	2580	2500	**7096**	**66321**
	Excavation slope protection	Compacted fill	m^3							**0**	9048			**9048**		2179	3196		**5375**	**14423**
Engineering measures	Overburden		m^3	70440		4350				**74790**	13250	6090		**19340**	990	4050	6470		**11510**	**105640**
	Land reclamation		hm^2			1.16	0.46	0.5	1.09	**3.21**	5.24	1.66	1.42	**8.32**		1.66	2.71	0.96	**5.33**	**16.86**
	Land rehabilitation		hm^2			0.59	0.23			**0.82**	2.77	0.88		**3.65**		0.73	1.03		**1.76**	**6.23**
	Drainage ditch	Excavation	m^3							**0**				**0**	659				**659**	**659**
		Cement laid stone masonry	m^3							**0**				**0**	402				**402**	**402**

	Desilting culvert	Nr.	Pieces							**0**				**0**	1				**1**	**1**
		Excavation	m³							**0**				**0**	10				**10**	**10**
		Cement laid stone masonry	m³							**0**				**0**	5				**5**	**5**
Vegetation measures	桥本	Prunus cerasifera	Plant							**0**				**0**	85				**85**	**85**
	Shrub	Coriaria sinica	Plant			650	450	575	1225	**2900**	1150	325	950	**2425**		1075	2175	850	**4100**	**9425**
		Photinia fraseri	Plant							**0**				**0**	206.5				**207**	**206.5**
		Redflowered loropetalum	Plant							**0**				**0.**	206.5				**207**	**206.5**
	Grass seed sowing	Area	h㎡			1.01	0.23	0.50	1.09	**2.83**	2.47	1.40	1.42	**5.29**	0.33	0.93	1.68	0.96	**4**	**12.02**
		Bermuda grass	kg			50.5	11.5	25.0	54.5	**141.5**	123.5	70.0	71.0	**264.5**	16.5	46.5	84.0	48.0	**195.0**	**601.0**
		Bluegrass	kg			50.5	11.5	25.0	54.5	**141.5**	123.5	70.0	71.0	**264.5**	16.5	46.5	84.0	48.0	**195.0**	**601.0**

7.3.4 Topsoil Balance

Overburden in the Project is mainly used for land rehabilitation and landscaping. Given that the Project area has pretty good hydrothermal condition resulting in quick soil formation rate, and according to site investigation and by consulting local water and soil conservation experts we know that the plough layer thickness along the Project is mostly about 30cm~60cm, therefore, a 30cm~50cm thickness of overburden for temporary Project land use can meet cultivation needs. As for landscaping overburden, overburden thickness for excavation and filling side slope is 10cm~20cm, for landscaping on both sides of road 10cm~30cm, for median separator 40cm~50cm. According to estimation, 105,600m³soil in total will be required for Project late stage overburden and for landscaping and land rehabilitation overburden. Since land acquisition by the Project main works and temporary works are mainly of cultivated land, forest land, grassland, therefore, soil required for later stage landscaping and land rehabilitation can use the topsoil stripped before construction. The stripped amount shall conform to the principle of "as required", in principle, stripping thickness for cultivated land is about 50cm, for forest land 30cm, and for grassland 20cm. Topsoil shall be stripped as per quantity demanded for later stage landscaping and land rehabilitation; and the stripping thickness for sections with relatively thick planting soil may be increased or decreased as appropriate.

For temporary construction site which is mainly used for material mixing and prefabrication of bridges, and for stacking of construction materials and equipment, the land acquisition is mainly of forestland and grassland and the construction disturbance is mainly of compaction disturbance, which will no longer be occupied and compacted, landscaping and rehabilitation of these is available by mere ripping treatment, therefore, topsoil stripping is unnecessary. To sum up, stripped topsoil in the Project is mainly from the areas within subgrade works and wastewater interceptor works.

See Table 7.3.4-1 for the balance of topsoil usage required for landscaping and land rehabilitation by the Project.

Table 7.3.4-1 Balance of Topsoil Usage Unit: m³

Item		Stripping Quantity	Actually Stripped Topsoil Quantity	Actual Overburden Quantity
Road Works	subgrade	118320	70440	70440
	Bridge	380	0	0
	Construction access	4350	4350	4350
	Construction site	1150	0	0
	Construction camp	1000	0	0
	Temporary soil storage yard	2180	0	0
	Subtotal	127380	74790	74790
Wastewater Interceptor Works	Pipe area	13250	13250	13250
	Construction access	6090	6090	6090
	Temporary construction area	2840	0	0
	Subtotal	22180	19340	19340

<table>
<tr><th colspan="2">Item</th><th>Stripping Quantity</th><th>Actually Stripped Topsoil Quantity</th><th>Actual Overburden Quantity</th></tr>
<tr><td rowspan="4">Linshui No.3 WWTP</td><td>Plant area</td><td>2160</td><td>990</td><td>990</td></tr>
<tr><td>Temporary construction area</td><td>1920</td><td>0</td><td>0</td></tr>
<tr><td>Wastewater pipe Area</td><td>4050</td><td>4050</td><td>4050</td></tr>
<tr><td>Off-plant drainage pipe area</td><td>6470</td><td>6470</td><td>6470</td></tr>
<tr><td colspan="2">Subtotal</td><td>14600</td><td>11510</td><td>11510</td></tr>
<tr><td colspan="2">Total</td><td>164160</td><td>105640</td><td>105640</td></tr>
</table>

7.3.5 Earth and stone balance

According to FSR, main earthworks/stoneworks of the Project include excavation and filling, borrowing and purchasing, topsoil is from the excavated earth. According to the topography and the natural environment characteristics in the Project area, and by comprehensively considering the excavation and filling characteristic along main works of the Project, the quantities of earthworks/stoneworks along and within the entire Project area is estimated in accordance with the principle of “excavation + import +outsourcing= backfill + export + spoil”.

5820m3 of sludge is excavated in the road works of the Project, all is used as the under layer for later stage road landscaping overburden.

Total excavation amount of the Project is 1.3835 million m³, total backfill 1.3804 million m³; of which 105600 m³ topsoil is comprehensively used in backfill, and abandoned amount 19,500m³, borrowed amount 16,400m³. See table below for earth and stone balance.

Table 7.3.5-1 Earthwork and Stonework Balance

SN	Item		Excavation		Filling		Export		Import		Borrowed	Abandoned
			Total quantity	Stripped topsoil	Total quantity	Overburden	Qty.	Destination	Qty.	Source		
(1)	Road Works	Road 1	406207	28685	940899	28685			518315	(2) (3) (4) (5)	16377	0
(2)		Road 2	505732	17390	104522	17390	401210	(1)				0
(3)		Road 3	67313	12963	69460	12963	1387	(1)	2148	(5)		0
(4)		Road 4	117435	6305	46405	6305	71030	(1)				0
(5)		Road 5	112849	5097	64627	5097	48222	(1) (3)				0
(6)		Construction access	11310	4350	11310	4350		/				0
/		Subtotal	1220846	74790	1237223	74790	521849	/	521849		16377	0
(7)	Wastewater Interceptor Works	Pipeline works	71815	13250	58134	13250						13681
(8)		Construction access	16050	6090	16050	6090						0
/		Subtotal	87865	19340	74184	19340						13681
(9)	Linshui No. 3 WWTP	Plant area	38700	990	38000	990						700
(10)		Wastewater Collection Pipeline	14580	4050	12310	4050						2270
(11)		Off-plant tail water pipe	21465	6470	18644	6470						2821
(12)		Off-plant rainwater drainage ditch	60									60
/		Subtotal	74805	11510	68954	11510	0	/	0	/	0	5851
Total			1383516	105640	1380361	105640	521849	/	521849		16377	19532

Note: The earth and stone quantities in the table above are natural cubic meters.

7.4 Investment Estimate for Soil and Water Conservation Works

The total Project investment for water and soil conservation works is CNY 69.7470 million, accounting 7.82% of the total Project investment (CNY 857.0,249 million); of which, investment for water and soil conservation works already listed in the main works is CNY 61.1,731 million, accounting 6.68% of the total Project investment, and the new investment for this water and soil conservation plan is CNY 8.5,739 million, accounting 0.96% of the total Project investment. Among the total investment in this regard, CNY 52.5341 million is for engineering measures, CNY 9.93,457 million for vegetation measures, CNY 3.9161 million for temporary measures, CNY 1.4177 million for independent work charge, CNY 397,800 for basic reserve funds, CNY 1.5,456 million for water and soil conservation compensation. See Table below for the summary of the investment estimation for the water and soil conservation measures by the Project.

Table 7.4-1 Total Investment Estimation for Water and Soil Conservation Measures

Unit: CNY 10,000

SN	Description	Cost of construction works	Cost of Vegetation Measures	Independent Costs		Total investment	Investment listed in the main works	Total
				Equipment costs	Other costs			
Part I Engineering measures		145.16	0	0	0	145.16	5108.25	5253.41
I	Road works area	89.91				89.91	4999.39	5089.30
II	Wastewater interceptor works area	28.57				28.57		28.57
III	Linshui No.3 WWTP	26.68				26.68	108.86	135.54
Part II Vegetation measures		0	8.77	0	0	8.77	984.80	993.57
I	Road works area		2.27			2.27	984.80	987.07
II	Wastewater interceptor works area		2.95			2.95		2.95
III	Linshui No.3 WWTP		3.55			3.55		3.55
Part III Temporary measures		367.35				367.35	24.26	391.61
I	Road works area	204.53				204.53		204.53
II	Wastewater interceptor works area	104.06				104.06	24.26	128.32
III	Linshui No.3 WWTP	54.14				54.14		54.14
IV	Other temporary works	4.62				4.62		4.62
Part IV Independent costs		0	0	1.20	140.57	141.77	0	141.77
I	Construction Management fee				10.43	10.43		10.43
II	Project construction supervision fee				9.97	9.97		9.97
III	Scientific research, survey and design fee				22.87	22.87		22.87
IV	Water and Soil Conservation Monitoring fee			1.20	47.30	48.50		48.50
V	Cost for the preparation of acceptance and technical assessment report on water and soil conservation measures				50.00	50.00		50.00

SN	Description	Cost of construction works	Cost of Vegetation Measures	Independent Costs		Total investment	Investment listed in the main works	Total
				Equipment costs	Other costs			
Total for 1 to 4		512.51	8.77	1.20	140.57	663.05	6117.31	6780.36
Basic reserve funds						39.78		39.78
Compensation fee for water and soil conservation						154.56		154.56
Total project investment						857.39	6117.31	6974.70
New investment in the plan								857.39
Investment already included in the main works								6117.31

7.5 Benefit Analysis of Water and Soil Conservation

1 Ecological benefit

By taking comprehensive and necessary water and soil conservation measures like temporary retaining protection, drainage, collected stacking of temporary pile soil, landscaping combining trees, shrubs and grass, land reclamation, and construction management in the Project area during construction, it is possible not only to effectively reduce or even basically contain the new water and soil loss in Project area, but also increase the greening area and facilitate a virtuous circle of ecological system. By means of landscaping of permanent land occupation like the side slopes of road works and the road median separator, etc., vegetation restoration of temporary land occupation like the wastewater interceptor works and the WWTP works, it is possible to realize 99.68% vegetation recovery rate, 31.77% forestry and grass coverage rate in the Project construction area.

2 Economic benefit

By implementing the water and soil conservation plan, it is possible to effectively prevent and manage the possible water and soil loss,to control, reduce and avoid the water and soil loss hazard which might be produced to the Project area and the upstream and downstream of rivers along the road works and pipeline works, to reduce mountain hazard and waterlogging road accident, to ensure the safety and smooth operation of highways, thus to ensure the best investment benefit and the biggest economic benefits of the Project.

In addition, by implementing various measures of the water and soil conservation plan, it is possible to avoid the silting of rivers, gulleys, small reservoirs and water conservancy works, thus reduce the dredging quantities and extend the service life of water conservancy works, bringing significant economic benefits and ecological benefits. The implementation of the water and soil conservation plan will effectively prevent and control the silting of ditches and farmland along the Project by water and soil loss and reduce the agricultural losses in the Project area, and the economic benefit is significan. Therefore, at macro level, the implementing of the water and soil conservation plan not only has lasting ecological and social benefits, but has considerable economic benefits.

3 Social benefit

By earnestly implementing soil and water conservation laws, and by taking prevention measures, treatment measures and supervision and inspection measures for water and soil conservation according to circumstances, it is possible to minimize the water and soil loss and hazard in the Project construction period and the natural recovery period, thus to ensure the smooth advance of Project construction, to safeguard forcefully the flood discharge capacity of rivers and gulleys in the Project area not affected, the normal operation of water conservancy works, the road traffic and the life and property security of people along the Project. The Project construction is combined with the regional urbanization construction and industrial development, and the road landscaping is coordinated with urban landscaping; this not only is in favor of the sustainable and rapid development of the Project area, but at the same time beautifies the project area landscape, promoting a sustainable and rapid development of local traffic, tourism and other industries. By implementing the water and soil conservation plan, it is possible to effectively control water and soil loss and avoid major water and soil loss hazard, to ensure rivers, gulleys and artifical channel along the Project unblocked; thus to facilitate the steadily development of national economy and social undertakings in the Project area, to realize the goal of promoting economy development in the Project area and its surrounding areas by highway construction; thus the Project construction will produce huge social benefits.

7.6 Brief Summary of Assessment

By conducting water and soil conservation analysis and demonstration in respect of Project location, route, general layout and construction schedule, it is concluded that there is no restriction on water and soil conservation in the Project, the proposed main work plan is reasonable and feasible, and the Project land occupation, earthworks/stoneworks quantities and the Project construction organization design and so on all meet the requirements for water and soil conservation.

By implementing the water and soil conservation measures of the plan during Project construction, it is possible to effectively prevent new soil and water loss, and by the design level year, all six indexes can achive the target values; in general the new and the existing water and soil loss during the Project construction and at later stages after Project completion will be effectively controlled, the ecological environment in the Project area will be protected and improved, vegetation coverage will be restored; in short, the plan will play an important role in safeguarding the safe operation of the Project and facilitate a sustainable regional development.

8 Environmental Risk Assessment

8.1 Risk Analysis on Wastewater Interceptor and Wastewater Pipeline Works

1. Environmental risk factors

After being put into operation, pipelines of the Project have no harmful effect on the environment in normal condition, however, in case of abnormal conditions (namely, accidental state), they may produce harmful effect impact on the external environment, especially water and air environment. Abnormal state is mainly refers to possible pipeline fracture, breakage, etc. Causes for abnormal conditions include two aspects, one is natural factor, referring to earthquake and climate change, etc., and the other is human factor, referring to material, construction, corrosion protection, maintenance, operation, non-conformity to standard of trench backfill and pressing or occupation of pipelines.

Accident caused by natural factors is unavoidable, what we can do is to find out and repair in time after the occurring of accident, while these caused by human factors is avoidable. Previous analysis indicates that the selections of Project pipelines are reasonable; therefore, what is needed is to enforce strict management during construction and operation period, to comply with the relevant provisions, to perform regular inspection, to execute standard operation, thus occurrence of accident caused by human factors may be drastically reduced.

2. Analysis of pipeline environmental risks

Abnormal condition of sewage pipeline mainly refers to fracture and rupture of pipeline, sewage leaked from which may pollute the surface water and groundwater environment.

In general, it is easy to find out when a pipeline is seriously damaged, resulting sewage spills and polluting the surface water environment, and the pollution degree and range may be reduced if only reporting to relevant departments in time. But if there is a leak in the pipeline which results sewage infiltration and pollution of groundwater, it is not easy to find out which may only be discovered by regular inspection. According analogous investigation, when a pipeline leaks and sewage seeps into the underground and gradually spreads to pollute the groundwater, the law is that the closer to the leakage and the longer time the leakage lasts, the more serious the pollution is; therefore, to find out the leakage as soon as possible and to take measures as soon as possible is the key to prevent environmental risks.

3. Precautions

(1) Human factors are often the main cause of the accident, therefore, to enforce strict management and managing people well to eliminate accident-causing human factors is the key to prevent accident. These include: strengthen the virtue education on staff to improve the staff’s sense of responsibility and initiative; provide systematic post training for operators to make them familiar with work procedures and rules and to strengthen the post responsibility system; for locations prone to accident, apart from in time inspection by worker of the post, safety inspector shall be appointed to perform routine inspection and maintenance, in order to find out and repair problems in time.

(2) It is suggested that the employer shall perform careful review in Project design stage and check the facilities concerning safety, health and environment in accordance with the relevant specifications and standards, and enforce strict management and inspection on these during the construction period to ensure the construction quality.

(3) In the event of an accident, it shall be reported to the relevant authorities in time to take effective treatment measures to minimize the harm on the surrounding environment and people's lives and properties.

8.2 Risk Analysis on WWTP

1. Environmental risk factors

According to analysis on the WWTP technology and the WWTP facilities, the types of pollution accident risks of WWTP mainly include environmental problems like sewage discharge, sludge bulking, and foul-smelling substances emissions under abnormal condition of WWTP. Links involving accident risks include the following aspects:

(1) Due to pipe blockage, pipe fracture and damage in joints in the sewage pipe network system, large amount of sewage may spill over and pollute the surface water and groundwater. Rupture of pipeline section crossing river may pollute the river water quality.

(2) Long time power outage of sewage pumping station or damage of sewage pump results in poor drainage and subsequent sewage overflow.

(3) Due to power outage, equipment damage, abnormal operation of sewage treatment facilities, and service shutdown, etc. of WWTP, large amount of untreated sewage discharges into nearby waters, causing pollution accident.

(4) Abnormal condition of sewage treatment tank like sludge bulking or sludge disintegration results in sludge loss, reducing treatment efficiency.

(5) Damages of sewage pipe, processing structures and storage yard due to natural disasters such as earthquake result in sewage to spill over the plant and surrounding area and water area, causing serious local pollution.

2. Accident prevention measures and countermeasures

(1) Pipe network maintenance measures

Pipe network maintenance is important for the normal operation of WWTP. Special attention shall be paid to the maintenance and management of pipe network and pump station to prevent the discharge capacity of pipe from being reduced by sediment jam. Pipe connection shall be prevented from leakage in polluting groundwater and emptying the foundation. Silting up of pipe shall be cleaned in time to ensure unblocked flowing in the pipe, in order to collect domestic sewage and industrial wastewater in full capacity. Design of main sewer and branch sewer shall select a proper fullness and minimum flow rate to prevent sludge deposit.

Special person shall be appoint to take charge of the incoming pump station of WWTP, who, at ordinary times, shall strengthen the maintenance of machinery and equipment and, in the event of accident, shall repair them in time to prevent sewage from flowing into the nearby rivers.

Strict maintenance system shall be enacted for the sewage pipe network. Users shall strictly execute relevant national and local emission standards, management on the inflow water quality of industrial wastewater collected shall be specially strengthened to ensure the inflow water quality of WWTP.

(2) Precautions for pollution accident

WWTP accident stems from equipment failure and maintenance, or from poor treatment effect due to changes of technology parameters. Precautions are:

1) Provide duplicate supply for WWTP. Provide standby for water pump,

blower and so on. Use mechanical equipment with reliable quality and performance, imported product is preferred.

2) In case of a shutdown accident of WWTP, the big discharging client shall restrain production to reduce discharge, and the WWTP shall start accident emergency pool which shall allow for 4 hours of servicing time which is 667m^3 in volume in the Project

3) In order to make the WWTP recover normal operation rapidly in the event of accident, corresponding buffer capacity shall be reserved in the volume of main hydraulic structures and corresponding equipment (such as reflux pump, reflux pipe, valve and instrument, etc.) shall be provided.

4) Choose high quality equipment. For mechanical and electrical equipment, instrument, etc. of WWTP, products of good quality, low accident rate, and easy to maintenance shall be used. Key equipment shall have one in use and one for standby; spare parts shall be provided for damageable parts in order to replace in time in case of accident.

5) Technological parameters of treatment unit like Water volume, water quality, residence time, and load intensity, etc. shall be controlled strictly to ensure a stable treatment effect. Flowmeter and water quality automatic monitoring instruments and the like shall be provided for regular sampling monitoring. Operator shall make adjustment in time to make the equipment in the best working condition. In case of abnormity, precautionary measures shall be taken immediately.

6) Establish safety operation procedures which are to be strictly followed at ordinary times. Perform regularly theoretical knowledge and skills trainings and examinations for WWTP staff.

7) Strengthen operation management and monitoring on the inflow and effluent quality, sewage untreated and not up to standard is prohibited from being discharged.

8) Toxic gas monitor shall be provided in sewage pump plant and necessary ventilation device shall be provided.

9) Establish safety responsibility system. A set of complete system shall be in place for daily work management which shall specify the responsibility of each person and shall be inspected regularly.

10) Establish emergency measures for risk accident which shall specify the emergent and rescue operation system.

3. Accident measures and emergency plan

In the event of sudden accident of WWTP in the process of sewage collection, transportation and treatment, it shall be handled emergently as per plan draw up in advance. Emergency plan includes the following:

(1) Profile of risk source

Describe in detail the type, intensity and location of the risk source.

(2) Emergent protection zone

Including the water quality control area downstream the waters near the Project.

(3) Emergency organization

Accident emergency team shall take overall command of the accident site, and professional rescue team shall take charge of the urgent repair or rule out of the accident or malfunction.

(4) Emergency facilities, equipment and materials

Provide relevant standby equipment, tools and materials.

(5) Emergency communication, notifications, and transportation

Stipulate contact communication methods in emergency, notify relevant parties, control the accident site, and make sure rescue teams arrive in time.

(6) Emergency environmental monitoring and post-accident assessment

For major accident, monitor the water environment nearby and assess the nature, parameters and the consequences of the accident to provide basic data for decision making by relevant department.

(7) First-aid measures

Control the accident to prevent it from expanding and chain reaction; close relevant gate to reduce harm.

(8) Emergency situation termination and recovery measures

Stipulate emergency termination procedures, make care-taking arrangement, and recover the normal operation of WWTP rapidly.

(9) Staff training and drilling

After the development of emergency plan, arrange training and drilling for relevant staff in peacetime.

(10) Recording and report

Make special accident record, establish accident records and reporting system, appoint full-time or part-time personnel to take charge of management.

9 Environmental Protection Measures and the Economic and Technical Demonstration

9.1 Environmental Protection Measures and Suggestions in Design Stage

(1) The route and location of new roads and wastewater interceptors shall be further optimized and adjusted to balance as possible the excavation and backfilling, reduce excavation and backfilling quantities, reduce damage to surface vegetation and reduce new water and soil loss.

(2) Road landscaping design shall be conducted at the same time with the main works design. Meeting the regional planning requirement, the route of roads shall maintain the natural landscape and harmonize with the surrounding environment as much as possible. To reduce damage to the existing ecological environment, landscaping and ecological construction works shall be carried out simultaneously in Project design.

(3) New WWTP shall strictly implement pollution prevention principles and take positively clearer production measures in order to reduce pollutants from the source and reduce risks to human and the environment;

(4) Raw materials shall be purchased locally;

(5) The Project design shall comprehensively consider the surrounding environment and shall further refine the permanent land occupation design to use land reasonably.

(6) Make a good water and soil conservation plan which shall not only take into account sufficiently the type, mode and intensity of water and soil loss caused by the Project construction, but integrate the general plan of the management area of Project operation period;

(7) Due to a pretty large noise produced in the construction of building works and road works, reasonable noise isolation and reduction measures shall be taken in Project design to mitigate the impact of construction noise on the field construction workers.

(8) The standard distance for the function area provided by the construction planning department shall be arranged rationally and no sensitive structure shall be built within the standard distance.

9.2 Environmental Protection Measures and Suggestions in Construction Period

9.2.1 Ecological environment protection measures

Flowers, grass and trees in the median separator and outer separator shall be transplanted and protected, these shall not be completely destroyed and plant new vegetation, they shall rather be temporarily transplanted and replanted as per design. Be aware to protect trees and green belt in the adjacent areas during construction. Road construction shall be conducted within the right-of-way as possible; earth-pile and stock-pile shall not intrude into the farmland nearby; As for the ruins belt caused by demolition in construction, this shall be handled by carrying out orderly demolition zone by zone and to avoid messy landscape, and barrier or protective plate (wood, glass, and iron sheet, etc.) may be used as fence to reduce landscape pollution; reasonable allocation shall be made for excavation and backfilling construction; excavation and backfilling construction shall not be done in rainy days to prevent water and soil loss by rainwater washing from polluting the waters and blocking the drainage pipe; meeting the construction demand, land occupation shall be minimized as possible and construction schedule shall be rationally arranged. After work finished, clear the construction site in time, withdraw from the occupied land, restore the original road and greening; reasonably arrange the construction period to avoid rainy season construction so as to minimize soil erosion.

Strengthen construction management and supervision and regulate construction activity to reduce construction land occupation and vegetation loss and reduce damage to wildlife habitat. Regulate construction activity and perform construction reasonably and orderly; optimize construction organization by gradually advancing construction in one direction in the same construction section, staggering the construction peak between two adjacent construction sections to avoid large scale concurrent construction in the same area and to reduce disturbance of terrestrial ecological environment by disordered construction. Strengthen environmental protection publicity and education and wildlife protection knowledge propaganda on the construction staff by multiple means like announcement, leaflets, blackboard newspaper and meetings to improve environmental awareness; forbid constructors from hunting frogs, snakes, wild animals, birds and other wildlife and engaging other activities hazardous to ecological environment protection.

9.2.2 Acoustic environment protection measures

1. Reasonable construction site layout

   Reasonable and scientific construction site layout is a major way in reducing construction noise. Place the fixed noise sources on the construction site collectively to reduce the noise affected scope.

2. Reasonable arrangement of construction time

   Arrange construction time reasonably in accordance with the provisions of the *Emission Standard of Environment Noise for Boundary of Construction Site (GB 12523-2011)*. Forbid construction operation with high-noise machinery at night (22:00~6:00). Adjust construction time as appropriate or take temporary noise reduction measures like setting up temporary noise barrier or adopting semi-underground construction and so on when performing construction near residential area. For worksite requiring continuous construction operation, the Contractor shall contact in time the environmental protection department according to specific situation to apply for nighttime construction certificate as per regulations and strive for public support as much as possible by issuing announcement.

3. Reasonable arrangement of construction transport routes

   Transport routes and time for construction transportation vehicles, especially large transport vehicles shall be reasonably determined as per provisions of the relevant departments, the transport route shall be far away from residences area. Vehicles for transporting and handling construction materials shall lower their speed to 20km/h at sensitive spot and blaring horns is prohibited.

4. Reasonable selection of construction machinery equipment

   Select construction machinery equipment with low noise as possible and perform regular maintenance for them; select the reasonable construction method, construction site; set up sound insulation board for high noise construction machinery on sides close to sensitive spot during construction to reduce the impact of noise on sensitive spot.

5. Strengthen environmental management and accept the supervision of environmental protection department

   In order to effectively control the impact of construction noise on the urban environment, in addition to the implementation of relevant control measures, environmental management must be strengthened; In accordance with relevant state and local laws, decrees and regulations, the constructor shall voluntarily accept the supervision and inspection of environmental protection department; in bid inviting of subsequent project, noise attenuating measure shall be explicitly included in the bidding documents; the contractor shall include the construction noise control into the contract content and special person shall be appointed to take charge in this respect during construction and engineering supervision to ensure the smooth implementation of construction noise control measures. Construction operation personnel and constructors on site shall control the working hours as per labor protecting standard and do well their own personal protection, wearing earplugs, helmet, etc., for example.

6. The contractor shall use construction site barrier in a standardized way to give full play to its noise reduction effect. At sensitive spots within 50m on both sides of the planned road like centralized dwelling district of Hejiayakou, Liujiawan, and Xinwuzui, the construction barrier height shall be increased or housing demolition shall be carried out in advance.

   As long as the contractor strictly executing the control measures provided in the EIA, the construction noise will not have obvious impact on the surrounding environment.

9.2.3 Atmospheric environmental protection measures

1. The Project site management shall strictly refer to the construction site management principle of “six must” and “six mustn’t”, namely, wet construction operation is a must, barrier circling construction is a must on urban road, road hardening is a must, providing washing facilities is a must, clean-keeping staff is a must, cleaning the construction site regularly is a must; and the six mustn’t, vehicles with mud mustn’t be allowed to leave, slag car mustn’t be allowed to overload, throwing built slag in the air mustn’t be allowed, mixing concrete on site mustn’t be allowed, ground water mustn’t be allowed, burning waste on site mustn’t be allowed, thereby effectively control the construction site dust pollution.
2. Provide dust-proof measures like construction barrier at concrete mixing station, or mix concrete inside building to effectively control dust pollution.
3. Watering in due time the construction site on non-rainy days, including the road section in construction and major transportation road. Watering frequency shall be determined by the site supervision personnel according to the actual situation.
4. Powder material like cement, lime shall be packed in tanks or bags, transportation of these in loose packing is prohibited, dust scattering in transportation is prohibited; while in storage, these shall be stored in warehouse or covered with tarpaulin.
5. Provide dust-proof mat at exits of construction site; clean the body and tires of transport vehicles out of the construction site. Forbid overload in soil, sand, stone transportation; the loading height shall not exceed the truck baffle and the loaded material shall be covered with tarpaulin to prevent sprinkling along the way.
6. In case of a wind velocity above level 4 which is prone to producing dust, it is suggested that the contractor shall temporarily stop excavation and take measures like covering, wetting the stockpile to effectively reduce dust pollution;
7. Collect and transport the construction waste in time, and cover those which cannot be cleared and transported temporarily; vehicles transporting sand, stone, cement, earth which is apt to produce dust must be covered tightly to prevent sprinkling and leak.
8. Provide dust mask for constructors to reduce health damage by dust.
9. Watering the temporary storage yard regularly to reduce the impact of dust on

the surrounding environment; set up closed enclosure with height no less than the piled up material around; divide the boundaries between the material area and road and clean up the scattered materials in time to keep the road neat and clean the road in time.

10. For soil pile of road and pipeline construction over 48 hours, it shall be completely covered to prevent dust.
11. Slag car shall use enclosed car bucket, vehicle cleaning platform shall be provided on the inner side of the in and out door for transport vehicles and shall be equipped with perfect drainage facilities; before leaving the construction site, vehicles shall have their tires and the bodies washed to prevent soil sticking.

9.2.4 Surface water environmental protection measures and suggestions

1. Construction wastewater in the Project is reused after treatment and is not directly discharged into local waters, and domestic sewage is discharged after treatment in septic tank or used as agricultural fertilizer, which in general will not impact the groundwater quality.
2. The constructor of the Project shall make simple processing to muddy water like filtering and precipitation, direct discharge is prohibited; the constructor shall strengthen construction management to perform civilized construction.
3. For living garbage, construction waste, maintenance garbage, which would produce pollution if directly discharged into the waters, therefore, they shall be recycled, sorted, stored and disposed; of which, the usable materials like most paper, wood, metal and glass wastes shall be reused or sold to garbage buyer, and the unusable shall be committed to health department for harmless treatment, incineration, landfill, stockpiling, etc.
4. Residual and waste oils produced in construction shall be collected, recycled and disposed with different vessel; aggregate wash water and concrete batch plant wash water produced in subgrade construction shall be reused after precipitation processing for watering the construction site to reduce dust.
5. Leakage and pressure test shall be performed after the connection of pipe network works, and the water pollutants for pressure test is mainly SS, which may be collected as dust suppression water or landscaping water after sedimentation.
6. Well-up water produced in the excavation of WWTP structures shall be used in construction after sedimentation.

9.2.5 Groundwater environmental protection measures and suggestions

1. Strengthen sewage and production wastewater treatment during construction; domestic sewage of constructors shall be used for agricultural irrigation or recycling after pre-treatment and production wastewater shall be used for dust suppression in the construction;
2. Loose piled stock ground shall be covered to prevent water and soil loss from polluting groundwater.
3. The contractor shall make scientific and reasonable construction schedule to shorten the construction period in order to reduce the impact of pumping and discharging of groundwater.
4. Organize construction by sections to prevent a superposition effect on the groundwater recession due to the excessive concentration of dewatering wells in part section.
5. Increase the number of drain wells as appropriate, choose reasonably the locations of drain wells to minimize the distance from the pipeline in construction so as to reduce the affected scope of groundwater recession.

6. Construction of the foundation of sewage wells shall be arranged in non-flood season to reduce the adverse impact of a lower groundwater depth on construction.

9.2.6 Environmental protection measures and suggestions for solid wastes

1. Domestic garbage produced in construction shall be collected by classification and shall be collected, transported and disposed uniformly by local health department.
2. Upon completion of works, dismantle the temporary facilities in the construction area, remove construction waste and all sorts of sundry, clear up and level up the domestic garbage, simple toilet, and sump and perform disinfection for these with carbolic acid and caustic lime, and restore the construction site.
3. The contractors shall arrange special person to take charge of the collection of production waste; scrap iron, scrap steel, waste wood pieces shall be stacked in the location specified, random piling and stacking is prohibited; Waste shall be uniformly reclaimed and committed to centralized treatment.
4. In the process of transportation, living garbage, and building materials shall be enclosed or covered to prevent garbage, sandstone, earth material from scattering along the way or into the river.

9.3 Environmental Protection Measures and Suggestions in Operation Period

9.3.1 Ecological Environment protection measures and suggestions

1. Ecological landscape design for road works

   Environmental protection measures for road works during the operation period mainly consist of landscape works' maintenance on both sides of road, regular renovation of greening trees in order to ensure the design effect of landscape works.

   1) Design Ideas

      According to the overall design ideas, landscape design is conducted for the entire road network of this area and the surrounding areas, as follow:

      (1) To highlight design effect, the main design method and style shall be uniform; the greening of trunk road and important local node landscape shall be emphasized; landscaping for sub-trunk road shall use evergreen shrubs as the background.

      (2) To form vertical green space system by combining spot greening, line greening and plane greening. Road greening in the Park shall consider the environment coordination and visual effect of the whole Park. The central greening of trunk road shall not only be of rich color, but shall protect the traffic safety of the opposite direction; and the vertical planning of plant shall form a “canopy line”, producing a micro-environmental plant community.

      (3) Different tree species shall be selected according to the environment characteristic of each road section, in order to protect and conform to the environment by virtue of the growth characteristic of plant. In high pollution plant area, high pollution resistance tree species like albizia, privet, and pagoda, etc. shall be selected, while catkins-flying trees cannot be planted.

      (4) Road greening in the Park shall be economic and applicable; investment shall focused on key sections; native tree species shall be selected to meet the need for extensive management as possible.

(5) Meet various functions. In addition to beautifying the road landscape in the Park, road greening shall also provide a safe and comfortable driving environment for the Park.

2) Landscape design

(1) Urban trunk road

For urban trunk road with width of 40-50m, landscaping works mainly includes the 4m wide median separator and the 1.5m wide outer separator on both sides. Landscaping mainly uses evergreen trees, together with multilayers of dungarunga and shrub. Between big evergreen trees and dungarunga there are layers of shrubs. The outer separator use trees as backdrop, combined with flowering small arbors and with the ground covered with grass flower in order to add color; thus urban trunk road characterized by many varieties and multi-function landscaping, four seasons evergreen, three seasons of flowering, bright and colorful, and thriving are presented. At the same time the continuity within the road section and the integrity of landscape shall be maintained.

Besides meeting the demand for vehicle driving and walking, in the design of the cross-section of urban road, engineering LID mode is introduced in the design of sidewalk, traffic separating strip, and the traffic island greenbelt in order to comprehensively utilize road surface rainwater which is dynamically integrated in the road landscape design. That is, on the basis of using water permeable bricks for sidewalk, eco grass ditch and recessed sidewalk green belt rainwater collection and treatment system are provided on the right-of-way side of sidewalk to form rainwater treatment system capable of effectively controlling the urban road run-off produced by rainstorm. Besides adopting the said tree, shrub and grass combination greening, the design of median separator meanwhile introduces LID low impact development technology to reduce the central elevation of the median separator and form on both sides recessed bioretention ponds and grass planting depression, forming belt-type rain garden, reducing surface run-off and filtering
pollutants.

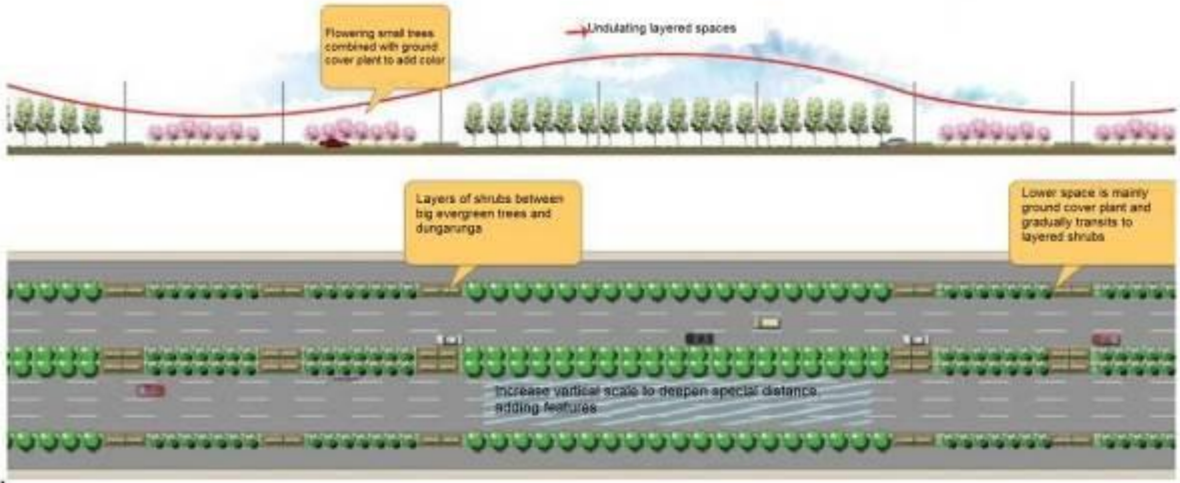


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Figure 9.3.1-1 100m Standard Demonstration Section of Trunk Road Landscaping WorksTable 9.3.1-1 Quantities of Trunk Road Landscaping Works (Estimated as per 100m Standard Demonstration Section)

SN	Item Description	Unit	Qty.
1	Trees, small arbors		

SN	Item Description	Unit	Qty.
	(Camphor, goldenrain tree, ficus microcarpa, etc.) diameter at breast height 12cm, 3m height, crown breadth 2.5m	Plant	1529
	(Crape myrtle, chaenomeles speciosa, purple-leaf plum etc.) diameter at breast height 6cm, 2.5m height, crown breadth 1.5m	Plant	2548
2	Shrubs, flowers, herbs		
	(Photinia fraseri, nandina, buxus microphylla, China Loropetal), etc. 36 plants/m^2	m^2	1592
	(Canna, iris, gerbera, corn poppy)etc. 36 plants/m^2	m^2	1592
	(Taiwan II, bermudagrass, ryegrass)etc. 20 g/m^2	m^2	15925

(2) Urban sub-trunk road

Urban sub-trunk road is 20-30m wide, the landscaping works of which mainly consists of the 2.5m wide sidewalks on both sides of the road; small arbors and low shrubs together with lawn will be planted to produce pretty wide visual spaces. Meanwhile urban road rainwater collection system is introduced to form LID technical system.

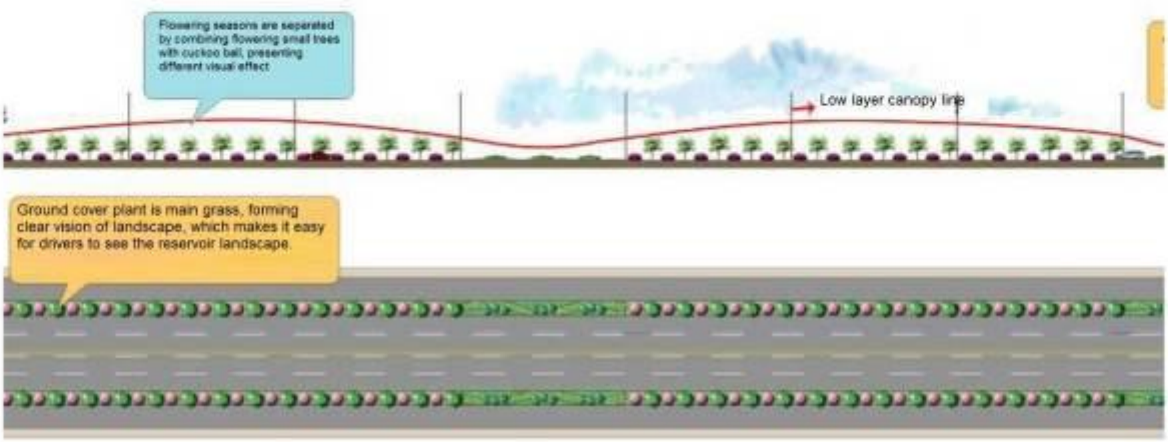


Figure 9.3.1-2 100m Standard Demonstration Section of Sub-Trunk Road Landscaping Works

Table 9.3.1-2 Quantities of Sub-Trunk Road Landscaping Works (Estimated as per 100m Standard Demonstration Section)

SN	Item Description	Unit	Qty.
1	small arbors		
	(Crape myrtle, chaenomeles speciosa, purple-leaf plum etc.) diameter at breast height 6cm, 2.5m height, crown breadth 1.5m	Plant	1249
2	Shrubs, flowers, herbs		
	(Photinia fraseri, nandina, azalea, China Loropetal), etc. 36 plants/m^2	m^2	2000
	(Canna, iris, gerbera, corn poppy)etc. 36 plants/m^2	m^2	2000
	(Taiwan II, bermudagrass, ryegrass)etc. 20 g/m^2	m^2	1800

(3) Branch road

All branch roads are 20-30m wide, the landscaping works of which mainly consists of the 2.5m wide sidewalks on both sides, landscaping plan similar to that of sub-trunk road can apply. Meanwhile urban road rainwater collection system is introduced to form LID technical system.

Table 9.3.1-3 Quantities of Branch Road Landscaping Works (Estimated as per 100m Standard Demonstration Section)

SN	Item Description	Unit	Qty.
1	small arbors		
	(Crape myrtle, chaenomeles speciosa, purple-leaf plum etc.) diameter at breast height 6cm, 2.5m height, crown breadth 1.5m	Plant	1502

2	Shrubs, flowers, herbs		
	(Photinia fraseri, nandina, azalea, China Loropetal), etc. 36 plants/m^2	m^2	2502
	(Canna, iris, gerbera, corn poppy)etc. 36 plants/m^2	m^2	900
	(Taiwan II, bermudagrass, ryegrass)etc. 20g/m^2	m^2	1910

WWTP

The assessment involves 2 WWTP. Targeted at the practical needs and development prospect of WWTP, two leading design concepts, namely, “humanized scale” and “ecological atmosphere” are proposed for the WWTP landscaping design; based on these two concepts, the design shall be conducted in proper scale and close to people as much as possible by analyzing the human behavior in the plant and various flow relationship, and by implementing the design goal of “ecologization combining dynamic and static”, in order to realize an reasonable and high quality landscaping effect no matter in terms of function layout, greening area, hard ground and so on. A comprehensive greening principle integrating spot, line and plane greening shall be adopted in the organization of greening system, together with small square, waters, hard ground, ultimately creating an ecological and landscaping plant environment.

Landscaping at the plant door shall mainly use pot flowers. Bench shall be provided at proper place in small parks; and small garden ornaments shall be used to perfect greening. Landscaping of the front of other buildings shall combine flowers and plants to form high and low layers of greening. Landscaping of road sides and the surrounding of plant walls shall mainly use trees which are suitable for the local climate and soil, and different tree species shall be planted in collocation considering the season changes.

Figure 9.3.1-3 Greenery Landscape Example of WWTP

9.3.2 Acoustic environment protection measures and suggestions

1 Noise Prevention Measures

According to the principles for noise control, noise control measure at sensitive sites is mainly to set sound-proof windows at 5 locations with a total area of 1840m^2, total investment of about CNY 920,000.Soundproof windows shall be provided according to the demolition conditions and the actual noise monitoring results at sensitive sites along the road after construction.

2 Suggestions on noise pollution control

Article 12, Chapter 2 of the Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise provides that the urban planning department shall, in determining architectural layout, provide a reasonable noise-proof distance between the buildings and traffic artery in accordance with national acoustic environmental quality standard and civil building design code and propose corresponding planning and design requirements; Article 37, Chapter 5 provides that for new noise-sensitive buildings on both sides of urban traffic artery, certain distance shall be reserved from the road in accordance with national regulations and traffic noise mitigation measures shall be taken; Article 5(2) of Technical Policies for the Prevention and Control of Ground Traffic Pollution (HF[2010] No.7) provides that for noise-sensitive buildings besides roads and tracks, the functions of rooms in a building shall be reasonably arranged to reduce traffic noise impact, for instance, kitchen and restroom and the like in residential apartment shall be located on the side facing the road or tracks.

(1) According to the said principles, land use on urban roadsides shall be properly planned and the function of land use along the road shall be strictly controlled; Based on the predicted noise value at varied distance and the predicted distance at which traffic noise meets the standard, it is suggested that acoustic-sensitive buildings like residential areas, schools and hospitals shall not be placed at the first row within 20m of the road centerline. In addition to reasonable planning of land function on roadsides, architectural layout and sound-proof design shall be strengthened to ensure the inside environment of noise-sensitive buildings meets requirements for use.

(2) Reduce the sound source noise radiation

Implement traffic control at night, restrict overspeed in sensitive sections at night; strengthen management on blaring horns; strengthen the maintenance and management of urban road and repair in time the damaged road; restrict the traffic of overspeed, overload vehicles and heavy-duty trucks.

(3) Suggestions on noise pollution control

Since Road No.2 to No.5 in the Project are all located in Linshui economic development zone, according to construction and development schedule this area will be developed during 2014~2016; currently land leveling is being carried out and some houses have already been demolished, it is suggested that housing demolition and resettlement should be carried out as soon as possible to reduce the noise impact of the Project.

9.3.3 Atmospheric environment protection measures and suggestions

1. Measures for road works

(1) Enforce strictly exhaust emission inspection system and restrict traffic of vehicles with excess emissions; organize transport route scientifically; restrict traffic of ultra-limit slag cars; strengthen road management and road maintenance and keep road in good operation condition and reduce traffic jam.

(2) Enforce strictly national vehicle exhaust emission standards; strengthen law enforcement on vehicle management; restrict traffic of vehicles with excess emissions to reduce exhaust emissions.

(3) Strengthen greening on road sides and plant trees capable of absorbing (or adsorbing) toxic gases like CO, NO_2, etc. to reduce road traffic air pollution.

2 Measures for WWTP

(1) Rational layout Place structure which is the main source of odor in the middle of the plant to ensure that the surrounding sensitive spots are beyond the protective

distance and not affected; provide mechanical ventilation facilities in wastewater lifting pump room, sludge dewatering room to eliminate odor and improve environment.

(2) Control odor radiationControl the odor emission by covering the pond of treatment facilities giving out odors to confine the odor in not fully open structures; use underground sludge reflux pump above which the landscaping is provided; adopt mechanical thickening and dewatering integrated process for dewatering of sludge which will be transported with special vehicle to the waste disposal plant for landfilling and ensure the sludge is kept for a very short period of time in the plant; collect the sludge on a daily basis to control the production of odor; and specify the health protection distance from the odor boundaries of WWTP.

In Project design, sealing covers are provided for coarse grid room, lifting pump station, fine grid room, and grit chamber, the EIA suggests that sealing cover shall also be provided for sludge thickening tank which emits strong odor. Remaining exhausted gas collected from these covered ponds shall be collected to be treated together; these shall be treated by efficient UV light odor releasing device to remove the hydrogen sulfide and ammonia, finally the treated exhausted gas is discharged to the air by a fan.The process flow is as follows:

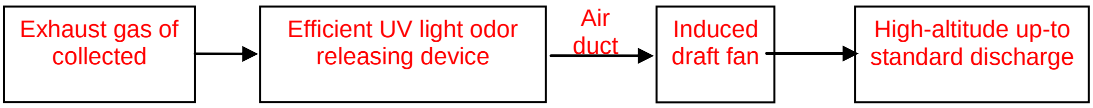


Figure 9.3.3-1 Process Flow of Efficient UV Light Odor Releasing in Lifting Pump Station

According to calculation, 100m health protection distance is set from the boundaries of odor sources (oxidation ditch, secondary sedimentation tank, rotary filtering chamber, and sludge thickener) as centers.Within health protection distance, there are 7 households in the north of WWTP and 1 in the west, so it is suggested that these 8 households with 36 residents be relocated to meet the requirement of health protection distance.According to *General Plan of Linshui Economic and Technological Development Zone (2008-2030)*, The WWTP is located in the planned area which will be developed during 2014~2016 and the WWTP will be built in 2017, at that time all residential houses around it will have been demolished, so there will not be any residential houses remained then.

In addition, as this area is planned for industrial use, so within the health protection distance no enterprise with high requirement for air environment like pharmaceutical, food shall be introduced, no enterprise's dormitory as well as sensitive and protected buildings like schools and hospitals shall be built within the health protection distance.

(3) Strengthen management. Control fermentation during sludge thickening and collection and transport dewatered sludge in time to reduce sludge stockpiling; during shut down for maintenance of various sewage pools or sumps, the bottom sludge will be exposed and generate odor, measures for clearing sludge deposit shall be taken in time to prevent the effect of odor.

(4) Enhance greening. Provide greening isolation belt around the sewage station, sludge production area and the coarse grid room of lifting pump station in the WWTP, and plant different series of tree species to form multilayer of protection and isolation belt against odor to reduce the odor pollution as possible. Green area in plant area and pump station shall be no less than 30%.

(5) Canteen fume emission is pretty small which, after being treated by the canteen fume purifier, can meet emission standard.

9.3.4 Surface water environmental protection measures and suggestions

1. Road transport component

The main impact during the operation period is the pavement run-off wastewater produced by rainfall scouring the pavement, this mainly occurs in the 30 minutes from the beginning of rainfall to forming run-off; after a half hour, the pavement is basically washed out and the pollutant concentration of pavement run-off is stabilized at a pretty low level.

A half-separated drainage system is adopted in design to collect the initial dirty rainwater which is discharged to the riverway after sedimentation.

2. WWTP component

(1) Feasibility analysis on WWTP technology

The designed short-term capacity of WWTP is 4000 m^3/d; the inflow is mainly the industrial wastewater and domestic sewage in the south area of the LETDZ. Although the south area of the Park has not been constructed, but the types of resident enterprises have been decided, they are mainly of machining, electronics and a few food processing enterprises. The types of enterprises are relatively simple and stable and their discharge is stable and easy to dispose.

The general idea for treatment plan is that pretreatment+ biological nutrient removal process+ water disinfection. See figure 3.2.3-3 for specific technological process. Combined process of "coarse grid + water collection tank + fine grid + rotational flow grit chamber + regulating tank + hydrolysis acidification tank + amended oxidation ditch + rotary filter tank" is adopted as the wastewater treatment process; and "ultraviolet disinfection" process is adopted for disinfection.

The LETDZ wastewater is collected by sewage pipe network and flows into WWTP. First it flows through the coarse grid and into the lifting pump room where the big suspended solids and floating objects are intercepted by the coarse grid; lifted by the lifting pump, it then flows through the fine grid and into the sand settling pool where sand with big specific gravity is removed from the wastewater, effluent from the sand settling pool then flows into the oxidation ditch where the pollutants in wastewater are removed by microorganisms; the effluent whereof now flows into sedimentation tank for sludge and water separation, the supernatant flows into the filter tank and, after disinfection and metering, is discharged up-to-standard.

1) Pretreatment plan (primary treatment)

The technology of "coarse grid + water collection tank + fine grid + rotational flow grit chamber + regulating tank" is proposed for pretreatment.

Grid is often used for pretreatment of wastewater which is mounted at the inlet of sewage pipe and pump room sump to intercept the big suspended solids and floating objects in order to prevent water pump, drainage pipe and subsequent treatment structures from being blocked and thus ensure the normal operation of treatment facilities and equipment.

Grit chamber is a pre-treatment technology by using gravity separation to separate sand from the wastewater. Water velocity in grit chamber is controlled at a level allowing organic particles to flow out with water while enabling the inorganic particle with larger density to precipitate.

Two stages of grid are provided in the WWTP which can effectively intercept the junks in wastewater to safeguard the normal operation of subsequent treatment units. Inorganic sand with diameter of 0.2mm or more can be removed in rotational flow grit chamber which further safeguards the normal operation of subsequent treatment units.

Regulating tanks is arranged to reduce or prevent the adverse impacts of shock load on the processing equipment due to wide fluctuations of water quality index of the wastewater discharged by industrial enterprises such as water quantity, water quality, pH or temperature with the passage of drainage time, thereby ensuring the stable operation of the system.

2) Biological treatment (secondary treatment)

Since industrial wastewater is mainly disposed in WWTP of the Project, accounting for 53%, the biodegradability of wastewater is required to be improved; hence, hydrolysis acidification process is adopted as pretreatment process for biological treatment to reduce the pollutant concentration of wastewater or improve the biodegradability of wastewater via anaerobic reaction, in order to facilitate the subsequent aerobic biological treatment.

The wastewater in the LETDZ Park is mainly industrial wastewater. There are machining, electronics, food processing and other industrial enterprises and discharges from these enterprises contain large amount of nitrogen and phosphorus pollutants, and therefore the WWTP is required to remove not only organics but also to remove nitrogen and phosphorus. Based on technical and economic comparison and demonstration in terms of process mechanism, process, process characteristics, process parameters, the main content of WWTP works and composite factor, **improved oxidation ditch process** is recommended for the biological treatment process of WWTP.

The biggest feature of improved Carrousel oxidation ditch process is to use specially designed vertical type low-speed surface aerator as aeration equipment; due to the use of vertical type aerator (different from horizontal axis aerator), at the same time of mixed aeration the sewage has a local hydraulic lifting effect of pump, enabling the mixed liquor to mix completely with raw water. After aeration the sewage will form good mixture of biological floc when flowing to effluent weir. This floc will increase the sludge sedimentation rate clarification effect in secondary sedimentation tank. In addition, plug flow model is also very important for the denitrification process in anaerobic tank. The denitrification process requires that there shall be almost no dissolved oxygen in the waters, when nitrate and nitrite nitrogen are the only oxygen source. By means of design and operation control of surface aerator, it is possible to reduce the dissolved oxygen in the end of aeration zone to minimum level to effectively prevent the problem of excess oxygen in front anaerobic tank. By adopting this flow pattern, the best denitrification effect can be achieved when mixed liquor with very low concentration of dissolved oxygen flows back to the front anaerobic tank. The process organically uses anaerobic / anoxic / aerobic process to realize synchronously the functions of organic matter removal, denitrification and dephosphorization.

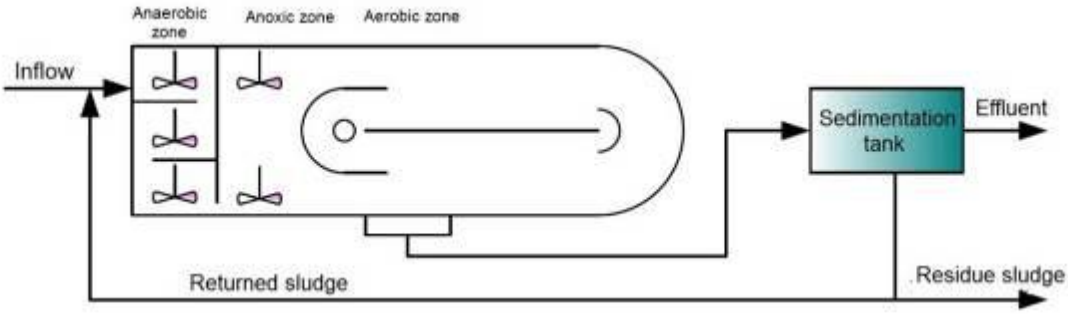


Figure 9.3.4-1 Technological Process of Improved Carrousel Oxidation Ditch

Currently many WWTP using improved oxidation ditch process have been built and put into operation in China, in which there are Fu'an City WWTP, Fuding Urban WWTP, and Wuyishan No.2 WWTP, etc. Running conditions of existing similar WWTP show that this process has the advantages of impact resistance, good ammonia nitrogen removal effect, COD index and water quality of effluent can steadily meet standard provided that standard-exceeding of inflow water quality is not too much; therefore it is feasible for Linshui No.3 WWTP to adopt Carrousel oxidation ditch as biochemical treatment process.

3) Advance treatment (tertiary treatment)

Advanced treatment is planned to adopt the process of “secondary sedimentation tank + rotary filter tank”.

Normal secondary treatment of sewage can only meet Class IB standard in Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002), and advanced treatment must be conducted in order to meet Class IA standard.

Commonly used advanced sewage treatment processes include coagulating sedimentation (or air floatation), filtration, activated carbon adsorption, chemical oxidation, etc. According to practical needs and the technical and economic factors single or comprehensive advanced treatment process may be used.

According to investigation on other domestic WWTPs like Binghe and Luofang WWTPs of Shenzhen, Phase I, and II project of Datansha WWTP of Guangzhou, Phase I, and II project of Sanwayao WWTP of Chengdu, in performing advanced treatment, all the said WWTPs adopt merely “direct filtration” to achieve advanced treatment effect, in addition to the advantages of very little demand for structures and automatic operation. Therefore this WWTP adopts the advanced treatment process of “direct filtration” by installing rotary filtration equipment to filter the secondary treatment effluent (i.e., effluent from the improved oxidation ditch).After advanced treatment by rotary filter tank, the effluent quality can meet Class IA standard in Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant (GB18918-2002).

4) Effluent disinfection plan

Disinfection must be performed for the effluent in order to reduce the total coliforms in WWTP tailwater. Commonly used disinfection methods include liquid chlorine, ClO_2, ultraviolet light, ozone, heat treatment, membrane filtration, etc. Based on overall consideration for applicability, maturity, security and reliability of engineering application, simple and easy operation, and processing costs of disinfection processes, ultraviolet light disinfection process is recommended to No.3 WWTP.

To sum up, upon the completion of wastewater treatment processes of WWTP, reasonable design parameters like the hydraulic retention time of oxidation ditch, sludge return ratio, etc. shall be selected for each treatment unit according to the actual inflow and effluent and water quality. While in design, the numbers of treatment structures like coarse grid, rotary filter tank, lifting pumps, oxidation ditch, etc. are all no less than 2 units (grids) and they are designed in parallel; in case the short term inflow is low, each treatment unit can start part of structures and operate them in grouping, thus not affecting the treatment effect.

Therefore, as long as the parameters are rightly selected and equipment stably operate, the wastewater treatment processes adopted by Linshui No.3 WWTP is feasible.

(2) Water pollution prevention and control measures

1) Sewage of staff, equipment wash water and initial rainwater in plant area shall be treated together by the WWTP.

2) Establish operation management and operational responsibility system for the WWTP, perform staff training, establish technical examination archives, those unqualified must not mount guard. Attach importance to the operation management of WWTP, find out problems and correct abnormal operation conditions in time to ensure that wastewater treatment facilities always operate normally and purposefully according to the change of inflow water quality.

3) In case of accident, strive to ensure the normal operation of grids and grit chamber to reduce the SS and COD in inflow water; in case of irresistible external causes like double circuit power cut, unexpected natural disasters which disable the effective treatment of sewage, start contingency plan and stop tailwater discharge in order to ensure the safety of waters.

4) Install online monitor and automatic control system

Strengthen monitoring on water pollution by introducing advanced control system, installing online monitor and automatic control system to perform on-line monitoring on the inflow and effluent quality of each treatment unit so as to know the operation condition of treatment facilities in time and rule out accident potential. Install pH, SS, COD, NH_3-N and TP online monitors for treatment tailwater and network such monitors with environmental protection department to ensure the quality of WWTP effluent discharged up-to-standard, avoid abnormal discharge and prevent accident discharge. Set up standard drain outlet and obvious signs as required.

5) The WWTP is an important environmental protection facility in LETDZ, however, the operation of WWTP alone is far from enough to improve the surrounding water environment and protect the water quality of Bajiao River; and environmental protection department, construction department, health department and municipal sectors in the Park shall perform their duties and implement coordinated management and duly perform daily monitoring work.

6) Water quality requirement for takeover industrial wastewater

According to EIA requirements, wastewater from enterprises in the Park must be pre-treated in plant (or shop) to meet the maximum allowable emission concentration stated in Table 1 for Type I contaminant, and the maximum allowable emission concentration stated in Table 4 for Type II contaminant in *Integrated Wastewater Discharge Standard (GB8978-1996),* before they can be discharged to sewage pipeline, so as to ensure the effective operation of WWTP and efficient treatment of wastewater.

Therefore, upon put into operation of WWTP, the Administrative Committee of LETDZ shall provide explicitly the takeover water quality of WWTP in the Bidding Document and issue notice informing local environmental protection department to facilitate executing discharge standard by resident enterprises and environment protecting management.

9.3.5 Groundwater environment protection measures and suggestions

To prevent seepage of wastewater from polluting the ground water, anti-seepage, anti-corrosion and anti-leakage treatment shall be performed for wastewater inceptor and sewage pipe, the ground of WWPT where pipes are laid on, and various treatment system of WWTP. Specific measures include:

- WWTP

(1) Basic criteria for construction condition

Wastewater treatment structures: the pool walls shall be vertical and have smooth surface, and concrete of the adjacent wet joints shall be tight and the thickness of concrete cover shall meet the specification; before placing pool wall concrete, the concrete construction joints shall be scabbled and washed clean, and concrete joints shall be free from leak; embedded pipe fittings, water stop and caulk board shall be firmly mounted in right position; full water test shall be performed for each pool to ensure quality.

Pipeline works: Quality control shall be strictly enforced in Project design and construction to prevent underground water pollution from the source; leakage of wastewater inceptor and sewage pipe and so on due to material, pipe fabrication, welding defects and operational errors shall be wiped out; strengthen anti-seepage treatment for pipe network, pool corners, bearings and joints. Strengthen monitoring in Project operation and make record for concealed works; perform regular inspection to effectively prevent wastewater leak.

(2) Zoned anti-seepage measures

Groundwater pollution prevention measures shall follow the anti-seepage measures of "source control, zoning control, pollution monitoring and emergency response" combining active and passive anti-seepage, dividing into three kinds of groundwater prevention zones, i.e., key pollution prevention zone, general pollution prevention zone and non-pollution zone. See Figure 15 for zoned anti-seepage plan.

The key pollution prevention zone covers water collection well, coarse grid, lifting pump room, find grid, rotational flow grit chamber, regulating tank, hydrolysis acidification tank, oxidation ditch, accident tank, secondary sedimentation tank, rotary filter tank, ultraviolet disinfection canal, sludge storage tank, sludge dewatering room, dosing room, mud cake cabinet, deodorization device and wastewater and sludge pipeline.

Anti-seepage concrete and HDPE anti-seepage measure (permeability coefficient ≤1.0×10-10cm/s) are adopted for key anti-seepage zone such as wastewater treatment tank body, temporary storage unit for sludge treatment and dosing room.

Water swelling strip is adopted for various structures construction and embedded waterstop and waterproof sealing material are adopted for deformation joint, in order to make the structures meeting the permeability standard as specified in the *Structural Design Code for Special Structures of Water Supply and Waste Water Engineering* (GB50069-2002).

Anticorrosive materials like stainless steel, carbon steel, or hot-dip galvanizing corrosion process shall be used for equipment component exposing to waste water.

The general pollution prevention zone incudes temporary storage site for general solid wastes, power distribution room, instrument room, warehouse for machine repair, blower room and roads in the plant.

The general anti-seepage zone is provided with the cement used for waterproof concrete and ordinary reinforced concrete structures, which ensures the quality of concrete casting, and certain amount of anti-cracking and water-proofing agent is added. With these measures, the permeability coefficient of the anti-seepage structure in the general pollution zone becomes less than or equal to 10^{-7}cm/s.

(3) Anti-floating measure for WWTP structures is mainly utilizing the weight of the structure itself, if the weight of structure itself is not enough for anti-floating, an anti-floating measure of combining balance weight (filled in the pond) and the weight of structure can be used.

(4) Develop an emergency plan for the risk accidents of groundwater and identify the closure and intercepting measures that should be taken under the condition of risk accident.

In conclusion, the Project will basically have no impact on the groundwater when the above measures are taken.

- Wastewater interceptors and wastewater pipeline works

(1) Wastewater pipe network shall have sufficient strength to withstand external load and internal water pressure;

(2) In addition to being able to withstand the scouring and wearing of impurities in wastewater, the wastewater pipe network shall have certain corrosion resistance to prevent it from being damaged by the corrosion of wastewater and ground water;

(3) The wastewater pipe network shall have good anti-seepage performance to prevent wastewater seepage or ground water infiltration;

(4) The inner wall of wastewater pipe network shall be smooth to reduce the friction loss of wastewater pipe;

(5) Strengthen management of construction quality; strictly control the construction quality of pipe and engineering technology.

The analysis believes that by taking the said measures it is possible to effectively control the seepage of wastewater to prevent polluting the ground water.

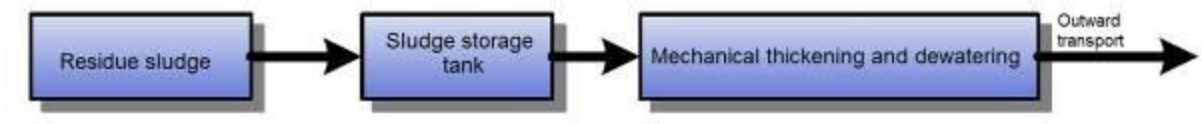
9.3.6 Environment protection measures and suggestions for solid waste

1 Sweep in time the road garbage; the garbage swept and collected shall be committed to local health departments for unified treatment;

2 According to WWTP sludge treatment plan, in short term sludge will be disposed by sanitary landfill which will be delivered to Linshui municipal solid waste landfill to be disposed together with the WWTP domestic garbage.

Sludge is a byproduct of WWTP, the treatment purpose of which is to reduce its moisture content and volume and to attain stable nature for further disposal and comprehensive use.Integrated mechanical thickening and dehydration process is adopted in WWTP design, followed by adding lime for final sludge dewatering.According to the quantity of wastewater effluent provided in design, about 82kg lime is required every day for the WWTP.

After dewatering by filter pressing and adding lime, the sludge moisture content of the proposed WWTP can fully meet the requirements for sanitary landfill (less than 60%). Therefore, disposing of sludge by Linshui sanitary landfill is feasible and its impact on the environment is trivial by virtue of the environmental protection measures of refuse landfill.



Mud cake cabinet and general waste storage area shall be provided in WWTP to collect respectively dewatered sludge, screenings and grit. Proper anti-corrosion and anti-seepage measures shall be taken for mud cake cabinet and general waste storage area; and household garbage shall be collected with bags.

Solid waste produced by the Project like grid residue, sand and garbage shall be delivered to Linshui refusal landfill for disposal; the said various solid wastes shall be collected and transported in time with enclosed vehicles to prevent sprinking and running off along the way in case secondary pollution.

According to the current conditions of enterprises within the scope of service of the WWTP, wastewater mainly consists of industrial wastewater and domestic wastewater. Industrial wastewater is mainly produced by enterprises of mechanical processing and manufacturing, electronic information, agricultural and sideline products processing, motorcycle accessories processing, food processing, and sludge is mainly organic pollutants. It is required to control from source the industrial wastewater produced by enterprises in ETDZ and to control strictly the quality of wastewater entering the WWTP; only when it meet relevant standard can wastewater enter into WWTP for treatment, in order to minimize the amount of heavy metals in the sludge of WWTP.

Therefore the sludge of WWTP will mainly be organism which is the residue of all kinds of microbes produced during biological treatment of wastewater. The dewatered mud cake of the WWTP is tentatively decided to be transported collectively by the municipal sanitary department to Wucha Waste Disposal Plant of Linshui County for landfilling.

Wucha Waste Disposal Plant of Linshui County has a daily processing capacity of 125t, covering an area of 86.19mu, of which the garbage library covers 58.1mu; it has a design service life of 14 years, adopts the treatment process of sanitary landfill. It was put into operation in the end of 2008; it is located in the north of No.3 WWTP, about 5km away.

However, given the fact that the service objects of the WWTP include mechanical processing and manufacturing, electronic information enterprises, and because the enterprises in ETDZ have not been constructed, there is uncertainty in wastewater composition. Therefore, after the WWTP is built and put into trial run, it is necessary to perform quantitative leaching analysis for sludge to decide its nature and finally determine its disposal destination. If it is identified as dangerous waste, then relevant procedures for dangerous waste disposal like a disposal agreement shall be obtained before the completion acceptance of WWTP; if it is identified as general solid wastes, then according to tentative plan it shall be collected by the municipal sanitary department and transported to Wucha Waste Disposal Plant of Linshui County for landfilling.

Special or part-time personnel shall be designated in WWTP to take charge of whole process management on the production, transportation, storage, treatment and disposal of sludge.Individuals or unit without relevant operation qualification are not allowed for sludge transport; transportation of sludge from WWTP to waste disposal plant shall be arranged at proper time and shall be along the designated route and shall not enter downtown as possible. The sludge transport vehicle shall be sealed with waterproof, leakage-proof and spillage-proof measures to prevent secondary pollution.

9.4 Mitigation measures and suggestions on social impact

1. Make sufficient preparation before construction; make detailed survey on roads and various ground and underground pipes and pipelines like communication, water supply and drainage, and gas, etc. affected by the Project, and coordinate in advance with relevant departments to determine demolition and relocation plans, and make various emergency works to ensure that construction would not affect the normal operation of necessary utilities like water, electricity, gas, and communication required by Linshui people and maintain a stable and normal social life.

2. The Contractor must strictly abide by *Law of the PRC on safe Production*, *Safe Production Regulations of Sichuan Province* and relevant laws and regulations. Prior to the commencement of Project, competent department of the company shall make safety technical disclosure to the engineering project department on key parts of the works and shall prepare official document; the head of Project department shall make construction organization technical disclosure to all construction management staff and shall prepare official document. Prior to the commencement of each work stage (component), the competent construction technical personnel of the Project department shall make safety technical disclosure to all construction workers and inform them about the hazards in workplace, about precautionary measures and accident emergency measures, and make records.

   Special measures and rules shall be enacted for the safety management on special work conditions like construction site, dangerous operations, working at heights, special weather operation, dig engineering construction, etc. and shall conduct special supervision. In this phase of monitoring the tenders visited on site all consistently comply with the safety management regulations and no major safety accidents occurred.

3. During road works construction, “Road work ahead, no passing” signs shall be set up at the entrance and exit of the road section in construction, and guidance for normal traffic shall be provided in the nearest distance. In principle, road works construction shall be conducted in the premise of not affecting the normal traffic of existing roads. Pay attention to passers-by in construction to prevent accident.

   Billboard shall be installed on the construction site to explain the Project content, construction time, to ask public understanding and forgiveness for the inconvenience due to construction, and indicate on the billboard contact person and complaints hotline, etc.

4. Reduce the impact of the Project on social environment by following the corresponding environmental planning in *Environmental Management Plan*.

5. In Project planning stage while performing plan optimization and comparison, pay as much attention as possible to the impact on local social and economic environment by the Project, and make this a key factor for plan optimization and comparison.

   To reduce housing demolition and resettlement quantity, the optimal design shall design different width for different road sections while basically maintaining the original right of way width, thus to minimize the impact on the socio-economy and people's lives. At the same time, use waste land and state land as much as possible to reduce farmland occupation.

   Strengthen basic data collection, make in-depth analysis on the status-quo and future development of local social economy, and make practicable Resettlement Action Plan based on the actual local conditions to ensure that the living standard of the affected persons will not reduce because of the Project construction.

Implement the compensation standard and compensation mode for land acquisition, demolition and resettlement proposed in Resettlement Action Plan to reduce the impact by Project construction.

6. Avoid construction in rainy season as possible, take good drainage measures, and make preparation for temporary works like construction road, and construction house.
7. Educate the constructors on safety and health, increase precaution consciousness, and make early warning and early prevention of dangers to prevent unnecessary loss.
8. In Project design, implementation, follow-up management and operation, enforce strictly public supervision mechanisms and information disclosure mechanism to ensure the Project to achieve targets and social benefits.

During Project preparation and Project design, perform social investigations and organize community public participation to solicit extensively public opinions on the Project; upon determination of red line for Project land acquisition, demolition and resettlement, publicize the physical quantity affected; the Project office shall set up special information dissemination channels and methods and shall publish regularly the advancement of Project implementation; in the process of Project implementation, it is required to publicize on government information public platform the Project design plan, resettlement action plan, Environmental Assessment Report, and social assessment report, etc. in order to accept public supervision and ensure feedback channels unblocked.

9.5 Environmental Protection Investment Estimate

The total investment for environmental protection of the Project reaches CNY91.6,245 million, of which total project investment is CNY854.4,574 million. The environmental protection investment accounts for 10.7% of the total project investment. See the table below for environmental protection works and investment estimate of the Project:

Table 9.4-1 List of Environment Protection Works Investment

<table>
<tr><th rowspan="2">Item</th><th rowspan="2" colspan="2">Content</th><th colspan="3">Project investment (CNY 10,000)</th></tr>
<tr><th>Already Included in the Main Works</th><th>Newly Added</th><th>Total</th></tr>
<tr><td rowspan="2">Ecological environment and water and soil conservation</td><td colspan="2">Shrub planting, seed broadcasting, drainage ditch, desilting culvert, land reclamation, shrub planting, seed broadcasting and temporary soil drainage ditch</td><td>6117.31</td><td>857.39</td><td>6974.7</td></tr>
<tr><td colspan="2">Landscaping</td><td>1260.65</td><td>/</td><td>1260.65</td></tr>
<tr><td rowspan="2">Acoustic environment</td><td>Construction period</td><td>Temporary sound insulation enclosure, etc.</td><td>/</td><td>10</td><td>10</td></tr>
<tr><td>Operation Period</td><td>Measures like sound proof window reserved</td><td>/</td><td>92</td><td>92</td></tr>
<tr><td rowspan="4">Air environment</td><td>Construction period</td><td>Dust-proof measures like watering</td><td>/</td><td>20</td><td>20</td></tr>
<tr><td rowspan="3">Operation Period</td><td>Deodorization device</td><td>35</td><td>/</td><td>35</td></tr>
<tr><td>Canteen fume purifier</td><td>/</td><td>1</td><td>1</td></tr>
<tr><td>Plant greening</td><td>Already listed in landscaping</td><td>/</td><td>/</td></tr>
</table>

Item	Content		Project investment (CNY 10,000)		
			Already Included in the Main Works	Newly Added	Total
		Resettlement fee	/	10	
Surface water environment	Construction period	5 sets of sedimentation tanks and privies established in the construction camp	/	50	50
	Operation Period	Installation of on-line monitoring device	/	100	100
		Installation of central control system	262.7	/	262.7
Groundwater environment	Construction period	Combined with the measures for surface water during construction and collect construction wastewater and domestic sewage in a unified manner	/	/	/
	Operation Period	Anti-seepage measures for wastewater collection and treatment structure, sludge treatment unit and dosing room	301.4	/	301.4
Solid wastes	Construction period	Collect domestic waste and construction waste for centralized treatment	/	5	5
	Operation Period	Mud cake cabinet and temporary storage site for general waste	/	5	5
		Domestic waste and street refuse collection and treatment	/	20	20
Environmental risks	Operation Period	One accident emergency pool for collecting wastewater	/	15	15
Total	/	/	7977.06	1185.39	9162.45

10 Environmental Management and Monitoring

The implementation of the Project causes a certain impact on socio-economic and physical environment in the local area. Therefore, environmental management is strengthened during the construction and operation period, and series of pollution control measures are implemented effectively, thus receiving the combined benefits in the fields of economy, society and environment.

10.1 Objectives

The Project causes a certain impact on social ecological environment, physical environment, socio-economic environment and people's living quality. Necessary environmental management and monitoring plans need to be prepared during the construction and operation period so that effective environmental protection measures are taken in time to reduce or eliminate the adverse impacts.

The main objectives: to define environmental management roles and responsibilities; to prepare proper mitigation measures; to establish monitoring procedures; and to provide the adequate budget to ensure the effective implementation of environmental management plan.

10.2 Environmental Management Suggestions

Avoid the adverse impacts on the environment due to the project construction, improve environmental management during the construction period, ensure the implementation of “Three Simultaneousnesses" principle and environmental protection measures of the Project, and establish and improve relevant environmental management system.

10.3 Environmental Management Targets

Systematic and scientific environmental management plan is prepared so that the construction and operation of the infrastructure project for the LETDZ in World Bank loan funded Sichuan-Chongqing cooperation (Guang'an) demonstration area conforms to the basic guidelines of "three simultaneousnesses" principle, i.e. “simultaneous design, simultaneous construction and simultaneous hand-over acceptance”. The plan provides a basis for the systematic implementation of environmental protection measures and the relevant supervision of the local environmental protection department.

Environmental management plan is prepared to minimize the adverse environmental impacts caused by the proposed works, thus realizing the coordinating, sustainable and stable development of social, economic and environmental benefits of the project construction.

10.4 Environmental Management

10.4.1 Management organization and responsibilities

The implementation of this EMP requires the involvement of several agencies and institutions, each playing a different but vital role to ensure effective environmental management of the Project.

There are two groups of institutions involved in the process of environmental management: those responsible for organizing or implementing the EMP, and those that enforce the standards, laws and regulations relevant to the project, supervise the EMP and the overall environmental performance during the construction and operation period of the Project. Diagram of environmental management and supervisory agency structure of the Project as shown in the following figure.

10.4.2 Responsibilities of environmental management institutions

The main environmental management responsibilities of the respective environmental management institutions are shown in the table below:

Table 10.4.2-1 List of Environmental Management and Supervisory Responsibilities

SN	Agency/Unit	Responsibilities
1	Linshui County People's Government (WBPMO)	Take the overall responsibility for environmental management of the Project, involving the effective implementation, monitoring and supervision of mitigation measures; report the budget to World Bank and local environmental protection bureau. Ensure that the measures involved in EMP are included in the bid documents and construction contract; Carry out the supervision on the construction unit for the implementation of pollution prevention measures, and report any infringement to the construction unit; Make sure that the supervision performed by Environmental Protection Bureau is included in the bid documents and contracts signed by the supervision engineer; monitor and engage in the supervision of the Project; Entrust environmental monitoring institution to monitor the environment during the construction period; provide supports for environmental monitoring during the construction period; Organize trainings related to environment for Contractors and ESE
2	Linshui Environmental Protection Bureau	Linshui Environmental Protection Bureau is responsible for environmental management and monitoring within the scope of LETDZ. On behalf of Sichuan Environmental Protection Bureau, carry out monitoring and supervision on environmental protection during the construction and operation period. Investigate and deal with public complaints during the construction and operation period. Ensure "Three Simultaneous" and normal operation of environmental protection facilities.
3	Linshui County Yuanfeng Industrial Development Co., Ltd.	Linshui County Yuanfeng Industrial Development Co., Ltd. is responsible for the implementation of infrastructure project funded by World Bank, including procurement, construction management, the implementation and compliance of safeguard policy, monitoring and reporting, etc.
4	Project operators	Operation of the environmental facilities and environmental management, etc. during the operation period.
5	Environmental supervision engineer (ESE)	Verify and assess whether the construction design meets the requirements for EIA and EMP, in particular, environmental management on the construction site and required mitigation measures; Monitor contractors' environmental management on the construction site, and provide proper guidance; Examine the implementation of contractors' EMP, verify and confirm environmental monitoring procedures, parameters, monitoring sites, equipment and results; Report the implementation condition of EMP; Based on the implementation of EMP, verify invoices or expenses.
6	Contractors	Prepare detailed contractors' environmental protection plan, as a part of the contract (including construction land plan related to access roads to communities or commercial stores). Report new environmental issues or cultural relics discovered during the construction period to the supervision engineer. Perform the continuous public

SN	Agency/Unit	Responsibilities
		consultations during construction.
7	Project operators	Operation of the environmental facilities and environmental management, etc. during the operation period.
8	Independent environmental management consultant (IEMC)	The IEMC, who is employed by the project owner, is independent of ESE and contractors. The IEMC is to assess the implementation of EMP during the construction period, to provide management suggestions and finally ensure that the Project satisfies the requirements for EMP.
9	Environmental quality monitoring consultant (EQMC)	The EQMC monitors the environment quality according to environment monitoring plan involved in EIA report. The project owner will engage an EQMC to implement the monitoring plan.

10.5 Environmental Supervision

10.5.1 Objectives, scope and stages

Environmental supervision is an important means to guarantee the effective implementation of EMP. The objective of environmental supervision is to perform the relevant obligations and to provide independent, fair, scientific and efficient services for the Project; to implement the environmental monitoring, to ensure that the Project conforms to national laws, regulations and policies, WB technical standards and specifications, approved design documents, bid documents and supervision and construction contract, the requirements for environmental protection and management in terms of design, construction and operation.

Based on the contract, each engineering supervision company shall entrust a professional ESE, who is responsible for the supervision on environmental protection performed by contractors by stages.

The scope of environmental supervision includes the construction area and densely populated areas of the Project. Environmental supervision is performed during the whole process, including: Construction preparation, construction and completion stages.

10.5.2 Environmental management contents

1. Environmental supervision before construction

ESE shall ensure the following tasks to be done before construction:

To assess pollution prevention control mechanism: Review treatment and disposal measures on discharged wastewater, wastes and solid wastes during construction, including the selection and feasibility of technology.

To review the contractor’s construction land plan and ensure that the following measures are included:

a) To ensure smooth traffic;

b) To minimize interference and other damages.

To review environmental protection clauses involved in the construction contract: The contractor shall meet all requirements for environmental protection as specified in the contract. During the construction period, the contractor is responsible for supervision, inspection and test work to minimize pollution.

2. Environmental supervision during the construction period

ESE shall perform the onsite inspection at different stages, for instance, check whether the construction conforms to environmental protection clauses, or the clauses are changed without any permission. The monitoring is adopted to make sure whether the operation meets the requirements for environmental protection during the construction period and the works meets the environmental protection standards. In addition, effective implementation of these measures is ensured. Main contents include:

Monitoring transportation of surplus materials, transportation management, the construction plan on the access roads to communities or commercial stores, pedestrian safety measures, etc.

Performing the supervision on soil conservation measures; in addition, minimize water pollution during the construction period. The measures include:

a) Soil conservation;

b) Spoil disposal;

c) Implementation of temporary and long term erosion control measures;

d) Implementation of sediment reduction measures (sedimentation tank and sediment fence);

e) Ensuring that the designed runoff control measures are taken properly;

f) Normal operation of all wastewater treatment facilities.

Supervising production and domestic sewage: to check treatment and disposal schedule for production and domestic sewage source and wastewater, treatment procedures and final treatment plant; to examine and supervise whether treatment measures meet the allowable discharge standards.

Environmental supervision on air pollution: air pollution in the project area is mainly the waste gas from all vehicles and fugitive dust produced during the construction period. The strict implementation of fugitive dust control measures by the contractor is ensured.

Environmental supervision on noise: noise attenuating measures shall be taken in accordance with design parameters and allowable noise level.

Environmental supervision on solid waste treatment: Solid waste treatment shall satisfy local requirements; effective cleaning measures are taken to maintain a clean and tide construction site. ESE will monitor the spoil transportation, which is responsible by building garbage transportation authorities.

Environmental supervision on greening plan: vegetation protection measures, in particular, the implementation of measures on tree protection and transplantation and the greening plan.

Environmental supervision on safety and health: to ensure that adequate safety and health measures shall meet relevant rules and regulations.

3. Supervision at the completion stage

ESE shall perform monitoring and management on environmental restoration and all pollution prevention control equipment, including:

Perform the supervision on prepared completion documents;

Organize initial inspection;

Assist World Bank (Guang’an) PMO in organizing the completion acceptance of the works;

Prepare final report of environmental supervision of the project.

4. Environmental Management during Operation

Organization and implementation of environmental monitoring during operation

10.6 Environment Monitoring Plan

10.6.1 Objectives

The objectives of environmental monitoring plan include: To monitor surrounding environmental quality and pollution emission amount, and implementation of inspection measures, and to provide a basis for mitigation and corrective measures on environment.

10.6.2 Responsibilities of implementation

The project owner shall entrust the qualified environmental monitoring institution (for example, local environmental monitoring station) to perform environmental monitoring during the construction and operation period.

10.6.3 Environment monitoring plan

Based on characteristics of works and construction operation at each stage, the monitoring plan during the construction and operation period is listed in Table 10.6-1.

Table 10.6-1Construction Period and Implementation of Environmental Monitoring Schedule

Category	Item	Monitoring Plan at each Stage	
		Construction Period	Operation Period
Acoustic environment	Monitoring location	The operation site with a large amount of operating equipment, especially in the area near the main sensitive area	Dongguawan, Xubwuzui, Wangjiawan, Xinfangzi, Group 6, Poshi Village, Meijiawan, Shiba Village, Liujiawan, Hejiayakou, etc.
	Factors to be monitored	Equivalent continuous sound level (L_{Aeq})	Equivalent continuous sound level (L_{Aeq})
	Monitoring frequency	Once/month	Once/quarter
Water environment	Monitoring location	Construction camp and construction site	The outlet of WWTP and its downstream
	Factors to be monitored	COD_{Cr}, BOD_5, SS and petroleum	pH,COD_{Cr},BOD_5,NH_3-N,TP
	Monitoring frequency	Once/quarter	To conduct real-time monitoring at the outlet, and conduct a monitoring once a month at the downstream
Air quality	Monitoring location	The operation site with a large amount of operating equipment, the sensitive area or on unpaved roads or empty grounds near the sensitive environment	WWTP boundary and three monitoring locations in the downwind direction at the boundary
	Factors to be monitored	PM_{10}	H_2S,NH_3 and odor intensity
	Monitoring frequency	To perform random sampling during the peak construction period	One day/quarter
Water and soil conservation	Monitoring location	Road works (K4+760.340, K3+124.577, K1+845.480.K1+070.860, K0+839.460, temporary soil storage yard),wastewater interceptors pipe area, Linshui No.3 WWTP, surface soil stacking area(K4+900)	Road works (K4+760.340, K3+124.577, K1+845.480.K1+070.860, K0+839.460, temporary soil storage yard),wastewater interceptors pipe area, Linshui No. 3 WWTP

Category	Item	Monitoring Plan at each Stage	
		Construction Period	Operation Period
	Monitoring Content	Disturbed surface area and level, amount and level of damage of original water conservation facilities, the area of stacked soil, implementation of prevention and control measures, water and soil loss hazards caused on the surrounding environment	The quality, intactness, stability and dammed slag or ashes and sediment results of works measures, such as slope protection drainage ditch; the number and treatment area involved by prevention and control measures; the survival rate, storage, coverage rate and area of forest and grass; site clearing and leveling
	Monitoring frequency	To monitor disturbed surface area once a month; once every three months for impact factor of water and soil loss; to perform the timely monitoring in case of rainstorm and strong wind, etc.	To take Vegetation measures for water and soil conservation; to conduct the monitoring on the growth once every three months during the recovery period of forest and grass; to perform the timely monitoring in case of rainstorm and strong wind.

10.6.4 Environmental monitoring report

1. Environment monitoring report during the construction period

The construction lasts about 48 months as performed according to the works contents at different stages. According to environmental management regulations of PRC and requirements of World Bank for business policy, the Owner shall prepare *Environmental Monitoring Report* and submit it to World Bank and Environmental Protection Bureau of Guang'an. The objective of the report is to assure environmental protection authorities that all environmental protection measures are implemented as required by the approved environmental monitoring plan in order to eliminate the adverse environmental impacts of the project plan.

Environmental monitoring report includes:

a) Brief introductions to works progress;

b) The establishment and responsibilities of environmental management institutions;

c) Main construction contents and methods, environmental impacts caused and mitigation measures and the relevant implementation;

d) Environmental monitoring report;

e) Public complaints and resettling

According to construction management provisions, the contractor and ESE shall submit the periodic environmental report to the Owner during the construction period.

2. Environmental monitoring report during the operation period

After the proposed project is put into operation, World Bank Loan (Guang'an) PMO entrusts the qualified environmental monitoring station to undertake the environmental monitoring in accordance with the monitoring plan. In addition, annual environmental monitoring report is prepared, and its contents include: The establishment of the environmental management institution, operation status of the works, the implementation of environmental prevention measures as required by the environmental protection bureau, environmental monitoring (date, frequency, locations, methods, applicable standards, etc.), statistical analysis results of monitoring data and necessary follow-ups. The prepared environmental monitoring report shall be submitted to Environmental Protection Bureau of Guang'an and World Bank

10.7 Environmental protection training

1. Environmental protection technology and skill training

(1) In-service training for environmental management personnel

The objective of organizing in-service training for environmental management personnel is to strength environmental management during the construction and operation period, and to ensure the quality of environmental monitoring and effective environmental management, thus improving the quality of the whole works. After participating in position training, environmental management personnel can tell apart main environmental issues during the construction period, and have a better understanding of existing problems and deficiencies on environmental management, and report to the engineering environmental protection office (department) in time in order to facilitate to take necessary prevention and control measures as soon as possible. During the construction period, project management institution shall invite environmental protection experts or environmental management personnel with similar management experience to make the onsite explanation on environmental problems and relevant solutions.

(2) Construction responsible personnel and training for construction workers

Before the construction, for the bid winner, the systematic environmental professional knowledge training shall be organized for the responsible personnel and construction workers responsible for construction in order to avoid environmental damages due to misoperation during construction. For contract responsible personnel, the objective of training is to define the environmental protection responsibilities of the contractor; for construction workers, the objective is to ensure the proper construction operation during the construction period in order to avoid some construction behaviors, which have adverse impacts on the environment. The training is helpful for the project responsible personnel to understand their obligations in environmental protection needed to be assumed and possible consequences of the environmental damage; construction workers have a better understanding of the protection level and methods for environmental sensitive areas. Based on the actual situation of the Project, the training for construction workers only lasts one week.

(3) During the operation period, project management institution shall provide the personnel with the periodic trainings on environmental protection knowledge so as to identify possible environmental issues at respective posts and take necessary measures. Each personnel shall hold the idea of environmental protection.

2. Training methods and expenses

Table 10.7-1Environmental Protection Training Plan

SN	Training Objects	Training Contents	Organizer	Training number	Training Time	Location	Budget (CNY10,000)
1	Personnel from PMO and engineering environmental protection office (department)	Knowledge in environmental protection management	The Owner	2 persons	15 days	Guang'an	0.6
2	Personnel from PMO and engineering environmental protection office (department)	Visit similar domestic project site so as to learn the mature environmental management experience.	The Owner	2 persons	5 days	/	0.2

SN	Training Objects	Training Contents	Organizer	Training number	Training Time	Location	Budget (CNY10,000)
3	Personnel from PMO and engineering environmental protection office (department)	Acquire all-round knowledge in environmental protection and management and understand the contents of environmental impact report of the works.	The Owner	2 persons	15 days	Guang’an	0.3
4	Site responsible personnel from supervision unit and engineering environmental supervisor	Knowledge in environmental supervision, the contents of environmental impact report of the works and environmental protection design documents related to the works	The Owner and Supervision Unit	1 persons	15 days	Guang’an	0.3
6	Main technical leaders and construction responsible personnel of the Contractor	Knowledge in environmental protection and management	The Owner and the Contractor	3 persons	15 days	Guang’an	0.9
7	Construction workers	Knowledge in environmental protection of the works	The Owner and the Contractor	150 persons	5 days	Guang’an	7.5
Total				/	/	/	9.8

10.8 Completion and Acceptance Inspection

Environmental issues shall be fully considered in the project design. Appropriated works measures are taken to protect environment during the project operation period. According to the relevant regulations on the completion acceptance inspection of environmental protection facilities, the owner shall submit an application for the completion acceptance inspection of the works to Environmental Protection Bureau of Guang’an, prepare monitoring plan and perform the monitoring after approved by Environmental Protection Bureau.

Table 10.8-1Execution Plan of Environmental Protection Measures

Content / Environment	Pollutants	Prevention and Control Measures	Execution Unit	Supervision Unit	Capital Source	Implementation Period
Ecology	Water and soil loss control	Apply dust cloth to cover temporary stacking site.	The Owner and the Contractor	Governmental departments	Included in the contractor’s quotation	Construction Period
	Vegetation recovery	Land reclamation and replanting of trees and flowers in the temporary land.	The Owner and the Contractor	Governmental departments	Special investment for the works	Operation Period
Noise	Noise of construction machinery	Reasonably arrange construction time and strengthen management.	The Owner and the Contractor	Governmental departments	Included in the contractor’s quotation	Construction Period
		Install temporary noise isolation screens.	Contractors	Governmental departments	Included in the contractor’s quotation	
	Traffic noise	Reserve budgets for noise isolation measures taken.	The Owner and the Contractor	Governmental departments	Special investment for the works	Operation Period

Content / Environment	Pollutants	Prevention and Control Measures	Execution Unit	Supervision Unit	Capital Source	Implementation Period
Water pollutant	Construction muddy water and muddy wastewater from piers drilling	Reuse the upper water upon preliminary sedimentation.	Contractors	Governmental departments	Included in the contractor's quotation	Construction Period
	Mechanical rinse water	Recycle the wastewater upon oil removal and sedimentation.	Contractors	Governmental departments	Included in the contractor's quotation	
	Domestic sewage	Use as farming fertilizer after preliminary treatment in the septic tank	Contractors	Governmental departments	Included in the contractor's quotation	
	Fecal sewage					
	Domestic sewage produced by working staff	Enter into the pipe network after the treatment in the septic tank.	Operators	Environmental protection authorities	Special investment for the works	Operation Period
Air pollutant	Demolition fugitive dust of buildings	Provide dust cloth and other sealing nets around the buildings.	The Owner and the Contractor	Governmental departments	Included in the contractor's quotation	Construction Period
	Fugitive dust	Provide dust cloth in the temporary storage yard in the prevention and control of dust, clear up the site.	The Owner and the Contractor	Governmental departments	Included in the contractor's quotation	
	Vehicle fugitive dust	Water for dust fall and provide the washing sites at in and out door for vehicles	The Owner and the Contractor	Governmental departments	Included in the contractor's quotation	
Solid waste	Spoils	Transport to Linshui Environmental Health Administration Office for timely treatment.	The Owner and the Contractor	Governmental departments	Included in the contractor's quotation	Construction Period
	Domestic waste	Deliver to environmental health departments for unified treatment.	Contractors	Governmental departments	/	
	Wastes scattered on the roads	Onsite recycling and timely collection	Operators	Environmental health departments	/	Operation Period
Environmental management and monitoring	/	Implement construction environmental supervision system, establish contract constraint mechanism, integrate relevant environmental protection measures into product quality management	Relevant qualified units entrusted by The Owner	Governmental departments	Special investment for the works	Construction Period

Content / Environment	Pollutants	Prevention and Control Measures	Execution Unit	Supervision Unit	Capital Source	Implementation Period
		system and acceptance index system, strengthen the special supervision on control measures for construction fugitive dust, noise and water and soil loss, etc., and publicize environmental protection laws and regulations.				
Environmental Monitoring	/	Environmental noise and air quality with the area	Relevant qualified units entrusted by The Owner	Environmental Protection Department of Guang'an	Special investment for the works	Construction Period Operation Period

11 Public Consultation and Information Disclosure

11.1 General

11.1.1 Objectives of Public Consultation

Public consultation is two-way communication between the project Owner, Environmental Assessment Working Group and the public. The objective is to provide the access for the public to fully understand project conditions via public consultation in order to gain public acceptance and improve environmental, economic and social benefits of the Project.

For development and construction of the Project, construction, completion and operation have positive or negative impacts on surrounding physical environment and social environment, thus directly or indirectly affecting living, working, studying, rest and entertainment of nearby residents. Local residents are direct or indirect beneficiaries or victims affected by the Project. Public consultation is helpful to avoid possible omission and negligence in EIA, thus providing comprehensive protection for physical and social environment. Their reasonable opinions and views are helpful to prepare complete and rational construction scheme of the Project and formulate feasible environmental protection measures, thus demonstrating better environmental, economic and social benefits of the Project.

Public consultation is helpful to let more people understand the significance of the proposed project and possible environmental issues in order to obtain understandings and supports from the public. It is also beneficial for the smooth implementation of the works. Furthermore, public consultation has a positive effect on improvement of environmental protection conscience and voluntary participation in environmental protection.

11.1.2 Principles of public consultation

Public consultation survey keeps to the principle of combining representativeness and randomness. Representativeness means that the respondents come from all walks of life in accordance with a certain proportion. Randomness means that the choice of respondents is characterized by statistically random sampling. The respondents are randomly selected from determined sampling population.

11.1.3 Survey scope and respondents

The survey scope of the public consultation mainly includes the areas along the Project. The respondents include personnel from local governments at all levels and relevant departments, entities or enterprises and government departments, staff from entities or enterprises, workers, teachers and students and self-employed workers directly affected by the construction. The selection of public representatives is characterized by favorable randomness and broad representativeness, taking gender, age, occupation and education background of the public into consideration.

11.1.4 Types and methods of public consultation

The construction will cause different levels of impacts on physical environment and social environment along the line. In order to obtain the attitude toward and views of the public on the construction, the specific survey methods applicable to the public consultation are as follows:

1) Visit relevant departments and units along the Project in order to understand their opinions on environmental impacts of the Project and demands.

2) Convene the public consultation symposium; introduce the overview of the works, estimated environmental impact factors, strength and scope; consult the public for related comments and opinions on the construction project; and listen to their advice;

3) Give out public consultation questionnaires to the residents along the Project, and pay attention to representativeness and randomness.

4) Make announcements via the internet or newspaper and other media, and listen to public opinions as widely as possible.

5) Posting announcement is beneficial to make the public understand the works in time; in addition, it also facilitates to give opinions on the project construction and environmental protection for the public without any chance to fill the questionnaires.

11.2 The First Round of Public Consultation

The first round of public consultation involved website announcement, interview investigation and consulting local functional departments for opinions and suggestions on the Project. Through investigation, the assessment unit had a basic understanding of main concerns and attitudes of local residents and functional departments during the project construction and operation period.

1. Website announcement

After receiving the EIA task, the EIA institute publicized the EIA report on the portal website of Guang'an Development and Reform Commission (http://www.gasfgw.gov.cn/) for the first time on Apr. 22, 2014.

利用世行贷款川渝合作（广安）示范区基础设施建设项目环境影响评价第一次公示

日期：2014年4月22日 作者：财贸外经科

一、项目名称及概要

项目名称：利用世行贷款川渝合作（广安）示范区基础设施建设项目

项目概要：本项目包括：

1、利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目，包含道路工程、截污干管工程、污水处理厂工程等子项目。

2、利用世行贷款川渝合作（广安）示范区前锋区工业园区基础设施建设项目，包含道路工程、芦溪河景观改造工程等子项目。

二、环境影响评价的工作程序和主要工作内容

1、工作程序

①建设单位委托有资质的环评机构；②第一次公示；③在环境质量现状调查以及项目工程分析的基础上，进行环境影响预测并编制初稿；④第二次公示；⑤公众意见调查；⑥编制环境影响报告书；⑦上报环境影响报告书及其他相关材料至环境保护主管部门审查、报批。

2、主要工作内容

①项目现场踏勘调查监测；②环境影响预测分析与评价；③提出环境保护对策措施及建议。

三、征求公众意见的主要事项

征求公众对环境保护方面的意见和建议，非环境保护方面的内容不在本次征求意见范围内。

四、公众参与主要方式

Figure 11.2-1 The First Round of Information Disclosure

B Interview investigation

During the site work, EIA workers visited local residents at random and provided them with basic information about the project construction and environmental impacts caused during the construction and operation period.Local residents had a certain understanding of the Project and supported the project construction. They expected that the earlier completion of the Project made it more convenient for the local residents in the future and improved the environmental quality in Linshui County.In addition, the public to be interviewed expected that land acquisition and house demolition shall conform to the relevant regulations; measures shall also be taken to prevent noise, water and soil loss and other environmental impacts produced by the roads.

Figure 11.2-2 Visit Local Residents

C Consult local functional departments for opinions

The EIA workers visited many administrative authorities in respect of planning, cultural relics and land resources etc., reported the relevant situation of the Project and listened to their opinions on environmental protection, water and soil conservation, soil resource protection, urban planning, cultural relic protection and animal and plant resources protection possibly involved in the project construction.

Local administrative departments at all levels would provide enormous supports for the project construction and expected that the railway construction was started as quickly as possible. As for their respective issues of concern, local administrative departments at all levels proposed specific opinions and suggestions in combination with local conditions:

Opinions from Planning Department: the construction is coordinated with urban planning, and the road construction keeps to the principle of convenient traffic and significant economic radiation driving effects. Wastewater interceptor construction shall comply with the terrain. During construction, the road to be occupied is minimized in order to avoid the long-term impacts on the traffic. The location of WWTP shall be consistent with the urban planning, and better services are provided for Linshui County.

Opinions from Department of Land and Resources: during the route selection, reduce the occupation of farmland, particularly basic farmland, establish compensation standard for the basic farmland occupied by the works, and realize “requisition-compensation balance” of basic farmland; reasonably construct the spoil area, occupy less farmland, combine the spoil area with land change and reclamation, eliminate the impact on the agricultural production caused by the project land occupation to the utmost extent; for the basic farmland to be occupied permanently, go through the approval formalities following relevant procedures by the Owner according to provisions under *Regulations on the Protection of Basic Farmland.*

Opinions from Cultural Relics Administrative Department: Wastewater interceptors are close to “Lingbaoshan Cultural Relics Protection Unit”, so please pay attention to the preservation of cultural relics during construction. During the construction of the Project, in case of any buried cultural relics discovered by the Owner and Contractor, cultural relic protection shall be performed in accordance with the relevant provisions under *Law of the People's Republic of China on Protection of Cultural Relics.*

11.3 The Second Round of Public Consultation

11.3.1 Survey method

A Website announcement

Upon completion of the EIA report, the environmental assessment unit publicized it on the portal website of Guang'an Development and Reform Commission (http://www.gasfgw.gov.cn/) for the second time in 2014.*Environmental Impact Assessment (EIA) Report of the Linshui component of the Sichuan-Chongqing Cooperation: (Guang'an) Demonstration Area Infrastructure Development Project* linked to the website provided the relevant information about project overview, environmental impact, environmental protection measures and preliminary assessment conclusions etc.

广安市发展和改革委员会
Guangan Municipal Development and Reform Commission
114年4月22日 星期二 网站首页 | 主要职能 | 领导介绍 | 政务服务 | 直属单位 | 资料交换 | 信息报送

利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目环境影响评价公众参与第二次公示

日期：2014年7月3日 作者：财贸外经科

一、建设项目情况简述
本工程位于广安市邻水县，为广安市邻水经济开发区基础设施建设项目，本工程包含3个子项目，分别为道路工程（新建邻水经济开发区、西部新城内5条道路，分别为一号路、二号路、三号路、四号路、五号路）、沿石坝河截污干管工程及污水处理厂工程。
表1 主要工程内容
序号 工程内容 建设内容
1道路工程 新建广安邻水县工业园区5条道路，道路总长约12km
2截污干管工程 沿石坝河两岸新建2条截污干管，管长约1km，管径DN400～DN1200。
3污水处理厂工程 位于邻水县城南新和村3组，预计处理规模近期5000m3/d，远期10000m3/d，改良型氧化沟工艺，受纳水体为芭蕉河
二、建设项目对环境可能造成的影响及主要防护措施
1、施工期
施工期的不利影响主要有：施工扬尘对环境空气质量的影响；施工车辆噪声和施工机械噪声对周围环境的影响；施工生产废水和生活污水对地

Figure 11.3-1 The Second Round of Information Disclosure

广安市发展和改革委员会
Guangan Municipal Development and Reform Commission
114年4月22日 星期二 网站首页 | 主要职能 | 领导介绍 | 政务服务 | 直属单位 | 资料交换 | 信息报送

利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目环境影响评价公众参与第二次公示

日期：2014年7月3日 作者：财贸外经科

一、建设项目情况简述
本工程位于广安市邻水县，为广安市邻水经济开发区基础设施建设项目，本工程包含3个子项目，分别为道路工程（新建邻水经济开发区、西部新城内5条道路，分别为一号路、二号路、三号路、四号路、五号路）、沿石坝河截污干管工程及污水处理厂工程。
表1 主要工程内容
建设单位：世行贷款广安项目办 联系人：倪女士 电话：0826-2332800 传真：0826-2332800 电子邮箱：6765161@qq.Com 通讯地址：广安市广安区兴安中街227号 邮编：638500
环评机构：中铁二院工程集团有限责任公司 联系人：魏女士 电话：028-87702625 传真：028-87672263电子邮箱：teygho@263.net.cn 通讯地址：四川省成都市通锦路3号环境工程研究院 邮编：610031

利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目

来源：市发展改革委

Fig. 11.3-2 EIA Disclosure Link

The EA was further revised after above disclosure and consultation. Revised full EA was disclosed at the website of Guang'an DRC on August 22, 2014, with newspaper announcement on Guang'an Daily on August 23, 2014; see below pictures.

广安日报

2014年8月 23 星期六

邓小平故里展现出焕然

王宁参观"两馆"缅怀

我市举行纪念邓小平同志诞辰110周年献花

侯晓春作重要讲话 全市机关单位干部职工组成30个方阵向邓小平铜像敬献花

广门乡妇联 积极维护妇女儿童合法权益

双鄢乡加强农村

利用世行贷款川渝合作(广安)示范区邻水县工业园区基础设施建设项目

环境影响评价公众参与第二次公示

利用世行贷款川渝合作(广安)示范区前锋区工业

环境影响评价公众参与第

中国银行业监督管理委员会广安监管分局

关于发放《中华人民共和国金融许可证》的公告

商务车转让

江淮瑞风七座商务汽车一辆欲转让，该车购于2013年7月，九成新，现行驶里程3万余公里，内置装配豪华。有意者，价格面议！

联系人：杨先生 13509492267

遗失启事

Fig. 11.3-3 Newspaper Announcement of full EA disclosure

广安市发展和改革委员会
Guangan Municipal Development and Reform Commission

2014年8月28日 星期四 网站首页 | 主要职能 | 领导介绍 | 政务服务 | 直属单位 | 资料交换 | 信息报送

利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目环境影响评价公众参与第二次公示

日期：2014年8月22日 作者：财政外经科

受世行贷款广安项目领导小组办公室委托，中铁二院工程集团有限责任公司正开展“利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目环境影响评价”工作，现依据《环境影响评价公众参与暂行办法》对本项目进行公示，并征求公众意见。

1、查阅公示方式与期限：公众可登陆广安市发展改革委员会门户网站（http://www.gasfgw.gov.cn/）查询本项目相关信息；或于邻水县经济开发区管委会查询报告书文本。

同时，自本公示公布之日起11个工作日，公众可通过电话、电子邮件、信函、传真等方式向建设单位或环评机构提出对项目环境保护方面意见和建议。

2、征求意见的范围及主要事项：本公示主要征求公众对项目环境保护方面意见，非环境保护方面的内容不属本次征求意见范围内。

3、联系方式：

建设单位：世行贷款广安项目办 联系人：倪女士 电话：0826-2332800 传真：0826-2332800 电子邮箱：6765161@qq.Com 通讯地址：广安市广安区兴安中路227号 邮编：638500

环评机构：中铁二院工程集团有限责任公司 联系人：魏女士 电话：028-87702825 传真：028-87672263 电子邮箱：tayghc@263.net.cn 通讯地址：四川省成都市通锦路3号环境工程研究院 邮编：610031

查看报告书请点击以下链接：http://www.guang-an.gov.cn/newscenter/content.jsp?id=86915&classId=0225

来源：市发展改革委

Figure 11.3-4 Full EA available at the website of Guang’an DRC

B Posting announcements

During EIA, post *Public Consultation Announcement for Environmental Impact Assessment (EIA) of the Linshui component of the Sichuan-Chongqing Cooperation: (Guang’an) Demonstration Area Infrastructure Development Project* in the area involved. The announcement contained project overview, environmental impact, proposed counter measures and the contact information of the assessment unit etc. Posting announcement was beneficial to make the public understand the works; in addition, it also facilitated to give opinions on the project construction and environmental protection for the public without any chance to fill the questionnaires.

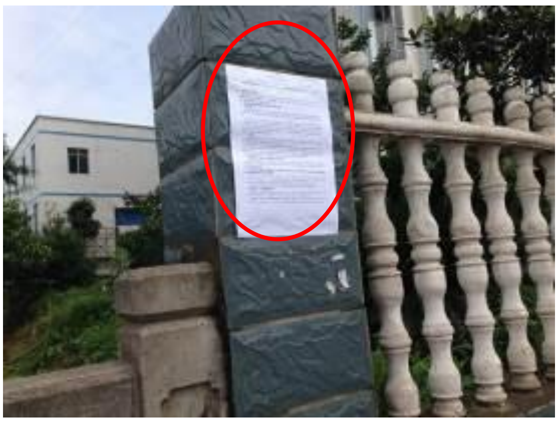


Fig. 11.3-5 Public Consultation Announcement

C Public consultation symposium

During the exploration process, public consultation symposium was convened selectively, and the residents in Chengnan Town, Xitian Township and Moujia Town along the line were called up to participate in the public consultation symposium in LETDZ Administrative Committee Office. The public opinions from different villages and towns were adopted so as to provide a reference for design, construction and operation and implement EIA. In the symposium, firstly, the assessment unit introduced Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area and made detailed explanations for positive impacts (such as environmental improvement and convenient traffic) due to the project construction, negative impacts (such as land requisition and demolition, water and soil loss, impacts on landscapes, ecological destruction, traffic block, noise, air and wastewater) and proposed environmental protection measures; then, the assessment unit made explanations on some respective issues of concern and questions proposed by the public. Through symposium, the assessment unit and the public made adequate and effective communication, and exchanged opinions.

(1) Symposium in Chengnan Town

The participants of the symposium mainly came from Poshi Village, Wenxing Village, Dafosi Village, Wucha Village, Zhengjia Village, Paifang Village, Sanhe Village and Xinhe Village in Chengnan Town. The participants were aged between 30 and 60 years old, mostly having junior or high school diploma. The participants would support the project construction; they considered that the project construction made it convenient for local residents, and the construction of wastewater interceptors and WWTP was helpful to improve water quality of Shiba River and Bajiao River etc. Opinions and suggestions were proposed: during the road excavation, residents' travel would be affected. Traffic dispersion measures were taken to guarantee the residents' travel; Management on the construction organization was strengthened to perform civilized construction and reduce fugitive dust, noise and traffic interference during construction.

(2) Symposiums in Xitian Township and Moujia Town

The participants of the symposium mainly came from Xitian Township, Yun'an Village and Mahe Village, Moujia Town. The participants were aged between 35 and 60 years old, mostly having junior or high school diploma. The residents would support the project construction. The project construction made it more convenient for residents, shortened the distance among Xitian Township, Moujia Town and Linshui County downtown, provided convenience for life. The construction of WWTP was helpful to improve the water quality of Bajiao River. The villagers were satisfied with the project construction. Furthermore, the following suggestions proposed: perform civilized construction; reasonably arrange construction schedule; for the Project, take greening measures into consideration so as to beautify the landscape in Linshui County while reduce dust and noise.

Figure 11.3-6 Public Consultation Symposium in Linshui County

D Public opinion questionnaires

Upon the publication of the questionnaire (abridged edition) on the newspapers and internet, the assessment unit gave out public consultation questionnaires to the public and units directly or indirectly affected along the Project. A total of 300 questionnaires were handed out to local residents and 290 of them were recovered, with recovering ratio of 96.7% (see appendix for statistics for basic information about the interviewees); A total of 10 questionnaires were handed out to the units and 10 of them were recovered, with recovering ratio of 100.0%.See the figure below for details of public opinion questionnaires.

During the process of giving out the questionnaires, the assessment unit introduced the project overview to the public and made detailed explanations on the necessity of the project construction, the positive impacts on local economic development and traffic, negative impacts (such as land acquisition and demolition, traffic block, noise and wastewater pollution) and proposed environmental protection measures; the assessment unit made the explanations on some issues of concern proposed by the public.


利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目公众意见调查问卷表（团体）


利用世行贷款川渝合作（广安）示范区邻水县工业园区基础设施建设项目公众意见调查问卷表（个人）

Figure 11.3-7 Sampling Tables of Public Consultation Questionnaires

11.3.2 Summary of public consultation

1. Investigation and statistics of opinions from the units

(1) Investigation of the units

The investigation included the opinions from 10 units or organizations. See table below for the statistics of the investigated units.

Table 11.3.3-1 Statistics for Respondents from the Units Involved in Public Consultation

SN	Organization Name	Contact person	Contact information
1	Village Committee in Zhengjia Village, Chengnan Town, Linshui County	Mr/Mrs Zhang	1355098****
2	Village Committee in Wucha Village, Chengnan Town	Mr/Mrs Zhang	1398266****
3	Village Committee in Xinhe Village	Mr/Mrs Zhang	1598265****
4	Village Committee in Wenxing Village	Mr/Mrs Dai	1355099****
5	Village Committee in Poshi Village	Mr/Mrs Qin	1388267****
6	Village Committee in Mahe Village, Moujia Town, Linshui County	Mr/Mrs Huang	1398268****
7	Community Committee in Dafosi Village	Mr/Mrs Wang	1310842****
8	Community Committee in Sanhe Village, Chengnan Town	Mr/Mrs Wu	1398260****
9	Village Committee in Paifang Village	Mr/Mrs Zhang	1398033****
10	Village Committee in Yun’an Village, Xitian Township, Linshui	Mr/Mrs Song	1828260****

	County, Sichuan Province		

(2) Main opinions from the investigated units

For 10 investigated units or organizations, they would support the project construction. The investigated units or organizations expected that the construction would be performed as soon as possible and obtained understanding and support on the environmental issues, such as traffic block, fugitive dust, noise. Furthermore, the following requirements and suggestions were proposed:

- Pay attention to environmental health during construction; perform safety and civilized construction; and reduce environmental pollution (such as waste) produced by the construction.
- Reasonably arrange construction schedule and site arrangement, and reduce the impact of noise during the construction and operation period.

2. Investigation and statistics of opinions from the residents

(1) Conditions of the respondents

See Table 11.3.3-2 for the statistics of conditions of the respondents, and see appendix for the statistics of basic information about the respondents.

Table 12.3.2-2 Statistics for Respondents Involved in Public Consultation

Item	Age					Education background				Ethnicity				
	Under 20	21~40	41~60	Above 61	Fill in no information	Junior school diploma or below	Senior high school and vocational school diploma	College diploma or above	Fill in no information	Han	Others		Fill in no information	
Percent (%)	0.00	15.54	61.82	22.30	0.34	81.76	8.11	5.07	5.07	99.66	0.00		0.34	
Item	Gender			Occupation										
	Male	Female	Fill in no information	Farmer	Unemployed person	Worker	Teacher	Student	Civil servant	Freelancer	Clerk	Retiree	Medical personnel	Fill in no information
Percent (%)	82.77	17.23	0.00	73.31	0.00	0.00	0.00	0.00	0.68	1.69	0.34	0.00	0.68	23.31

It can be seen from the above table that copies of questionnaires to be given out are proportional to the number of the affected residents along the line. Age structure, occupation, educational background, etc. of the respondents are characterized by favorable representativeness and rationality.

(2) Public consultation survey and analysis

See Table 11.3.3-3 for the specific survey results.

Table 11.3.3-3 Statistics for Public Consultation Questionnaires Results

SN	Contents	Opinions	Percent (%)
1	Through which channels do you know the Project?	A. Network	18.92
		B. TV	30.07
		C. Newspaper	16.22
		D. Special publicity materials	44.59

SN	Contents	Opinions	Percent (%)
		Learning from others	22.30
2	What is your attitude toward the project construction?	A. Support	99.66
		B. Do not care	0.34
		C. Oppose	0
3	What do you think of the major positive impacts of the project construction?	A. Satisfy the requirements for urban planning	42.91
		B. Promote economic and tourism development	42.57
		C. Increase the employment	54.39
		D. Improve traffic conditions	19.93
		E. Others	0.00
4	What do you think of the major impacts during the construction period?	A. Mechanical noise	60.81
		B. Construction fugitive dust	43.92
		C. Water and soil loss	7.09
		D. Land occupation by construction	7.77
		E. Congested roads caused by construction vehicles	11.15
		F. Increase the employment	12.84
		G. Security problems to be caused with migrant construction workers increased	1.35
		E. Others	0.00
5	What do you think of the major impacts during the operation period?	a. Odor from WWTP	21.28
		B. Automobile exhaust gas emission	20.95
		C. Noise pollution	38.85
		D. Surface water pollution	6.42
		E. Impacts of Solid Wastes	25.34
6	What is your attitude toward the impacts caused during the construction and operation period?	A. Excusable	84.46
		b. Excusable and mitigation measures to be taken	28.38
		C. No comment	0.00
7	If the project construction had a certain impact on your living environment, what measures are taken?	A. Take treatment measures	53.38
		B. Optimize the project scheme	32.09
		C. Economic compensation or relocation	51.01
		D. Reasonably plan the layout	19.59
		E. Establish the green belt	23.31
		E. Others	0.00
8	What is your opinion on house demolition and relocation?	A. Reasonable economic compensation	63.51
		B. Compensation building for demolished houses	64.19
		C. Improve the living condition	20.61
		E. Others	0.34

A total of 300 questionnaires were handed out to local residents and 290 of them were recovered. The results show that 96.9% respondents hold supportive, instead of oppositional attitudes toward the Project. Furthermore, 0.34% respondents do not care.

The respondents thought the implementation of Project met the requirements for the urban planning, and it was conducive to improving economic and tourism development, increasing the employment, improving traffic conditions, and providing convenience for production and life.

Furthermore, series of measures were expected to be taken in order to reduce the environmental impacts, such as treatment measures taken, optimization of the project scheme, economic compensation or relocation. The residents would provide enormous supports for the construction and expected that the construction can be started as quickly as possible.

11.4 Implementation of Public Opinions

EIA report objectively reflected the public opinions, which were reported to the design department in time so as to provide design guidance, optimize the design scheme and reduce the impact of the works. It was recommended that the Owner shall closely cooperate with local governments, take full account of opinions and demands, and analyze their rationality and possibility of solving the problems so as to reasonably adopt the public opinions. See the table below for the implementation of the public opinions at different stages.

Table 11.4-1 Table of Implementation of the Public Opinions

the Public Opinions	Stages	Units	Implementation Condition
Infrastructure project for Linshui Industrial Park in World Bank Loan funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area was taken as a popular-support project, the project construction had prominent significance so that the Project shall be carried out as soon as possible.	Design and construction stages	The assessment unit, Designer, Owner and Contractor	The EIA unit, Designer and Owner are accelerating the first-phase preparations. So far, the feasibility study report and EIA report are prepared. It is suggested that the next phase of work would be conducted by the Owner as soon as possible, so that the Project will be commenced and completed quickly in order to solve the problem of heavy traffic in urban areas.
The advanced construction method was adopted in order to minimize the impact of fugitive dust, noise and vibration, etc.	Design and construction stages	The assessment unit, Designer, Owner and Contractor	Reasonable operation time was selected, low noise and vibration equipment and construction methods were adopted, noise attenuating measures taken; if the Construction was performed near the houses with worse building structures, low vibration equipment would be adopted, or the vibration operation avoided in order to reduce the impacts on surface structures; ground and muck car flushed, spoils covered, and construction barriers established.
The effective measures were adopted to minimize the noise interference during the operation period.	Design and construction stages	The assessment unit, Designer, Owner and Contractor	Asphalt pavement was designed and the green belts were constructed on both road sides to effectively reduce the noise impacts of the road.
The road landscape design management was strengthened to create a good urban living condition.	Design and construction stages	The assessment unit, Designer, Owner and Contractor	Landscape design and green coverage was in accordance with the local customs and culture and landscape characteristics of Linshui County.
Series problems, such as traffic block and inconvenient traffic, were properly resolved.	Design and construction stages	The assessment unit, Designer, Owner and Contractor	The Owner and Contractor shall reasonably make construction organization plan. If some roads were closed, transportation of neighboring residents shall be taken into consideration, and reasonable traffic organization scheme was formulated.

Through public consultation, the assessment unit knew the public's attitudes to and understanding of the Project, and the information was reported to the Designer and Owner. During the construction and operation period, the Owner shall strengthen the commutations with the public, and reasonable environmental requests proposed by the public shall be satisfied in time.

11.5 Summary of Public Consultation

The public opinions were asked in the report via network publicity, symposium and public consultation questionnaires.

A total of 10 questionnaires were handed out to the units and 10 of them were recovered, with recovering ratio of 100%.The investigated units or organizations would support the project construction. A total of 300 questionnaires were handed out to local residents and 290 of them were recovered, with recovering ratio of 96.7%.For the individuals to be investigated, 99.66% respondents held supportive, instead of oppositional attitudes toward the Project. Furthermore, 0.34% respondents did not care.

The statistical results showed that the public had a certain understanding of the project via network, TV, newspaper, interview with the respondents by the environmental assessment personnel, etc. In general, the public showed their support for the Project construction along the line. They thought that infrastructure project for Linshui Industrial Park in World Bank Loan funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area was of great significance in improving the transportation and environment in Linshui. The public thought the environmental impacts mainly included noise, solid wastes and air pollution and effective treatment measures shall be taken. In the report, Series of measures were taken, such as construction of green belt, installation of deodorization devices in WWTP and uniform collection and disposal of solid wastes, thus effectively reducing the impacts of noise, air pollution and solid waste on the environment.

12 Induced and Cumulative Environmental Impact Assessment

The infrastructure construction in the Project will promote the process of urbanization and industrialization and the EIA results show that the degree and scope of direction impact from project activities are limited while the induced and cumulative environmental impacts are the main challenge of the Project. Without reasonable planning and implementation, fast urbanization and industrialization, the surrounding environment quality will be adversely affected and local communities will suffer long term influence. In general, the induced and cumulative impacts are beyond the scope of direct impact of a project. The Project will indirectly facilitate the urban expansion and industrial development, which is one of the reasons to study said induced and cumulative impacts in this assessment. However, different from the past, present development activities may be superimposed with possible development activities in the future, producing cumulative environmental impact.

According to the project design, the phased EIA tasks during the project preparation include preliminarily screening and assessing the cumulative environmental impact and preparing the terms of reference for detailed assessment in the next stage. And during the project implementation, detailed assessment on cumulative environmental impact will be carried out with technical assistance.

12.1 Assessment Scope and Period

1. Assessment scope

This assessment covers the whole region of Linshui County in accordance with *General Planning of Linshui County Downtown* (2009-2030) (April 2010). By 2030, the proposed construction land in Linshui will extend to Zhaojiaqiao in the north, end before the Shizikou Reservoir Dam in the west, be bounded by the expressway in the southwest and Wucha and the expressway in the south, reach Chang'an Bridge along the Bajiaohe Bridge in the east and Jingjiagou east by north; the central urban area covers 37.4 km^2, with available construction land of around 28.3km^2.

2. Assessment period

In the principle of considering the past, present and future foreseeable activities, the cumulative EIA is divided into the following periods:

1. Emphasize on the review of development and operation activities in central urban area and LETDZ of Linshui occurring before this assessment stage (April 2014);
2. Analyze the project related activities in prospect (2014-2020) in the southern area of LETDZ, the West Ring Road under construction and the road connecting the central urban area of Linshui to the west exit of proposed Shanghai-Chengdu Expressway.
3. Take into consider the proposed development of Linshui county downtown by 2030 in accordance with the *General Planning of Linshui County Downtown*.

12.2 Review and Status Analysis of Constructed Area

12.2.1 Introduction to enterprises settled in LETDZ

1. Development status of Linshui County downtown

After the People's Government of Linshui County was established on December 21, 1949, Guang'an was change from a district to a city in 1997. Currently, Linshui County governs 18 towns and 27 townships with total population of 1.03 million and permanent population of 170,000 in an overall area of 1919.22 km^2

and constructed area of 11.12km^2 in county downtown.

2. Status of enterprises settled in Linshui County

Built in 2006, the LETDZ is situated in the south of Linshui County with constructed area of 7km^2.The agricultural and sideline products processing industry, machinery manufacturing industry, electronic and information industry, part manufacturing for rail transit and new energy vehicles, nonferrous metal melting and calendering industry, etc. are mainly developed in LETDZ.

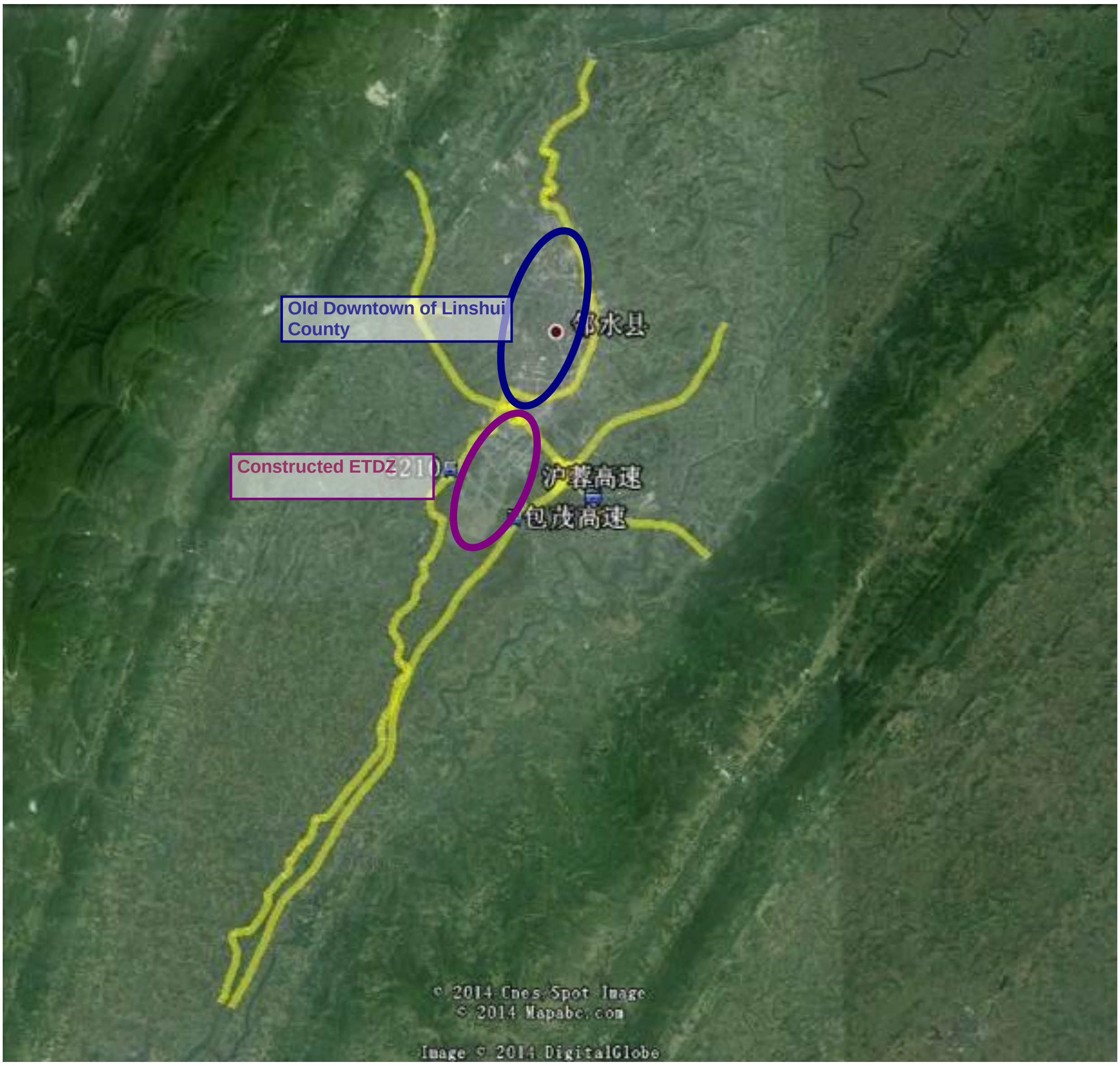


Figure 15.2.1-1Status Quo of Linshui County

Land already developed and used in Linshui County are mainly for residential, public facilities, industrial, and landscaping.

Table 12.2.1-1 Land utilization status

SN	Code of Land	Land use classification	Status quo		
			Area (10,000m^2)	Percentage (%) (%)	Per capita (m^2/person)
1	R	Residential land	296.35	27.8	19.76
2	C	Land for utilities	131.79	12.4	8.79

		Of which	Administrative land	23.37	2.2	1.56
			Land for culture and education	53.58	5.0	3.57
			Land for market and business	48.28	4.5	3.22
			Land for medical treatment and public health	6.56	0.6	0.44
3	M	Industrial Land		228.33	21.4	15.2
4	W	Land for warehouse		15.45	1.5	1.0
5	T	Intercity transportation land		38.93	3.65	2.6
6	S	Land for roads and squares		175.26	16.4	11.7
7	U	Land for public facilities		25.51	2.4	1.7
8	G	Green area		147.45	13.8	9.8
		Of which: land for landscaping		106.6	10	7.1
9	D	Land for special use		6.35	0.6	0.42
Total		Urban construction land		1065.42	100	71

3. Enterprise overview

Presently, there are 60 enterprises in the LETDZ, concentrated in northeastern part of the north area and mainly engaged in automobile production, motorcycle parts processing, food, etc.

It is known from the following table that these enterprises are mainly relied on equipment manufacturing, machinery manufacturing and processing.

Table 12.2.1-1 Statistical Industrial Enterprise Status in LETDZ

SN	Enterprise	Product	Settle-in Time	Expected Output Value (CNY 10,000/year)	Number of Employees	Remarks
1	Sichuan Lonchon Power Co., Ltd.	Aluminum alloy castings, automobile and motorcycle accessories	2006.03	80000	470	Put into Service
2	Linshui County Jinggong Power Machinery Factory	Motorcycle cylinder, minicar cylinder	2006.03	15000	50	Put into Service
3	Sichuan Hermes Technology Co., Ltd.	Agricultural machinery	2009.08	10000	42	Put into Service
4	Sichuan Guang’an Huifang Industrial Trading Co., Ltd.	Car body	2009.1	5000	30	Put into Service
5	Sichuan New-artery Auto Parts Manufacture Co., Ltd.	Motorcycle cylinder sleeve, cylinder head and auto parts and castings	2010.04	30000	120	Put into Service
6	Sichuan Zuojun Machinery Co., Ltd.	Gasoline engine oil tank	2010.5	10000	61	Put into Service
7	Sichuan Shengjin Fan Co., Ltd.	Automobile parts like air conditioner	2010.8	40000	200	Put into Service
8	Sichuan Jindexing Auto Parts Co., Ltd.	Automotive appliance accessories	2010.9	50000	528	Put into Service
9	Sichuan Jindexing Mg-Al Technology Co., Ltd.	Laptop accessories	2011.9	8500	463	Put into Service
10	Sichuan Hangxie Automobile Air Conditioner Parts Co., Ltd.	Air conditioner piping assembly and accessories	2011.7	20000	160	Put into Service

SN	Enterprise	Product	Settle-in Time	Expected Output Value (CNY 10,000/year)	Number of Employees	Remarks
11	Sichuan Qinyu Electromechanical Co., Ltd.	Auto and other parts	2011.4	15000	30	Put into Service
12	Sichuan and Yucheng Machinery Co., Ltd.	Pump impeller volute, general machinery end cover and generator support	2010.7	18000	60	Put into Service
13	Sichuan Tiankun Automobile Dies	Automotive stamping and plastic parts	2010.12	22000	155	Put into Service
14	Sichuan Lijue Machinery Manufacture Co., Ltd.	Finished motocycle	2012.3	12000	40	Put into Service
15	Sichuan Chuanglin Machinery Co., Ltd.	Motorcycle muffler and general machinery muffler	2011.7	12500	75	Put into Service
16	Guang'an Huaxun Electronics Co., Ltd.	Electronic parts and components for communication network	2008.05	20000	200	Put into Service
17	Sichuan Aotai Auto Parts Co., Ltd.	Auto parts (rubber and plastic products)	2010.12	16000	82	Put into Service
18	Sichuan Qunli Auto Parts Co., Ltd.	Auto parts production	2011.5	50000	80	Put into Service
19	Sichuan Yu Teng Machinery Forging Co., Ltd.	Forgings	2011.6	50000	60	Put into Service
20	Sichuan Feichen Machinery Co., Ltd.	Three-wheel motorcycle gearbox	2011.6	25000	108	Put into Service
21	Sichuan Yulin Auto Parts Co., Ltd.	Automobile engine piston and shock absorber	2011.6	30000	60	Put into Service
22	Sichuan Shaxi Machinery Manufacture Co., Ltd.	Motorcycle fuel tank, mudguard, auxiliary radiator and plastic guard shield; automobile and motorcycle gear production	2011.6	28000	70	Put into Service
23	Sichuan Seho Machinery Co., Ltd.	Engine connecting rod for automobile and motorcycle	2011.7	28000	27	Put into Service
24	Linshui Xinyu Machinery Manufacture Co., Ltd.	Gasoline engine connecting rod, transmission and trunk	2011.7	7000	96	Put into Service
25	Sichuan Lintong Automobile Air Conditioner Co., Ltd.	New project of automobile air-conditioning equipment production	2011.11	25000	50	Put into Service
26	Sichuan Pastoral Chang Carburetor Manufacturing Co., Ltd.	Carburetor	2012. 1	6500	25	Put into Service
27	Sichuan Dinghao Machinery Manufacture Co., Ltd.	Frame, trunk and muffler assembly for three-wheel motorcycle	2012.5	25000	180	Put into Service
28	Sichuan Jiudu Technology Co., Ltd.	Wires and ropes, carton box, etc.	2012. 1	3000	30	Put into Service

SN	Enterprise	Product	Settle-in Time	Expected Output Value (CNY 10,000/year)	Number of Employees	Remarks
29	Linshui Huayi Spring Co., Ltd.	Spring roll of seat belt	2012. 5	16000	20	Put into Service
30	Sichuan Chuandong Ramie Textile Co., Ltd.	China grass textiles	2007.3	23000	190	Put into Service
31	Sichuan Lvhao Foods Co., Ltd.	Frozen foods	2009. 2	10000	201	Put into Service
32	Guang'an Yongpeng Foods Co., Ltd.	Raw pork, beef, mutton, duck and rabbit meat products, dumplings	2008. 08	120000	20	Put into Service
33	Linshui Jinchuan Plastics Industry Co., Ltd.	Composite packing bag for cement	2009. 11	10000	150	Put into Service
34	Sichuan Yihao Shoes Industry Co., Ltd.	Leather shoes and leather products	2006. 07	10000	50	Put into Service
35	Linshui Rongyu Plastic Co., Ltd.	Plastic products	2008. 06	4500	20	Put into Service
36	Sichuan Tiansheng Pharmaceutical Co., Ltd.	Medicinal capsules/inner and outer packaging products	2008. 09	64000	200	Put into Service
37	Linshui Jinjiu Advertising, Packaging and Printing Co., Ltd.	Carton	2009. 2	5000	20	Put into Service
38	Linshui Dibang Technology Co., Ltd.	Heat resistant silicone coatings	2011.12	6000	10	Put into Service
39	Sichuan Wantai Packaging Products Co., Ltd.	Cement package	2010. 5	5000	53	Put into Service
40	Linshui Kaituo Paper Co., Ltd.	Carton	2011. 11	3000	20	Put into Service
41	Sichuan ERI Co., Ltd.	New paper and plastic production project	2011. 5	2500	50	Put into Service
42	Sichuan Jinmeng Property & Commercial Concrete Co., Ltd.	Commercial concrete	2008. 02	2700	60	Put into Service
43	Sichuan Concentric Door Industry Co., Ltd.	Dire pressure plate, security door and complete set of kitchen fittings	2006. 04	20000	90	Put into Service
44	Sichuan Hongwei Ornamental Engineering Co., Ltd.	Doors and windows	2010.12	10000	25	Put into Service
45	Sichuan Hanyu Space Steel Structure Co., Ltd.	Grid, truss and light steel	2009. 08	30000	150	Put into Service
46	Sichuan Xinya Ceramics Co., Ltd.	Ceramics	2010.4	12000	360	Put into Service
47	Sichuan Lindu Ceramics Co., Ltd.	Daily chinaware and ceramic artworks	2010. 7	20000	80	Put into Service
48	Linshui Shanyuan Furniture Co., Ltd.	Furniture production	2009. 12	9200	20	Put into Service
49	Linshui Juneng New Building Materials Co., Ltd.	Concrete admixture	2010.3	10000	10	Put into Service
50	Sichuan Shunhe Coating Co., Ltd.	Coatings and exterior wall paint	2012.12	5000	30	Put into Service
51	Sichuan Jianye Machinery Co., Ltd.	Auto parts production	2011.5	25000		Construction Completed
52	Linshui Qiaoyan Machinery Manufacture Co., Ltd.	Machining and electronic processing	2011.7	18000		Construction Completed

SN	Enterprise	Product	Settle-in Time	Expected Output Value (CNY 10,000/year)	Number of Employees	Remarks
53	Sichuan Xu's Coal Mining Equipment Co., Ltd.	Self-rescue equipment in mine, miner light and gas detector	2006.01	10000		Production Suspended
54	Sichuan Guohua Fire-fighting Equipment Co., Ltd.	New fire-fighting equipment and auto parts	2010.12	5000		Production Suspended
55	Linshui Guanglin Industrial Trading Co., Ltd	Automotive upholstery production project	2012.5	5000		Production Suspended
56	Sichuan Yonggang Machinery Co., Ltd.	Magnesium alloy and aluminium alloy automobile and motorcycle parts	2011.5	25000	245	Under Construction
57	Sichuan Jiayi Huangguan Technology Co., Ltd.	Final motorcycle assembly, engine, general machinery and frame	2012.05	20000	200	Put into Service
58	Sichuan Saite Refrigeration Equipment Co., Ltd.	Refrigeration equipment production project	2012.05	25000	200	Put into Service
59	Sichuan Xianglin Technology Co., Ltd.	Motorcycle parts	2012.05	15000	150	Put into Service
60	Sichuan Huayuan Century Automobile Components Manuf. Co., Ltd.	Manual and electric window regulators, electric regulator and micro motor for automobile	2012.03	38000	60	In pilot production

12.2.2 Discharge of main pollutants

1. Investigation of main air pollution sources

1) Industrial air pollutants

Enterprises in the area mainly use natural gas, coal and electricity for energy supply.In this assessment, existing industrial pollution sources of enterprises are investigated in combination with the environmental assessment of each project components and the environmental statistics provided by Linshui Environmental Protection Bureau to obtain the emissions of main air pollutants of industrial enterprises in LETDZ in 2011, namely 1173.05 t/a of SO_2, 327.18 t/a of NO_x and 993.4 t/a of smoke and dust.

2) Domestic air pollutants

Currently, the permanent population is 32,000 in the LETDZ; the residential energy sources for living are mainly natural gas for relocated residents and coal, liquefied gas and firewood for rural residents. The environmental statistics of Linshui County in 2011 shows that the domestic air pollutant emissions in proposed area include about 21.3 t/a of SO_2 and about 20.8 t/a of soot.

Table 12.2.1-1 Statistics of Regional Air Pollutant Emissions in 2011

Region	Type of Waste Gas	Pollutant Emission (t/a)	
		SO_2	Soot
LETDZ	Domestic waste gas	21.3	20.8
	Industrial waste gas	1173.05	993.403

Total		1194.35	1014.203

2. Investigation of main water pollution sources

1) Industrial water pollution sources

Enterprises owning its wastewater treatment station are Sichuan Chuandong Ramie Textile Co., Ltd., Sichuan Lvhao Foods Co., Ltd., Sichuan Guangda Starch Product Co., Ltd. (shut down now) and Guang'an Yongpeng Foods Co., Ltd.

Except for above enterprises, other industrial enterprises in LETDZ discharge small amount of wastewater with simple composition, which is mainly domestic sewage from plant and discharged after simple treatment. The environmental statistics provided by Linshui Environmental Protection Bureau shows that the industrial water pollutants in LETDZ in 2011 include about465.27t/a of COD and about 26.8 t/a of NH3-N.

2) Domestic water pollution sources

Currently, the permanent population is 32,000 in the park area, where the domestic sewage is discharged directly without treatment. The annually discharged domestic sewage is about 1.4016 million tons when calculated with a domestic sewage volume of 150L/person.d and river load ration of 0.8.If calculated at 300 mg/L COD_{cr} and 30 mg/L NH_3-N in domestic sewage, the annually discharged COD_{cr} and NH_3-N in domestic sewage are about 420.48t and 42.05 t respectively.

Table 12.2.2-2 Statistics of Regional Water Pollutants Discharged in 2011

Region	Type of Wastewater	Pollutant Emission (t/a)		Receiving Water Bodies
		COD_{Cr}	NH_3-N	
Industrial Park	Domestic sewage	420.48	42.05	Shiba River and city moat
	Industrial wastewater	465.27	26.8	
Total	/	885.75	68.85	

12.2.3 Retrospective assessment of environmental quality in constructed area

In order to better identify the environmental impacts of developed projects, this retrospective assessment will compare with data on existing environmental quality in planning EIA by setting same positions of monitoring points as those of planning EIA to intuitively express the variation in environmental quality. The planning EIA passed the review by Sichuan Provincial Environmental Protection Department in 2011.

1. Observation and assessment of existing ambient air quality

(1) Arrangement of monitoring points

The ambient air monitoring points are arranged based on the function division. The sampling was performed in March 2012 for planning EIA and in July 2014 for this assessment. There are totally 8 monitoring points in the whole city. See the table below for specific positions and Figure 12.2.3-1 for the location plan of air monitoring points.

Table 12.2.3-1 Layout of Existing Ambient Air Quality Monitoring Points

No.	Description		Monitoring Indicators
1#	Outside the Park	Residential district planned on the west	PM_{10}, SO_2 and NO_2
2#		Residential district planned on the east	
3#	Inside the Park	Industrial land in the west area	
4#		Industrial land in the east area	
5#	Urban area of Linshui		

No.	Description	Monitoring Indicators
6#	Moujia Town	
7#	Xitian Township	
8#	Lingbaoshan cultural relics protection unit	

(2) Comparison of monitoring results

See the table below for the monitoring results of existing ambient air quality.

Table 12.2.3-2 Results of Comparing Ambient Air Quality

Monitoring Point	Pollutant	Standard Value	**Original Concentration Range**	Up to standard (Yes/No)	**Current Concentration Range**	Up to standard (Yes/No)	Variation
1#	PM_{10}	0.15	0.086-0.123	Yes	0.057-0.089	Yes	-
	SO_2	0.5	0.016-0.051	Yes	0.007-0.011	Yes	-
	NO_2	0.2	0.022-0.047	Yes	0.005-0.013	Yes	-
2#	PM_{10}	0.15	0.064-0.093	Yes	0.051-0.099	Yes	-
	SO_2	0.5	0.013-0.034	Yes	0.007-0.012	Yes	-
	NO_2	0.2	0.015-0.034	Yes	0.005-0.013	Yes	-
3#	PM_{10}	0.15	0.072-0.094	Yes	0.091-0.101	Yes	+
	SO_2	0.5	0.014-0.048	Yes	0.007-0.014	Yes	-
	NO_2	0.2	0.019-0.044	Yes	0.005-0.021	Yes	-
4#	PM_{10}	0.15	0.077-0.098	Yes	0.051-0.109	Yes	+/-
	SO_2	0.5	0.010-0.042	Yes	0.007-0.013	Yes	-
	NO_2	0.2	0.017-0.043	Yes	0.005-0.012	Yes	-
5#	PM_{10}	0.15	0.075-0.102	Yes	0.062-0.100	Yes	-
	SO_2	0.5	0.009-0.038	Yes	0.007-0.011	Yes	-
	NO_2	0.2	0.015-0.032	Yes	0.005-0.015	Yes	-
6#	PM_{10}	0.15	0.082-0.092	Yes	0.053-0.095	Yes	-
	SO_2	0.5	0.009-0.032	Yes	0.007-0.012	Yes	-
	NO_2	0.2	0.016-0.033	Yes	0.005-0.012	Yes	-
7#	PM_{10}	0.15	0.087-0.119	Yes	0.052-0.101	Yes	-
	SO_2	0.5	0.014-0.053	Yes	0.007-0.013	Yes	-
	NO_2	0.2	0.017-0.046	Yes	0.005-0.013	Yes	-
8#	PM_{10}	0.15	0.064-0.087	Yes	0.058-0.089	Yes	-
	SO_2	0.5	0.008-0.031	Yes	0.007-0.013	Yes	-
	NO_2	0.2	0.015-0.034	Yes	0.005-0.014	Yes	-

Note: "-" indicates improvement of air quality while "+" indicates the deterioration.

It is known from the above table, PM_{10}, SO_2, and NO_2 are declining on the whole, the main reason is the comprehensive banning of the "15 kinds of small enterprises", the "5 new kinds of small enterprises", and projects included in the list for eliminating backward production, technology and products issued by the state. Moreover, it is because the expanding use of clean energy and the increasing urban gasification rate by adjusting fuel structure. Enterprises settled in LETDZ shall use natural gas as clean energy. Civilized construction management shall be strengthened during the construction of LETDZ; commercial concrete shall be used in urban construction, and dust-proof measures like closed work, closed operation, cleaning the car before setout, and watering shall be taken to control construction dust. Burning the straw directly in the field or disposing at willof straw shall be prohibited in order to increase the recycling use of straw.

By taking the said measures, relevant departments of Linshui County government has banned enterprises with large pollution, and strictly controls the pollution of new enterprises by using new energy and strengthening construction management, thus significantly improving the ambient air quality of Linshui County.

2. Monitoring and assessment of existing surface water environment quality

(1) Arrangement of monitoring sections

The sampling was performed in March 2012 for planning EIA and in July 2014 for this assessment. In a bid to better understand the existing water environment quality in the Park, each of the rivers is monitored on site for the present situation. See the table below for monitoring section and point arrangement for existing river and canal water environment quality and Figure 12.2.3-1 for the layout of water quality monitoring sections.

Table 12.2.3-3 Layout of Existing Water Environment Quality Monitoring Points

Section No.		Section Location	Item
Bajiao River	1	Downstream of proposed No. 3 WWTP outfall	pH value (dimensionless), COD, BOD_5, NH_3-N, Phosphorus (in P), Zn, As, Hg, TN, Cr (VI), Cd, Pb, fecal coliform, cyanide, fluoride, volatile phenol and petroleum.
	2	Downstream of proposed No. 2 WWTP outfall	
Shiba River	3	At the outfall of municipal wastewater treatment plant in west area of Linshui County	
City moat (Xiaoxi River)	4	Upstream of Xiaoxi River's confluence with Bajiao River	

(2) Monitoring results of existing surface water environment

See the table below for the monitoring results of existing surface water quality.

Table 12.2.3-4 Results of Comparing Surface Water Environment Quality

Monitoring Point	Pollutant	Standard Value	Original Concentration Range	Up to standard (Yes/No)	Current Concentration Range	Up to standard (Yes/No)	Variation
1#	pH (dimensionless)	6-9	7.81	Yes	7.61-7.73	Yes	/
	COD	20	15.06-15.48	Yes	5.84-8.06	Yes	-
	BOD_5	4	2.20-2.32	Yes	1.2-2.0	Yes	-
	NH_3-N	1.0	0.672-0.699	Yes	0.072-0.085	Yes	-
	Phosphorus (in P)	0.2	0.052-0.054	Yes	0.03-0.05	Yes	-
	Zn	1.0	0.005	Yes	ND	Yes	/
	As	0.05	ND	Yes	0.003	Yes	/
	Hg	0.0001	0.00006	Yes	ND	Yes	-
	Cr (VI)	0.05	ND	Yes	ND	Yes	/
	Cd	0.005	ND	Yes	ND	Yes	/
	Pb	0.05	ND	Yes	ND	Yes	/
	Cyanide	0.2	ND	Yes	ND	Yes	/
	Petroleum	0.05	ND	Yes	ND	Yes	/
2#	pH (dimensionless)	6-9	7.74	Yes	7.54-7.68	Yes	/
	COD	20	17.78-18.20	Yes	7.78-10.8	Yes	-

Monitoring Point	Pollutant	Standard Value	Original Concentration Range	Up to standard (Yes/No)	Current Concentration Range	Up to standard (Yes/No)	Variation
	BOD_5	4	2.52-2.60	Yes	2.0-2.6	Yes	-
	NH_3-N	1.0	0.526-0.547	Yes	0.071-0.091	Yes	-
	Phosphorus (in P)	0.2	0.054-0.059	Yes	0.05-0.07	Yes	-/+
	As	0.05	ND	Yes	0.003	Yes	/
	Cr (VI)	0.05	ND	Yes	ND	Yes	/
	Cd	0.005	ND	Yes	ND	Yes	/
	Pb	0.05	ND	Yes	ND	Yes	/
	Cyanide	0.2	ND	Yes	ND	Yes	/
	Petroleum	0.05	ND	Yes	ND	/	/
3#	pH (dimensionless)	6-9	7.72	Yes	7.17-7.21	Yes	/
	COD	20	18.41-18.82	Yes	5.00-7.22	Yes	-
	BOD_5	4	2.70-2.85	Yes	1.0-1.6	Yes	-
	NH_3-N	1.0	0.517-0.537	Yes	0.033	Yes	-
	Phosphorus (in P)	0.2	0.059-0.062	Yes	0.05-0.07	Yes	+/-
	Zn	1.0	0.005	Yes	ND	Yes	/
	As	0.05	ND	Yes	0.0001	Yes	/
	Hg	0.0001	0.00005	Yes	ND	Yes	/
	Cr (VI)	0.05	ND	Yes	0.009	Yes	/
	Cd	0.005	ND	Yes	ND	Yes	/
	Pb	0.05	ND	Yes	ND	Yes	/
	Cyanide	0.2	ND	Yes	ND	Yes	/
	Petroleum	0.05	ND	Yes	ND	Yes	/
4#	pH (dimensionless)	6-9	7.79	Yes	7.07-7.10	Yes	-
	COD	20	25.1-25.52	No	7.40-8.61	Yes	-
	BOD_5	4	2.48-2.61	Yes	1.8-2.1	Yes	-
	NH_3-N	1.0	1.201-1.212	No	2.35-2.4	Yes	-
	Phosphorus (in P)	0.2	0.060-0.065	Yes	0.29-0.3	Yes	+
	Zn	1.0	0.004	Yes	ND	Yes	-
	As	0.05	ND	Yes	0.0006	Yes	-
	Hg	0.0001	0.00004	Yes	ND	Yes	-
	Cr (VI)	0.05	ND	Yes	ND	Yes	-
	Cd	0.005	ND	Yes	ND	Yes	-
	Pb	0.05	ND	Yes	ND	Yes	-
	Cyanide	0.2	ND	Yes	ND	Yes	-
	Petroleum	0.05	ND	Yes	ND	Yes	-

Notes: 1. ND standards for “not detected”; 2. “-” indicates improvement of air quality while “+” indicates the deterioration.

It is known from the above table that water quality factors at the monitoring sections in July 2014 meet the standards for category III water area in the *Environmental Quality Standards for Surface Water* (GB3838-2002); and most water quality factors are better than before in varying degrees.

The main reason is that in Linshui County, supporting wastewater interceptor network works of WWTP is being constructed to accelerate the construction of wastewater treatment and supporting facilities, and urban drain system is being reconstructed to realize the implementation of rain sewage diversion and improve the urban wastewater collection rate. In addition, the wastewater from the enterprises must be discharged into nearby water bodies after the wastewater is treated up to Class I standard in *Integrated Discharge Standard of Pollutants*.

Through improvement, reconstruction and construction of rain sewage pipe network, the wastewater collection rate has been effectively improved and up-to-standard discharge by all enterprises in accordance with the discharge standards is also helpful to improve the water quality of all rivers in Linshui County.

3. Monitoring and assessment of existing groundwater environment quality

(1) Arrangement of monitoring sections

The sampling was performed in March 2012 for planning EIA and in March 2014 for this groundwater status monitoring. In a bid to better understand the existing groundwater environment quality, 4 groundwater monitoring points are arranged according to the direction of groundwater flow in the assessed area and proposed geological site location. See the table below and Figure 12.2.3-1 for the layout of water quality monitoring sections.

Table 12.2.3-5 Layout of Existing Groundwater Environment Quality Monitoring Points

No.	Description	Item
1	West area of LETDZ	Potassium permanganate index, NH3-N, fluoride, Hg, Cd, Cr (VI), Pb, As, Cyanide, Fe and Mn
2	East area of LETDZ	
3	Water wells of rural households midstream of LETDZ segment of Bajiao River	
4	Water wells of rural households 500m downstream of LETDZ segment of Bajiao River	

(2) Monitoring results of existing groundwater environment

See the table below for the monitoring results of existing groundwater quality.

Table 12.2.3-6 Results of Comparing Groundwater Environment Quality

Monitoring Point	Pollutant	Standard Value	Original Concentration Range	Up to standard (Yes/No)	Current Concentration Range	Up to standard (Yes/No)	Variation
1#	Hg	0.001	0.00006	Yes	ND	Yes	/
	Cd	0.01	ND	Yes	ND	Yes	/
	NH_3-N	0.2	0.371	No	0.03	Yes	-
	Permanganate Index	3.0	1.64	Yes	/	/	/
	Cr (VI)	0.05	ND	Yes	ND	Yes	/
	Fluoride	1.0	0.37	Yes	0.5	Yes	+
	Pb	0.05	ND	Yes	ND	Yes	/
	As	0.05	ND	Yes	ND	Yes	/
	Cyanide	0.05	ND	Yes	ND	Yes	/
	Fe	0.3	ND	Yes	0.04	Yes	+
2#	Hg	0.001	0.00002	Yes	ND	Yes	-
	Cd	0.01	ND	Yes	ND	Yes	/
	NH_3-N	0.2	0.379	No 0.179	0.05	Yes	-

Monitoring Point	Pollutant	Standard Value	Original Concentration Range	Up to standard (Yes/No)	Current Concentration Range	Up to standard (Yes/No)	Variation
	Permanganate Index	3.0	1.25	Yes	/	/	/
	Cr (VI)	0.05	ND	Yes	ND	Yes	/
	Fluoride	1.0	0.36	Yes	0.4	Yes	+
	Pb	0.05	ND	Yes	ND	Yes	/
	As	0.05	ND	Yes	ND	Yes	/
	Cyanide	0.05	ND	Yes	ND	Yes	/
	Fe	0.3	ND	Yes	0.04	Yes	-
3#	Hg	0.001	0.00005	Yes	ND	Yes	/
	Cd	0.01	ND	Yes	ND	Yes	/
	NH_3-N	0.2	0.154	Yes	0.04	Yes	-
	Permanganate Index	3.0	1.31	Yes	/	/	/
	Cr (VI)	0.05	ND	Yes	ND	Yes	/
	Fluoride	1.0	0.36	Yes	0.4	Yes	+
	Pb	0.05	ND	Yes	ND	Yes	/
	As	0.05	ND	Yes	ND	Yes	/
	Cyanide	0.05	ND	Yes	ND	Yes	/
	Fe	0.3	ND	Yes	ND	Yes	/
4#	Hg	0.001	0.00006	Yes	ND	Yes	-
	Cd	0.01	ND	Yes	ND	Yes	/
	NH_3-N	0.2	0.177	Yes	0.09	Yes	-
	Permanganate Index	3.0	1.2	Yes	/	/	/
	Cr (VI)	0.05	ND	Yes	ND	Yes	/
	Fluoride	1.0	0.37	Yes	0.2	Yes	-
	Pb	0.05	ND	Yes	ND	Yes	/
	As	0.05	ND	Yes	ND	Yes	/
	Cyanide	0.05	ND	Yes	ND	Yes	/
	Fe	0.3	ND	Yes	0.14	Yes	/

Notes: 1. ND standards for “not detected”; 2. “-” indicates improvement of air quality while “+” indicates the deterioration.

It is known from the above table that groundwater monitoring factors in this monitoring meet the class III standard in the Quality Standard for Ground Water (GB/T14848-93).The monitoring results show that the groundwater quality is not improved; the water environment quality is up to the standard. This indicates that all enterprises pay attention to the protection of groundwater resources in the construction process, without arbitrary wastewater discharge by any enterprise, and the groundwater environment is well protected.

4. Monitoring and assessment of existing ambient noise

(1) Arrangement of monitoring points

According to the land use status and execution of planning schemes for the Park of LETDZ, the contrast analysis is performed for the constructed part of south area in the LETDZ in this cumulative assessment. Four monitoring points are arranged in the constructed area in the south.

(2) Monitoring results of existing acoustic environment

See the table below for the monitoring results of existing acoustic environment quality.

Table 12.2.3-6 Results of Comparing Acoustic Environment Quality

Monitoring Point	Monitoring Results											
	Day						Night					
	Original monitoring value	Standard	Up to standard (Yes/No)	Current monitoring value	Up to standard (Yes/No)	Variation	Original monitoring value	Standard	Up to standard (Yes/No)	Current monitoring value	Up to standard (Yes/No)	Variation
1# west boundary	46.0~46.1	65	Yes	48.5	Yes	Increase	37.3~38	55	Yes	40.3	Yes	Increase
2# south boundary	45.2~45.3	65	Yes	46.7	Yes	Increase	37.4~38.1	55	Yes	41.7	Yes	Increase
3# east boundary	45.0~45.2	65	Yes	48.2	Yes	Increase	37.5~37.9	55	Yes	41.1	Yes	Increase
4# north boundary	63.3~63.8	65	Yes	61.9	Yes	Decrease	54.0~54.1	55	Yes	53.9	Yes	Decrease

It is known by comparing that the boundary is affected by the traffic noise and the general noise level here increases to some extent due to the increased traffic volume when the roads surrounding the Park are put into service since the operation of completed LETDZ. However, the small increment contributes to the low monitoring values at the north boundary and insignificant variation in general.

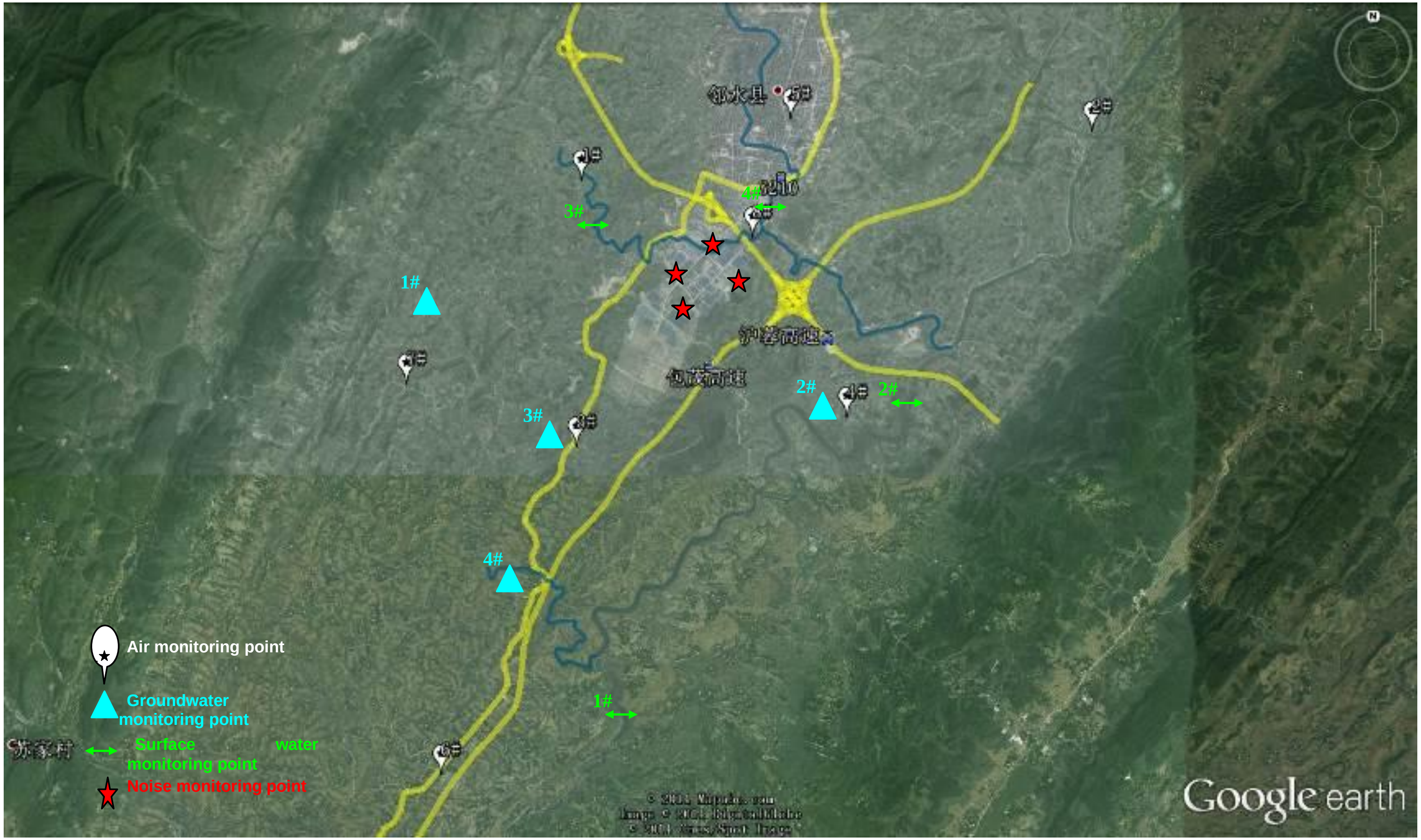


Figure 15.2.3-1 Location Plan for Air, Groundwater and Surface Water and Noise Monitoring Points

12.2.5 Summary

Currently, the development and constructed area is 18.2km^2 in old downtown and LETDZ of Linshui. Through the investigation on air pollutants, water pollutants and solid wastes in the constructed area, the water consumption is obtained to be 2.4×10^4t/a, wastewater volume 1.9×10^4t/a, discharged COD_{cr} about 885.75 t/a and NH_3-N 68.85 t/a; the air pollutant emissions include 1194.35 t/a of SO_2, 1014.203 t/a of soot, 327.18 t/a of NO_X; and the solid waste produced is 5.84×10^4t/a, among which the dangerous waste shall be delivered to competent organization for treatment.

In this assessment, the surface water, ambient air, groundwater and acoustic environment in the assessed area are monitored (in July 2014) and the monitoring results show that all environmental factors in the area satisfy the requirements of quality standards. In comparison with the monitoring data (monitored in March 2012) for the planning EIA, the factors of surface water, ambient air and groundwater are improved to different extents while the monitoring results of acoustic environment increase to some extent over those of the planning EIA. These are attributed to the fact that the boundary is affected by the traffic noise and the general noise level here increases to some extent due to the increased traffic volume when the roads surrounding the Park are put into service since the operation of completed LETDZ.

As it can be seen from the comparison, the construction of LETDZ causes no significant impact and the good regional environment quality shows that the concept of attaching equal importance to the development and environmental protection has been adhered consistently, which are mainly reflected in the following aspects: ① strictly check enterprises to settle in the Park and ensuring the majority of them are light-pollution, labor sensitive and science and technology driven enterprise; ② actively utilize clean energy to reduce the air pollutant emissions from the source; and ③ effectively support the development of LETDZ with completion of environmental protection infrastructures such as the wastewater treatment plants and landfills.

12.3 Environmental Impacts in Proposed Areas (2014-2019)

12.3.1 Overview of planning

In chronological order of Linshui development, the major development components from 2015 to 2019 include Chengnan Electromechanical Industrial Park Phase 3, Western New City (within the red border of Figure 12.3.1-1), wastewater interceptors along Shiba River, No. 2 and No. 3 WWTPs, West Ring Road and roads connecting the central urban area of Linshui to the west exit of proposed Shanghai-Chengdu Express. By 2020, the constructed area will reach 22km^2.According to the industrial space layout and plan in the general planning of LETDZ, the machining and electronic information shall be the leading industries.

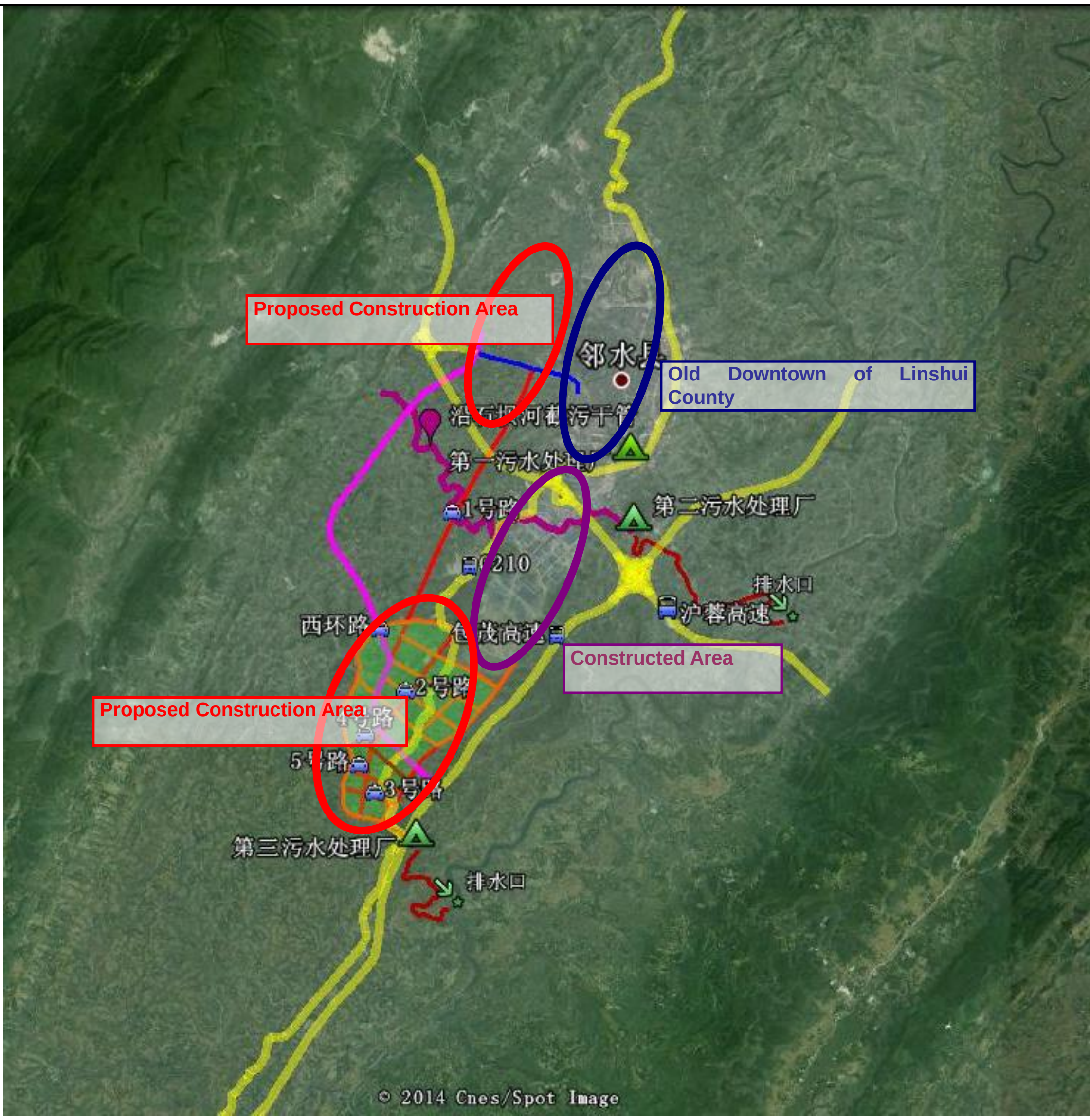


Figure 12.3.1-1 2014-2019 Proposed Construction Areas

12.3.2 Impact prediction

According to the investigation of existing pollution sources, there has been no enterprise settled in the proposed LETDZ. Therefore, the pollution source prediction in the planning EIA and feasible study report will be based on the analogy analysis with constructed area of similar nature and the estimated discharge amount of pollutants.

1. Prediction of air pollution source

The air pollutants are predicted based on two scenarios:

① The settled enterprises use natural gas as the energy for industrial purpose, which is clean energy producing few pollution. In such scenario, no prediction is required due to the little effect of pollution.

② In most unfavorable scenario, i.e., all settled enterprises use coal instead of natural gas, the impact will be predicted. According to the environmental statistics of planning EIA in 2011, the emission intensity per unit of area is estimated via the statistics on the SO_2 and soot emissions from enterprises using coal-fired boilers to obtain discharge coefficient of 105.91 t/a•km^2 and

29.54t/a•km^2 for SO_2 and NO_X respectively.

Based on the above prediction principle, by the end of planning period, the area of industrial land will be 0.99km^2 and the pollutant emissions will be 104.85 t/a and 29.24t/a for SO_2 and NO_X respectively.

2. Prediction of water pollution source

By 2019, the daily average water consumption in assessed area will be 8,200m^3/d, among which the consumption for domestic and public use accounts for 5,200m^3/d, consumption of industrial use accounts for 1,100 m^3/d and consumption for other use accounts for 2,100m^3/d; the annual water consumption will be 3.0295 million m^3 and the water drainage will be about 2.4236 million m^3.

3. Prediction of solid waste production

(1) Prediction of domestic waste

It is predicted that the population of residents in assessed area will increase by 150,000 in 2019 and at per capita domestic waste of 1.0kg produced per day, the production of domestic waste will be 15t/d and 5475t/a.

(2) Prediction of general industrial solid waste and dangerous solid waste production

Prediction equation: $V_{工} = S_1 \times M$

$V_{工}$: Solid waste production (t/a)

S_1 : Discharge coefficient of industrial solid waste (t/ha/a)

M : Area of industrial land (ha)

The discharge coefficient for the general industrial solid waste and dangerous solid waste, the area of land planned for comprehensive use and the predicted production of general industrial solid waste and dangerous solid waste in the demonstration park are determined through analogy and shown in the table below.

Table 12.3.2-1 Prediction of Industrial Solid Waste Production

Area of Industrial Land (ha)	General Industrial Solid Waste		Dangerous Solid Waste	
	Discharge Coefficient (t/ha/a)	Production (t/a)	Discharge Coefficient (t/ha/a)	Production (t/a)
99	12	1188	0.2	19.8

The general industrial solid waste in assessed area is mainly comprehensively utilized, domestic waste transported to the landfill and dangerous solid waste transported to competent organization for treatment.

4. Change in nature of land use

Currently, the developed and constructed area is 18.2km2 in old downtown and ETDZ of Linshui; by 2019, the construction area will be 22km^2; after the completion of Chengnan Electromechanical Industrial Park Phase 3, Western New City, wastewater interceptors along Shiba River, No. 2 and No. 3 WWTPs, West Ring Road and roads connecting the central urban area of Linshui to the west exit of proposed Shanghai-Chengdu Express, the construction area will be 3.8km^2.Namely, there will be 3.8km^2 of farmland, forest land or grassland transformed into land for industrial use, road transport and other purposes.

12.3.3 Overview of enterprises to be Settled

According to the industrial development planning for LETDZ, it is required to continuously improve the quality and efficiency of developing modern logistics by 2020, bring into full display the driving effect of informatization and logistics finance to the logistics enterprises. The enterprises to be settled in the Park are mainly of machinery manufacturing and electronic and information industries.

12.3.4 Summary

Through the prediction on water pollutants, air pollutants and solid wastes in the proposed area, the water consumption will be 3.03×10^6t/a, the wastewater quantity will be 2.42×10^6t/a, and the air pollutant emissions will include 104.85t/a of SO_2 and 29.24t/a of NO_X. The solid waste production will be 0.5×10^4t/a and the dangerous waste shall be transported to competent organization for treatment.

12.4 Environmental Impact Prediction for Future Planning and Development (2020-2030)

12.4.1 Overview of planning

In chronological order of Linshui development, the major development components from 2020 to 2030 include the western area of Linshui County, the western area and eastern area of LETDZ (within the green border of Figure 12.4.1-1).By 2030, the area of Linshui County will increase to 28.3km^2.

In accordance with *General Planning of Linshui County Downtown (2009-2030)*, the planned land is mainly residential and industrial land and the enterprises settled in are mainly of the warehouse and logistics, accessories for rail transit, new energy auto parts manufacturing, machinery manufacturing, nonferrous metal melting and calendering industries.

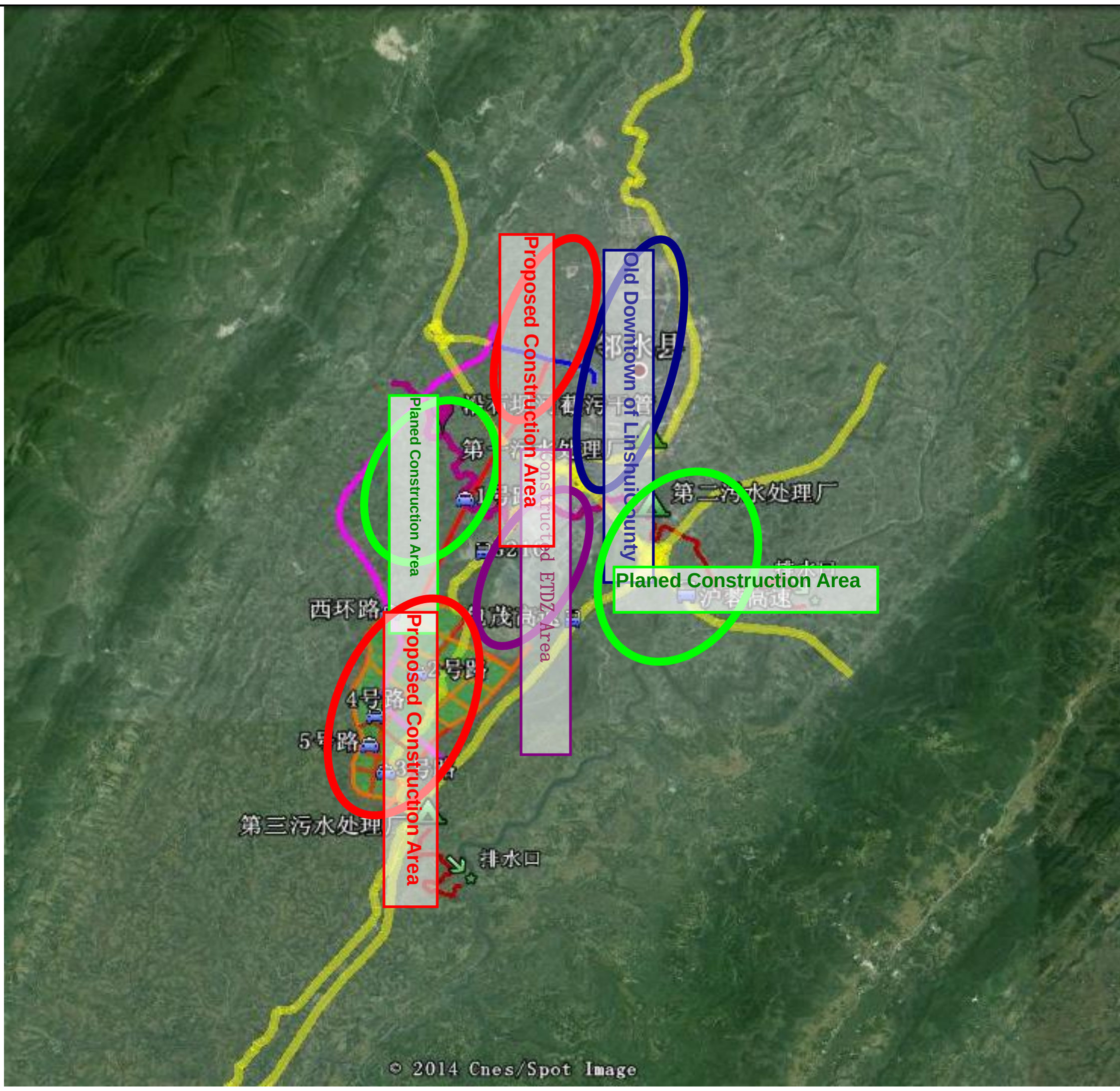


Figure 12.4.1-1 2020-2030 Proposed Construction Areas

12.4.2 Environmental Impact Prediction

1. Prediction and assessment of ecological impact

(1) Ecological environment impact of land occupation

Linshui features middle and low mountains and hills; the type of land used for the development is primarily the cultivated land and secondarily the forest land and grassland; as for current land use status, land to be used for development has relatively high absolute amount and percentage of area.

After the construction of the Park, the cultivated land, forest land and grassland will be converted to industrial use, fundamentally changing the nature of local agriculture and the nature of land use. This will greatly reduce the production scale of farmland, compromising the potential productivity; the farmland will be changed in quantity, i.e., the relative area will be reduced, bringing some impact to local agro-ecology. Rural households inside the Park mainly rely on working outside and farming for economic income, so the acquisition of certain amount of land in the Project certainly will influence their income and standard of living to a certain degree.

Conversion of land use status is expected for the urbanization development.

In accordance with *General Planning of Linshui County Downtown (2009-2030)*, the construction of proposed area will convert current agricultural land (farmland), forest land and grassland totaling 6.3km^2 to residential, industrial, road transport and other use.

Table 12.4.2-1 Construction Land Composition in Assessment Area by 2030

<table>
<tr><th>No.</th><th>Code</th><th colspan="2">Name of Land</th><th>Area
(ha.)</th><th>Percentage
(%)
(%)</th><th>Per capita
(m^2/person)</th></tr>
<tr><td>1</td><td>R</td><td colspan="2">Residential land</td><td>900</td><td>30</td><td>25.7</td></tr>
<tr><td rowspan="9">2</td><td rowspan="9">C</td><td colspan="2">Land for utilities</td><td>420</td><td>14</td><td>12</td></tr>
<tr><td rowspan="8">Of which</td><td>Administrative land</td><td>50</td><td></td><td>1.43</td></tr>
<tr><td>Land for commercial services and finance</td><td>221</td><td></td><td>6.3</td></tr>
<tr><td>Land for cultural recreation and sport</td><td>10</td><td></td><td>0.3</td></tr>
<tr><td>Land for medical treatment and public health</td><td>15</td><td></td><td>0.4</td></tr>
<tr><td>Land for education and scientific research</td><td>120</td><td></td><td>3.4</td></tr>
<tr><td>Land for cultural relics and historic sites</td><td>2</td><td></td><td></td></tr>
<tr><td>Land for religious activities</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>M</td><td colspan="2">Industrial Land</td><td>630</td><td>21</td><td>18</td></tr>
<tr><td>4</td><td>W</td><td colspan="2">Land for warehouse</td><td>60</td><td>2</td><td>1.7</td></tr>
<tr><td>5</td><td>T</td><td colspan="2">Intercity transportation land</td><td>60</td><td>2</td><td>1.7</td></tr>
<tr><td>6</td><td>S</td><td colspan="2">Land for roads and squares</td><td>510</td><td>17</td><td>14.6</td></tr>
<tr><td>7</td><td>U</td><td colspan="2">Land for municipal utilities</td><td>30</td><td>1</td><td>0.9</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">G</td><td colspan="2">Green area</td><td>375</td><td>12.5</td><td>10.7</td></tr>
<tr><td colspan="2">Of which: land for landscaping</td><td>300</td><td>10</td><td>8.6</td></tr>
<tr><td>9</td><td>D</td><td colspan="2">Land for special use</td><td>15</td><td>0.5</td><td>0.4</td></tr>
<tr><td colspan="2">Total</td><td colspan="2">Urban construction land</td><td>3000</td><td>100</td><td>85.7</td></tr>
</table>

It is known from land use planning of Linshui County, going forward, farmland, forestland and grassland will convert to construction land, resulting in fundamental changes in nature of local agriculture and the nature of land use. Although the area of various land types increase somewhat, but the proportion of various land types remains unchanged, especially the proportion of green area remains 13% all the time, sufficiently demonstrating that Linshui County pays much attention to the protection of green area in urban development.

Table 12.4.2-2 Change of Land Use Type before and after Planning

SN	Code	Name of Land	After Planning		Before Planning	
			Area	Percentage (%)	Area	Percentage (%)
			(ha.)	(%)	(10,000m^2)	(%)
1	R	Residential land	900	30	296.35	27.8
2	C	Land for utilities	420	14	131.79	12.4
3	M	Industrial Land	630	21	228.33	21.4
4	W	Land for warehouse	60	2	15.45	1.5
5	T	Intercity	60	2	38.93	3.65

SN	Code	Name of Land	After Planning		Before Planning	
			Area	Percentage (%)	Area	Percentage (%)
			(ha.)	(%)	(10,000m^2)	(%)
		transportation land				
6	S	Land for roads and squares	510	17	175.26	16.4
7	U	Land for municipal utilities	30	1	25.51	2.4
8	G	Green area	375	12.5	147.45	13.8
		Of which: land for landscaping	300	10	106.6	10
9	D	Land for special use	15	0.5	6.35	0.6
Total		Urban construction land	3000	100	1065.42	100

However, fundamental changes in nature of local agriculture and the nature of land use occurs, which will greatly reduce the production scale of farmland, compromising the potential productivity; the farmland will be changed in quantity, i.e., the relative area will be reduced, bringing some impact to local agro-ecology.

(2) Analysis of impact on vegetation

Presently, plants inside the undeveloped part of proposed area are mainly field crops, including arbors, shrubs and low weeds; there is no rare and endangered animals and plants with ordinary biodiversity; there is no sensitive area such as scenic spots and reserves within 5km.Regional development and construction will change the cultivated land and vegetation in the Park in the quantity and area.

In the execution of planning schemes, the variation of land type will directly reduce the cultivated land, as well as the quantity and area of vegetation. Currently, the land in the Park is mainly cultivated land, providing a simple ecosystem neither densely covered with natural vegetation nor planted with artificial forest. The development and construction on this land will change the cultivated land in quantity, namely smaller relative area, compromising the potential productivity to a certain degree, but this will not cause the loss of natural vegetation and vegetation with outstanding ecological value. As a result, the execution of planning schemes exerts little impact on regional surface vegetation.

2. Prediction and assessment of impact on air environment

(1) Prediction mode

In this assessment, the Aermod model (ver.07026) recommended in the *Guidelines for Environmental Impact Assessment - Atmospheric Environment* (HJ2.2-2008) is adopted for calculation.Aermet model (ver.06341) is used for meteorological pretreatment. AerMAP model (ver. 09040) is used for terrain pretreatment.

(2) Predictive range and factors

In this assessment of impact on air environment, the area 5km extending outward from the planned boundary will be determined as the predictive range; and the predictive factors are SO_2 and NO_2.

(3) Prediction results

It is known from the prediction results that the maximum hourly concentration of SO_2 is 0.2mg/m^3 with highest percentage of ground concentration in standard concentration being 42.3%.The maximum hourly concentration of NO_2 is 0.06mg/m^3 with highest percentage of ground concentration in standard concentration being 29.3%, which satisfy the requirements of environmental function division.

In the planning, the impact on air environment is predicted for the most unfavorable conditions (i.e., all industrial enterprises utilize coal as the energy source). It is predicted that the hourly, daily and long-term maximum ground concentrations satisfy the requirements of Class II standard in *Ambient Air Quality Standard* (GB3095-1996) after superimposing the background concentration in the circumstance of discharging up-to-standard pollutants such as SO_2 and NO_2 from the LETDZ. Therefore, construction in the Park will neither bring significant impact on regional air environment quality nor change the function level thereof.

3. Prediction and assessment of impact on surface water environment

(1) Impact on WWTP

The industrial wastewater and domestic sewage in Linshui County enter into the wastewater treatment plant built and to be built in Linshui for treatment; the discharge of wastewater from such wastewater treatment plant follows Class IA standard in the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002), which will normally cause no pollution of receiving water bodies.

(2) Impact of project construction on natural drainage

In the land development, there is no river being occupied, so the natural width, the flow direction and river width will not be changed; the land development has little impact on the natural drainage.

The system of diverting storm water from wastewater is applied in the planning and construction of pipe network, namely, the storm water runoff on the road of Park is connected with storm water pipe network and flows into river after sedimentation, which having small impact on the quantity of natural water bodies.

The implementation of wastewater interceptors and wastewater pipe network may have some impact on the quantity of natural water bodies, but this may prevent wastewater from directly flowing into the river to affect the water quality. Therefore, the implementation of project remains beneficial for the environments.

4. Prediction and assessment of impact on acoustic environment

The regional noise is affected by industrial noise, traffic noise, population density and other factors and may change correspondingly with the socio-economic development. At present, the change in overall regional noise is predicted according to the change in regional population density with the following predictive mode:

$$\Delta L_{eq} = 10\lg\left(\frac{\rho_2}{\rho_1}\right)$$

Where, ΔL_{eq} – predicted variation of regional noise, dB(A);

ρ_2 – predicted annual average population density in the region, person/km^2;

ρ_1 – baseline annual average population density in the region, person/km^2.

In accordance with the *Environmental Impact Assessment Report of General Planning for the LETDZ in Guang'an District of Guang'an City*, the existing population in the proposed area is 55,000; and in accordance with the *General Planning for the LETDZ in Guang'an District of Guang'an City*, the existing residents in the proposed area will be relocated and the population size in the Park is planned to be 75,000 in 2020.In consideration of only the variation of population density, the predicted value of regional noise in target year of planning in ETDZ is shown in the table below.

Table 12.4.2-1 Predicted Value of Regional Noise of Linshui County in Target Year

Description	Item	Existing Average in 2020	Predicted Value in 2030
LETDZ	Average population density (person/km^2)	1951	2661
	Day (dB (A))	48.3	49.7
	Night (dB (A))	41.2	42.6

It is known from above regional prediction results that the noise level in Park increases with the population density. The day and night noise levels in LETDZ increases to some extent at the end of planning period compared with those during the base year and satisfy the requirements of applying Class II standard.

The day and night noise levels in LETDZ increases to some extent at the end of planning period (2030) compared with those during the base year and satisfy the requirements for applying Class II standard.

The traffic noise has a significant impact on the residential district, so corresponding control measures shall be taken against road noise that having significant impact on buildings requiring low noise inside the regional environment.

5. Analysis of the impact of solid wastes on environment

(1) Domestic waste

After the completion of LETDZ, the population is expected to be 35,000, producing daily domestic waste of 35 tons in total; the designed daily waste treatment capacity of waste disposal plant is expected to be 125 tons with designed service life of 14 years since put into service in 2008. Therefore, the treatment capacity is sufficient for the domestic waste of Linshui County.

(2) General industrial solid waste

The industrial solid waste production in the LETDZ is predicted to be about 9924t/a. The general industrial solid waste will be recycled as possible according to the requirements of reclamation of wastes. The general solid waste inside the LEDTZ mainly includes the byproducts and substandard products from the production of transportation equipment manufacturing industry and new building materials industry, which may be used as raw materials and sold as substandard goods, and even recycled to realize the reclamation of solid waste.

(3) Hazardous waste

The hazardous waste production in the LETDZ is predicted to be around 165.4t/a, and no disposal site is planned in the park area for such waste. The hazardous waste produced may be delivered to competent organization by nature for disposal so as to ensure that the impact of disposal on surrounding environment will be minimized.

6. Impacts on groundwater environment

The type of groundwater in western Linshui is the ramifying fissure water from weathered zone, a subtype of bedrock fissure water, with spring flow of 0.11 – 1l/s and being categorized to be poor water zone by the water abundance. The type of groundwater in eastern Linshui is red beds confined water, a subtype of pore-fissure water in clastic rocks, with spring flow of 0.005 - 0.376l/s, water yield of single well of 100-500t/d and being categorized to be moderate water zone by the water abundance. Linshui County does not have groundwater resource in abundance, lacks water sources for centralized production and has no groundwater environment related reserve established by the state and local governments. Constructions in Linshui County are mostly above the ground, causing no change to groundwater flow field or level, so they will not result in environmental hydrogeological problems.

Groundwater in the park area is supplemented by atmospheric precipitation and surface water bodies. It is therefore analyzed that the execution of planning schemes influences the regional groundwater mainly in the mechanism of:

① The initial rainwater of enterprise, for the high pollutant concentration will affect the groundwater through surface water infiltration;

② Break, poor anti-seepage or damage of pipeline and water pond for production, storage and transportation of enterprises, causing the leakage of dangerous substances and groundwater pollution through infiltration;

③ Discharge of WWTP tailwater under accident condition into water bodies, affecting the groundwater through flow or infiltration.

④ Construction of roads and factories, transforming the ground in park area from natural soil into impervious areas such as cement floor and asphalt pavement, which may bring some influence on the supplementation of groundwater in park area. However, there is no abundant groundwater in Linshui County, so the construction barely has any effect on portable water of residents.

7. Analysis of impact on social environment

According to the economic, social and employment analysis, the construction of the LETDZ may provide jobs for residents inside and surrounding Lnshui County. During the development of few other industrial zones, there are examples of social impact that incomprehensive consideration in planning, incomplete facilities or defective social management measures make it unable to effectively deal with the large incoming population.

According to the planning of the LETDZ, it is positioned as an urban comprehensive functional area featuring the advanced manufacturing industry and livable communities. According to the planning, the residential district will be provided with good facilities for water supply and drainage, wastewater treatment, waste collection and treatment, electricity supply, communication, gas supply, landscaping, medical care, education and entertainment. It will be able to provide the incoming population with good dwelling, living, infrastructure and environmental protection conditions. Besides, dormitories, health and care and other facilities and services for workers will be provided inside the factory according to China’s relevant regulations on labor protection to ensure their dwelling and living conditions.

According to the contents of resettlement action plan and institutional enhancement, employment training schemes and labor market information system will be developed during the implementation of the Project. The capability building will take into consideration the code of conduct, health, culture and so on. The trainings will be helpful for the establishment of civilized, safe and harmonious development area.

8. Analysis of impact on urban planning

In accordance with *General Planning of Linshui County Downtown* (2009-2030), Linshui county downtown is positioned as the traffic hub of east Sichuan and north Chongqing highways, the satellite town in the outskirts of north Chongqing, the political, economic and cultural center of the whole county and livable garden city focusing on the development of modern industry and logistics.

Planning of urban spatial structure

The urban special pattern of Linshui County could be summarized to be ”Two Cores, Two Axis and Four Supporting Points” to lead to the path of polarized-to-balanced development by means of using experience of one point to lead the line and promoting the whole area starting from the line.

“Two Cores”:

The major core refers to the central urban area of Linshui County covering Dingping Town, Chengbei Town and Chengnan Town. It is the center of whole county. It is also the center of western economic zone in the county. The minor core refers to Fenghe Town, which is the center of eastern economic zone in the county.

“Two Axis”:

One axis refers to the north-south axis of Xicao, i.e., Gaotan Town – Tantong Town – Heliu Town – Moujia Town – county downtown – Guanyin Town – Ganzi Town, which runs through the whole western economic zone and drives the economic development of Xicao. Another axis refers to the north-south axis of Dongcao, i.e., Yaotan – Jiulong – Yuanshi – Fenghe – Liutang – Shizi – Xingren - Hulin, which runs through the whole eastern economic zone and drives the economic development of Dongcao.

“Four Supporting Points”:

Jiulong, Xingren, Tantong and Ganzi regions are the secondary central towns of Linshui. It is proposed to speed up the development of these four regions to drive the development of southwest, northwest, southeast and northeast regions.

At the end of planning, the southern, eastern and western development zones of Linshui County constitute the special pattern of” Two Cores, Two Axis and Four Supporting Points” to lead to the path of polarized-to-balanced development by means of using experience of one point to lead the line and promoting the whole area starting from the line for the purpose of developing Linshui County as a whole. The future construction and development of Linshui satisfy the requirements on the expansion direction and function of urban land in *General Planning of Linshui County Downtown* (2009-2030) and are in line with the general planning of Linshui County downtown.

12.4.3 Summary

The development and construction of proposed area will have impacts on the water environment, air environment and solid waste treatment. It is predicted and analyzed that there will be 6.3km^2 of farmland, forest land and grassland in Linshui County converted to residential, industrial, transport and other use from 2020 to 2030.It is known from the prediction results that the maximum hourly concentration of SO_2 is 0.2mg/m3 with highest percentage of ground concentration in standard concentration being 42.3%.The maximum hourly concentration of NO_2 is 0.06mg/m3 with highest percentage of ground concentration in standard concentration being 29.3%. By 2030, the predicted regional noise level will be 49.7dB (A) in the day and 42.6dB (A) at night; the domestic waste production will be 1.3×10^6t/a, general industrial waste production about 9924t/a and hazardous waste production about 165.4t/a. The domestic waste and general solid waste will be transported to landfill and hazardous waste to competent organization for treatment. The discharge of wastewater from wastewater treatment plant will follow Class IA standard in the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002), which will normally cause no pollution of receiving water bodies. Groundwater is not used as water source for Linshui residents and enterprises, so the urban expansion will cause no impact on the life heredity is know from above analysis that the influence of urban expansion on the environment is limited and controllable.

12.5 Potential Issues and Measures Related to Induced and Cumulative Impacts

12.5.1 Loss of urban green space

1. Impact of urban expansion on green space

   By 2030 of the long-term planning, the constructed area in Linshui County will increase to 28.3km^2 of 2030 from 10.65km^2 of 2009.Urban expansion will intrude into the landscaping are surrounding the urban core, resulting in the loss of forest land, grassland and green belt of Linshui County.

2. Mitigation measures

   (1) During the implementation of road works, landscape works is performed for the roads to create a linear landscape belt; during the implementation of factory construction, the landscape works is designated as a necessary part for the factory construction. Urban landscaping is possible in making up for the loss of biomass and area caused by construction.

   (2) The green space system planning shall be taken into consideration during the planning. It is stated in the general planning of LETDZ that one comprehensive park is positioned against the natural mountain in the west of proposed area; the belt-shape green lands of parks are arranged in combination with natural waters while the riparian park at the relatively open area; the belt-shape green lands are positioned along the street according to the layout of urban truck roads. The construction of green space system may also compensate to some degree the reduction in vegetation area and quantity caused by the construction of Park, so it is very necessary.

   (3)The natural hills in the middle of LETDZ planning area shall be planned as ecological green area, in which trees of various types shall be planted to form the green background of LETDZ.

   (4)Design slow traffic system on the both sides of road, which include pedestrian traffic and non-motorized traffic. The slow traffic system is environmental-friendly and beneficial to personal safety, producing no environmental pollution and conductive to physical activity. Moreover, the slow traffic is integrated with the concepts of fairness and harmony, people foremost and sustainable development. It cannot be replaced by motorized traffic for its roles in improving the short-distance travel efficiency, filling a gap in the bus service, promoting the sustainable traffic development and guaranteeing the travel convenience of vulnerable groups. It competes and cooperates with private motorized traffic and public traffic to constitute the urban passenger transport system.

12.5.2 Impact of city on environment

It is unavoidable that the urban expansion and construction may bring some water, air and noise pollution. See sections 12.3 and 12.4 for the analysis in detail. It is know from the analysis on the resources and environmental carrying capacities that the supportive role of resources and environment in the subsistence and development of Linshui people is an important reflection of sustainable development.

1. **Analysis of resources carrying capacity**

(1) Analysis of water resource carrying capacity

The water for LETDZ is supplied by No. 2 Water Plant of Linshui County, which comes from Guanmenshi Reservoir. No. 2 Water Plant built in 2005 is designed with capacity of 50,000m^3/d, with total design capacity of 70,000m^3/d, and actual water supply of 20,000m^3/d. Guanshimen Reservoir located 6km upstream of Linshui county downtown is a medium sized reservoir integrating flood control, irrigation and water supply functions with water-collecting area of 30.65km^2, total storage capacity of 23.186 million m^3 and available storage capacity of 18.3 million m^3. The water storage capacity may effectively guarantee the water supply of park area and the implementation of park planning.

(2) Analysis of power source carrying capacity

In accordance with the *General Planning of Linshui County Downtown* (2009-2030), the 35kV substation in the middle of proposed area is reserved; the 110kV Niubeishan Substation in the east area will be expanded in long run with main transformer capacity of 2×40MVA; two 110kV substations will be newly built in the west of proposed area with main transformer capacity of 2×60MVA.

(3) Analysis of gas source carrying capacity

Being accepted as clean and high-quality energy source, natural gas has become an important energy source for living and industrial production of people in modern cities. With rich natural gas reserves, Linshui County becomes the major exploration area of gas fields in eastern Sichuan Province with annual gas production of 0.4 billion m^3. The gas for the LETDZ is provided by county's gas well and natural gas main network. In accordance with the general planning of LETDZ, a Φ219 long-distance pipeline will be established from Chang'an Pigging Station of State Grid to access the storage and distribution station under construction in the county downtown for supply to the Chengnan Electromechanical Industrial Park.

2. **Analysis of environmental carrying capacity**

(1) Analysis of water environment carrying capacity

The environmental capacity of receiving water bodies is calculated as follows: according to the drainage destination demonstration in the preceding chapter, the drainage destination of No. 3 WWTP of Linshui County is Bajiao River, where the water environment capacity of COD and NH_3-N is 595.4t/a and 78.47t/a respectively. It is predicted that the discharge of wastewater from No. 3 WWTP of Linshui County follows Class IA standard with annual discharge of 73 t/a and 7.3t/a for COD and NH_3-N.All these values are within the range of water environment carrying capacity of Bajiao River.

(2) Analysis of air environment carrying capacity

In this assessment, the multi-source and A-P value method are applied to estimate the environment capacity of regional NO_2, of which the calculated minimum value will be taken as the final value. Statistical results are shown in the table below:

Table 12.5.2-1 Estimated Results of Air Environment Capacity (Unit: t/a)

Indicator	Method of Calculation	Total Environmental Capacity	Predicted Total Amount of Emission	Residual Environmental Capacity
NO_2	**Annual concentration up to standard**	662	37.2	624.8

According to above estimated results, the total environmental capacity of regional NO_2 is about **662**t/a.

According to the prediction in the preceding section, the predicted total amount of NO_2 emission is **37.2**t/a in short term after the execution of planning scheme, which is within the range of regional air environment carrying capacity.

3. Mitigation measures

- Mitigation measures for air environment impact

(1) Reasonably arrange the enterprises to be settled in the Park strictly according to the proposed leading industries and the layout of industrial land.

(2) Strengthen the control over industrial waste gas pollution in the five aspects: ① promoting cleaner production; ② optimizing the structure of energy utilization by using natural gas in preference; ③ making sure the effective control of waste gas from enterprises' technology; ④ improving the environmental management and surveillance; and ⑤ perfecting the emergency response mechanism in case of accident discharge.

(3) Regularly monitor the enterprises that may produce air pollutants in the park area to ensure the normal implementation of enterprises' waste gas treatment and the emission of up-to-standard waste gas.

(3) Design slow traffic system on the both sides of road, which include pedestrian traffic and non-motorized traffic. The slow traffic system is environmental-friendly and beneficial to personal safety, producing no environmental pollution and conductive to physical activity. Moreover, the slow traffic is integrated with the concepts of fairness and harmony, people foremost and sustainable development. It cannot be replaced by motorized traffic for its roles in improving the short-distance travel efficiency, filling a gap in the bus service, promoting the sustainable traffic development and guaranteeing the travel convenience of vulnerable groups. It competes and cooperates with private motorized traffic and public traffic to constitute the urban passenger transport system.

(4) Strengthen atmospheric environmental management; strictly review and restrict high-energy consumption and high pollution industrial project, constantly reduce energy consumption per unit output value

and pollution emission standard, and encourage the development and utilization of clean energy.

(5) Shut down small enterprises with atmospheric pollution emissions exceeding standard value and projects listed in catalogue of outdated production capacity, technologies and products to be phased out.Energetically promote cleaner production, and boost ISO14000 environmental management system certification in order to change resources utilization from extensive form to intensive form.

(6) Strengthen civilized construction management; use commercial concrete for urban construction and take dust control measures like closed work, closed operation, clean the vehicle before setout, and watering so as to control construction dust.

- Mitigation measures for surface water environment impact

(1) Apply the system of diverting wastewater from clean water and storm water from wastewater by enterprises in the Electromechanical Industrial Park;

(2) Popularize cleaner production processes by enterprises in the Electromechanical Industrial Park;

(3) Implement fully the emission declaration and permit system;

(4) Make sure that wastewater from enterprises in the park area must be discharged to WWTP for further treatment after the wastewater is treated up to Class III standard in *Integrated Wastewater Discharge Standard* so as to realized discharge of up-to-standard wastewater.

(5) Strengthen the water environment protection of rivers and canals in the park area;

(6) Develop proper emergency response plan in case of WWTP accident discharge;

(7) The long-term WWTP treatment capacity may be adjusted according to the actual settlement of enterprises in the Park to make sure the WWTP is capable of receiving the production and domestic wastewater in the Park and avoid pollution of nearby water bodies like rivers.

(8) Complete the construction of existing supporting wastewater interceptor works of WWTP; accelerate the construction of wastewater treatment and supporting facilities, renovate urban wastewater treatment system, apply the system of diverting wastewater from rain water so as to improve municipal wastewater collection rate; establish WWTP, regional wastewater collection, treatment and discharge system in different areas.

- Mitigation measures for groundwater environment impact

(1) Enterprises apply proper ground anti-seepage measures according to possible pollutants form production in the overall principle of higher anti-seepage level and lower infiltration coefficient for regions with more severe pollution and higher probability of accident.

(2) Wastewater from enterprises shall be first treated in respective wastewater treatment facilities until the wastewater satisfy the requirements of being received by the WWTP and then enter into the WWTP where it shall be treated up to standard before discharge. It is forbidden to discharge wastewater arbitrarily. The wastewater under

accidental condition and fire-fighting wastewater shall be discharged into the accident pool, guided in batches into respective wastewater treatment facilities until the wastewater satisfy the requirements of being received by the WWTP then enter into the WWTP where it shall be treated up to standard before discharge.

(3) Strengthen the maintenance and management of WWTP to ensure the long-term stable discharge of up-to-standard wastewater after centralized treatment and prevent the accidental discharge of wastewater from severely affecting the surface water and groundwater;

(4) Perform strict quality inspection during the construction of proposed area and strengthen the anti-seepage treatment of pipeline and structures in the design and construction to make sure the engineering and pipeline construction are in line with design requirements and guarantee both the quality and quantity.

- Noise control measures

(1) Measures for industrial noise control, arrange reasonably to the noise level at boundary is up to standard;.

(2) Measures for construction noise control, arrange the construction time reasonably;

(3) Measures for traffic noise control, buildings sensitive to noise, including residential and school buildings should not be planned or constructed on both sides within 30m from the main roads and main traffic artery of proposed area; besides green belt of 20-50 wide shall be established to mitigate the impact of traffic noise by means of range attenuation and noise reduction by afforestation.

(4) Measures for controlling noise of social activities.

- Solid waste management and disposal measures

(1) Strengthen the management of general industrial solid waste, realize reclamation of waste and used materials, explore approaches of comprehensive utilization, strengthen the disposal and exchange management of industrial solid waste, establish the information system for industrial solid waste production, direction of flow, storage, disposal and exchange and encourage the waste recycling among production enterprises in the Park;

(2) Implement the system of hazardous waste production, declaration and registration, and the permit system for the business of hazardous waste storage, collection, disposal and facility utilization. The whole process management shall be provided in the collection, transport, storage, utilization, treatment, disposal of hazardous waste.

(3) Establish the waste collection system, waste storage system, waste transport system and waste treatment system and realize harmless disposal of domestic waste.

12.5.3 Impact of urban construction on natural drainage

1. Environmental Impact

In the land development, there is no river being occupied, so the natural width, the flow direction and river width will not be changed; land leveling is required before land development, which may change the landform to a certain degree and have some impact on the natural runoff inside the county downtown. The system of diverting storm water from wastewater is applied in the planning and construction of pipe network, namely, the storm water runoff on the road of Park is connected with storm water pipe network and flows into river after sedimentation, while the wastewater flows in to the WWTP for discharge into natural water bodies after being treated up to standard; therefore, this development in Linshui County has limited impact on the quantity of natural water bodies.

The construction of roads and factories will transform the ground in park area from natural soil into impervious areas such as cement floor and asphalt pavement and the hardened ground reduces the permeability of natural soil layer, which may, to some extent, hinder the direct supplementation of aquifer by atmospheric precipitation.

2. Mitigation measures

DThe change of ground from natural soil into impervious areas such as cement floor and asphalt pavement and the hardened ground reduces the permeability of natural soil layer, which may, to some extent, hinder the direct supplementation of aquifer by atmospheric precipitation.Therefore, during construction enough attention shall be paid to the relationship between the infrastructure construction and the natural drainage and groundwater recharge.

During the construction of Park area, infiltration green area, permeable ground, and municipal drainage shall be adopted to increase the natural drainage rate.

Infiltrating green area: during the urban construction, the green area near the factory and road will be lower than the road and factory levels, through which the storm water runoff from surrounding hardened ground flows naturally into the green area to supplement the groundwater

Pervious ground: pervious asphalt pavement is considered for the road in the implementation of road works; measures such as pervious colored pavement brick are taken for the pedestrian path; impervious pavement in catchment area are improved by using porous materials instead of completely hardened ground to increase the amount of infiltration and supplement the groundwater.

Urban drainage: with reference to the actual situation in urban area of Linshui County, the design repetition period of rainfall, P, in planning is recommended to be: P= 2-3 years for general residential district and roads; P= 3-5 years for the central area, artery and square; and P= 10 years for the extremely important area. During the planning design, the impact of rain storm to the city is fully taken into consideration to ensure the drainage capacity of the city.

12.5.4 Farmland loss caused by urban construction

1. Influence mode

Urban expansion will intrude into the farmland and according to the planning, the constructed area in Linshui County will reach 28.3km^2 by 2030 while it is 18.12 km^2 for now. In other words, there will be 10.18 km^2 of farmland, forest land and grass land converted to urban construction area by 2030.The farmland area of rural households will gradually disappear with the development of urbanization and be replaced by factories and centralized resettlement districts. According to the survey, Linshui people mainly rely on non-agricultural means such as working outside for economic income, and income from other sources takes up relatively low percentage, which means that the affected households are less dependent on the land for survival. The general impacts of farmland loss is limited, however, the influence on some areas and part of the agricultural population shall be taken seriously.

2. Mitigation measures

Economic compensations are provided for the acquisition of housing and farmland. The establishment of local enterprises provides employment opportunities and increases income of local workers. The infrastructure improvement at project site may attract external enterprises which need to recruit may local works for their development, thus create creating many new jobs, providing employment opportunities for local low-income groups, vulnerable groups and women, and providing jobs for land-lost farmers to increase their income and improve the living standard of local residents.

For project occupying high yield farmland, based on the principle of "Occupy how many, cultivate how many", the area of farmland reclaimed shall be equal to that of occupied. In case it is impossible to reclaim new farmland or the reclaimed farmland cannot meet requirement, farmland reclamation fee shall be paid as per regulations to be specially used for reclaiming new farmland. According to requirements of the people's government of county level and above, during construction the plough layer soil of farmland occupied shall be used for the soil improvement in newly reclaimed farmland, poor land, or other farmland.

12.5.4 Addressing Cumulative Environmental Impact

1 Environmental Management

Controlling the impact of regional development on environment is an important step to control from source. For instance, strictly review and restrict high energy consumption and high pollution industrial project; shut down small enterprises with atmospheric pollution emissions exceeding standard and the projects listed in catalogue of outdated production capacity, technologies and products to be phased out; pre-treat the wastewater of the enterprises in the Park up to standard before discharge; strengthen civilized construction management and supervision; all these need the support of local environmental protection department.

A total of 50 persons work in Linshui Environmental Protection Bureau, including Environmental Monitoring Stations and Environmental Monitoring Corps.Construction of Environmental Monitoring Stations is up to national standard class 3, and that of Environmental Monitoring Corps is up to national standard class 3 and is to be accepted as per national standard class 2.

Linshui County covers a large area, the staffing of the county environmental protection bureau currently can meet requirement. However, with the expansion of Linshui County, in order to better meet the requirement of environmental protection, to constantly increase the environmental supervision capacity and to boost the healthy development of environmental protection work in Linshui County, it is suggested to set up Environmental Monitoring Stations by zoning within the county territory.

2 Implementation of Environmental Protection Measures

In the process of urban development, in order to control environmental impact, it is necessary to implement and manage specific environmental protection measures in all aspects.

(1) When the planning department makes or adjusts urban planning, the percentage of urban greenbelts in the total planned area shall be fully taken into consideration. During the process of land planning, it shall avoid incorporating high yield farmland into the planned area; in the construction and development of Linshui District, Linshui Housing and Urban-Rural Development Bureau shall implement the construction of greenbelts works according to the plan made by

the planning department.

(2) According to the condition of enterprise settlement in Linshui County, Linshui Water Affairs Bureau shall promptly adjust the treatment capacity of WWTP for effective wastewater collection and treatment in the park.

(3) Housing and Urban-Rural Development Bureau of Linshui County shall pay attention to the construction of the pipeline works in Linshui County such as wastewater pipe network, rainwater pipe network and water supply pipe network, to collect effectively wastewater from different areas of Linshui to be transmitted to WWTP for further effective treatment. The repetition period of rainfall in Linshui County shall be taken into account, so as to ensure adequate drainage capacity provided by the rainwater pipe network to reduce the impact of rain storm to the city;

(4) During the implementation of road works by Linshui Housing and Urban-Rural Development Bureau, the utilization of new materials, such as infiltrating greenbelts, pervious asphalt pavement, pervious colored pavement brick, is required for the construction of the road works to reduce the impact of pavement hardening on natural drainage.

(5) Linshui Bureau for Environmental Health shall establish the waste collection system, waste storage system, waste transport system and waste treatment system, and focus at any time on the capacity of the refuse landfill to ensure the hazard-free treatment for general industrial waste and domestic garbage.

The source of capital mainly includes self-raised funds and loans.

12.5.5 Detailed cumulative environmental impact assessment – A strategic environmental and social assessment

During preparation of EIA of the Project, induced and cumulative environmental impact assessment is conducted based on the available data.However, given the insufficient of data available, and various urban and industrial development planning is under preparation and perfection, the current induced and cumulative environmental impact assessment is only a preliminary one.On the other hand, the pressure and impact of rapid urbanization and industrialization on the environment, resources and society have to be coped with seriously.Therefore, in the technical assistance part of the Project a second-stage induced and cumulative environmental impact assessment is included.This assessment shall, based on preliminary assessment, further collect data, conduct research and consultation, and carry out detailed cumulative environmental impact assessment. This assessment will closely coordinate with ongoing various planning processes of Linshui and will cover both environmental and social aspects, thus is considered a Strategic Environmental and Social Assessment. The TOR (term of reference) shall include the following:

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The rapid assessment method is proposed for this assessment and the assessment shall be performed in combination with other factors of technical assistance project, in particular the preparation of strategic urban plan. The assessment procedures include: **1.** Components introduction and background: Describe the proposed project component, its background and other components and activities that may have any cumulative effect; use the environmental assessment report and other documents such as master

urban planning of LInshui, Linshui ETDZ master and/or regulatory planning, relevant environmental function zoing, resource utilization, heritage protection planning, etc. In the induced and cumulative impact assessment (CIA), determine the sequence of component planning and construction, the sequence of affiliated and local infrastructure construction and the possible industrial type and development status. Identify the potential impact on important environmental factors and put forward geological information (including the administrative boundary or watershed) and time limit by the consultant for cumulative impact assessment.

Component introduction includes:

(1) Known components

Components that have been implemented inside the assessment area for World Bank loan and other regions, for which the description covers the scale, overview and scheduled implementation time of current stage; the World Bank loan funded components in the same area and the overview of proposed construction area in current period; the urban infrastructure related to the known components including the proposed roads, power transmission lines and gas transmission lines; and for which the environmentally sensitive area, main stakeholders and affected residents in the region shall be identified.

(2) Past, present and future possible components

After the determination of assessment scope and environmental impacts, the past, present and future possible components and activities in particular time and space frames shall be analyzed. The assessment of other components and activities shall consider:

- Assessing all components proposed or planned to be implemented in the assessed area;
- Determining the time period of past, present , proposed and planned future components;
- Assessing the approved components, components to be approved and components proposed or being designed in the area for cumulative impact assessment;
- Assessing the potential industrial development pattern and tis potential pollution load in the area for cumulative impact assessment;
- Assessing the environmental factors of reasonably foreseeable social and environmental cumulative impacts, in particular components exerting direct impact on the water resource, land resource and biodiversity and drawing basic maps for the future development of existing and future components and expansion area.

(3) Identification of important environmental and social issues

Identify the cumulative impacts of urban expansion in assessment scope to important resource, such as on the groundwater, the biodiversity and the life of local people, all of which are usually known as valued ecosystem components (VECs) and determined through consultation with potential affected groups, local government authorities, non-governmental organizations and experts and scholars to make sure that they could be measured with relevant indicators. The potential VECs and indicators may include:

Damage of urban green areas, green areas and natural habitats caused by urban expansion;

Automobile exhaust due to urban road construction and increased number of vehicles and noise from running vehicles; impact of factory construction in LETDZ to the quality of ambient air and acoustic environment;

Natural soil with good permeability used for the ground in the region prior to the development and construction; but the ground will be hardened in the urban construction. The hardened ground reduces the permeability of natural soil layer and the concrete has poor permeability, which may, to some extent, hinder the direct supplementation of aquifer by atmospheric precipitation.

The farmland owners will lose their land due to the urban expansion, which may impact the income source and sustenance of farmers to some extent.

Impact of urban expansion and infrastructure construction on physical cultural resources.

(4) Baseline map

Use geographic information system or other tools to mark the selected VECs. Develop the plan on the required indicators for status, environmental carrying capacity, urban development trend and urban expansion for each VEC within the time frame.

2. Impact Assessment

The degree of induced and cumulative impacts shall be assessed. For this, the method used is similar to the environmental assessment, but the components within given time and space frames are assessed in the induced and cumulative impact assessment as well as other components and activities.

The assessment includes the impacts during the construction and the planning and development stages. The assessment of each environmental factor and cumulative impact considers the typical parts of environmental assessment, i.e., the degree, frequency, duration, order of magnitude, uncertainty and possibility. The assessment method is subject to the qualitative analysis and the analysis on available quantitative data obtained via data collection or analogy; the assessment may consider the map overlay method to analyze the future industrial development and additional load of environmental system, such as the WWTP.

3. Determination impact degree or scope

The degree and scope of cumulative impact is determined. The impact degree shall be determined according to the preset threshold limits, laws, rules or policies, or the professional judgment and consultation based

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qualitative assessment and the degree or scope of cumulative impact must stand up to scrutiny.

The assessment consultant shall define the impact degree and scope, following them in the past, present and planned components. The impact degree or scope of each VEC in any past, present and future components is subject to assessment, as well as the cumulative impact of induced development.

4. Development of impact mitigation measures

Reasonable and feasible methods are analyzed to mitigate or avoid significant induced and cumulative impacts. Corresponding action plans (including the time, organization and duties and budget) are developed according to the analysis conclusions to clarify the mitigation measures and incorporate such measures in to the environmental management plan. For example, the available environmental impact mitigation measures for the urban region development or the development and construction of industrial park include:

- Full consideration of landscaping area in factories during the construction and green area creating surrounding the industrial park;
- Riparian parks for main rivers of Linshui County, such as Shiba River and moat; full consideration of green area and green area in the center of street in the design of urban streets to form green corridors in Linshui County and bring benefits to the urban ecological environment and landscaping;
- Emphasis on protection or bypassing of high yield farmland during the planning and expansion of city and LETDZ;
- Full consideration of phased WWTP construction and adjustment of WWTP capacity according to the population increase and enterprise settlement in Linshui County to satisfy the urban expansion requirements;
- Full consideration of new materials in road construction (i.e., pervious asphalt pavement), full consideration of infiltrating green area (lower than the factory and road level) in road and factory construction and use of porous materials in catchment area instead of completely hardened pavement to reduce the possible impact on groundwater supplementation by atmospheric precipitation;
- Development of more complete, normative and stringent requirements on water and air pollutant emission by local environmental department for factories inside the LETDZ;
- Strengthened surveillance by local environmental department on water drainage and gas emission from enterprises inside the LETDZ and development of environmental detection plan for better understanding of pollutant discharge in park area;
- Development of other traffic systems, such as slow traffic, and consideration of bicycle path and pedestrian path;

It is suggested that the adaptive management method for impact be included since the high uncertainty of impact or the lack of information may result in incomprehensive

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assessment.

12.6 Conclusion

The induced and cumulative environmental impacts are preliminarily assessed through the comprehensive analysis based on the terms of reference and the summary of general urban planning, planning EIA and status survey. It is know from the screened main induced and cumulative environmental impact factors that the cumulative impact in Linshui County will be significant by 2030.Due to the limited available materials, there is a lack of detailed and complete data and materials concerning the environmental and social impacts of the infrastructure construction and the industry and commerce development of Western New City and Eastern New City. It is difficult to conduct more definitive and quantitative analysis, so the particular cumulative impact assessment combined with the actual regional development and basic data is required during the construction period.

13 Conclusions

13.1 Project Background and Composition

13.1.1 Project background

The Infrastructure Project for World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area meets the need to realize the national economic development strategy. As required in the notice issued by the National Development and Reform Commission, the Ministry of Finance, the World Bank loan shall be actively applied to the infrastructure construction for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area. In the second half of 2011, Guang'an City launched the loan application for the Infrastructure Project for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area (including Qianfeng and Linshui Components) and in the early half of 2012, the Infrastructure Project for Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area was included in the World Bank Loan Funded National Plan for 2013-2015.

According to *China's Memorandum for Proposed Infrastructure Project for Sichuan-Chongqing Cooperation Demonstration Area* dated June 2013, the Infrastructure Project for Linshui Industrial Park of Guang'an is one of the components in the Infrastructure Project for World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area.

13.1.2 Contents

The development of Project is targeted at meeting the current and prospected development demands of Linshui and supporting the improvement for traffic, wastewater treatment, labor skills and investment promotion services. For this purpose, the Project will support the following activities:

(a) connection of the low-income communities in central urban area of Linshui to the traffic corridor of the LETDZ and roads of 11.77km long in total inside the Park; (b) drainage and sewage pipelines, lighting and landscaping for the traffic corridors and roads inside the Park; (c) No. 3 Wastewater Treatment Plant (WWTP) with daily capacity of 4,000m^3 to serve the southern area of the LETDZ; connection of 13.066km wastewater interceptors for No. 2 Wastewater Treatment Plant (WWTP); and (d) provision of short-term skill trainings for impoverished and low-income people in Linshui County.

13.2 Existing Environmental Quality

1. Ecological environment

   The works is located in Chengnan area of Linshui County, where it features low hills and the farmland and artificial vegetation accounts for the majority of land and vegetation, presenting simple ecosystem in the project area. Due to frequent human activities, there is no habitat for large wild animals and only a few common animals such as barn swallow, sparrow and field mouse. Most of planning land is now undeveloped and on the whole a natural rural ecological environment.

2. Acoustic environment

   The Project is located in the proposed industrial area of Linshui County, around which there is no major noise pollution source and social noise is the main pollution source; it is known from the monitoring and assessment of acoustic environment, the overall acoustic environment quality here is good, with noise level of 44.8~53.4dBA in the day and 37.5~46.2dBA at night, so the regional noise level satisfy the requirements of Class II acoustic environment function zone as specified in GB3096-2008.

3. Air environment

Through status monitoring, the indicators at selected monitoring points within the air assessment scope are up to standard and meet the Class II standard in *Ambient Air Quality Standard* (GB3095-1996).The ambient air quality is good in the project area.

4. Surface water environment

The monitoring results show that the water quality is good upstream of Bajiao River and Shiba River and the water quality factors monitored meet the standards for category III water area in *Environmental Quality Standards for Surface Water* (GB3838-2002).

With the moat running through Linshui County downtown, there are many concentrated residential areas along the moat; some domestic sewage enters into the moat making the NH_3-N and total P therein exceeding the limits of category III water area in *Environmental Quality Standards for Surface Water* (GB3838-2002).

5. Groundwater environment

The water wells of rural households in western area and eastern area of LETDZ, midstream of LETDZ segment of Bajiao River, 500m downstream of LETDZ segment of Bajiao River are monitored to know that the groundwater environment quality is good in Linshui County, meeting Class III standard in Quality Standard for Ground Water (GB/T14848-93).

6. Domestic waste

There are about 160 tons of domestic wastes transferred, collected and disposed for Linshui urban area. The street refuse and domestic waste are collected and transported to the transfer stations and then delivered to Wucha Waste Disposal Plant for landfilling.

13.3 Environmental Impact and Environmental Protection Measures during the construction period

The land occupation of the Project includes permanent land occupation by project and temporary land occupation for construction within the scope of land acquisition, the scope of land renting and the jurisdiction of land use of the Owner. The permanent land occupation includes land occupation for the subgrade and bridge in road works, pipelines in wastewater interceptor works, and the plant area and some drainage pipelines outside the plant of Linshui No. 3 WWTP. The types of land occupied are paddy land, dry land, forest land, grassland, countryside homestead, highway land, pond and hydraulic structure land. The temporary land occupation for construction includes that for the access road, construction site, construction camp and temporary stack yard in road works, the access road, some pipeline and temporary construction in wastewater interceptor works, the wastewater collection pipelines, some drainage pipelines outside the plant and temporary construction of Linshui No. 3 WWTP.

The infrastructure construction in the LETDZ will inevitably bring some damage to the regional ecological environment, which will change the existing land-use type and cause the surface vegetation to disappear. Moreover, crushing of various motor vehicles, activities of construction personnel and piling of earth and stone will also cause more serious damage and impact to the vegetation. As the construction continues, some plant species within the scope of land requisition will disappear and the vast majority of plant species will be greatly reduced, so the regional biodiversity will be affected hereby. However, all damaged vegetation types are common types in the assessed area, without national key protected rare or endangered plants and wild plants. Therefore, infrastructure construction in LETDZ has little impact on the flora and vegetation type, which will not lead to the extinction of existing species and vegetation types in the region. After the construction period, the vegetation will be gradually restored through landscape construction, and it will make up the loss of plant species diversity.

The direct impact on terrestrial animals during the construction period is mainly from group activities of construction personnel and disturbance on animals during construction; while the indirect impact refers to the damage to vegetation and soil due to the construction of industrial enterprises, resulting in the loss of some terrestrial animal habitats. However, no important activity trace of mammals, amphibians and reptiles is found in the construction area, and the main animals are relatively small number of small mammals, small common birds and frogs and common lizards, which are in small numbers and have strong ability of migration. Therefore, the sustenance of such animals will not be impacted during the construction period. It is worth noting that the main mammal in the construction area is rodents, with many types and in large numbers, most species of which are harmful to the agriculture and forestry on different levels, especially the mouse. Due to the dense population and abundant foods during LETDZ construction, such mammal may breed in high density and some species may spread to the surrounding places, which may lead to large number and high density of mice in the surrounding places of the construction area. Therefore, the Owner must perform well in construction camp health and protection in accordance with the requirements of the environmental management plan.

The subgrade filling, expanding excavation of river course, temporary piling of spoils and housing demolition during construction will crush and damage the surface vegetation, disturb the topsoil structure and change the existing terrain. New water and soil loss may be caused under the action of gravity, raindrop hit, current scour and other exterior forces.

Concentrated rainfall in the project area will greatly aggravate the water and soil loss during the construction period, so construction in rainy season shall be avoided as much as possible.

According to related contents in the *Water and Soil Conservation Plan for the Infrastructure Project for Linshui Industrial Park in World Bank Loan Funded Sichuan-Chongqing Cooperation (Guang'an) Demonstration Area* and the prediction analysis on water and soil loss caused by the construction of the Project, the original topography disturbed and land and vegetation damaged by the Project cover 69.64hm2; and due to the construction disturbance of the Project, the total water and soil loss in the project area within the forecast period amounts 26485t, and 23191t of water and soil loss is added on account of project construction. Among all the additional amount of new water and soil loss, 17790t occurs in the road works area, accounting for about 76.7% of the increment; 4083t in wastewater interceptor works area, accounting for about 17.6% of the increment; and 1317t in WWTP, accounting for about 5.7% of the increment. The ecological impact on the region due to water and soil loss is mainly as follows:

The ecological impact on the region due to water and soil loss is mainly as follows:

(1) The damage of surface vegetation causes some impact on the ecological environment in project area. The cultivated land, forest land, water area, wasteland and other soil conservation facilities with soil and water conservation function occupied for the construction of main works cover an area of 46.69hm^2, and surface vegetation destruction in the project area reduces the percentage of forestry and grass coverage, which will exert some impact on the ecological environment in the project area.

(2) Impact on river course

Wastewater interceptors are laid along Shiba River. If the water and eroded soil flow into the river along the slope during construction, the river course may be blocked and it may impact the downstream of the dam.

(3) Impact on the project area and surrounding production and living environment

For the construction in new district of the town and the LETDZ, protective measures are not taken, so greater soil and water loss will adversely impact the surrounding production and living environment while impacting the construction schedule.

2. Acoustic environment

If a single construction machinery is used, the noise level at place where is 35m away from the construction site may achieve the value specified in Noise Limits for Construction Site (GB12523-90) in the day and that 218m away from the construction site may achieve the standard limit at night. But in the actual construction process, a variety of machines are often used at the same time, so the noise will have a boarder scope of impact. Within around 5-30m in average from the boundary of construction site in the noise sensitive area, the construction noise of have greater impact on surrounding acoustic environment. The acoustic environmental protection targets along the Project (Hejiayakou, Xujiawan and Xinwuzui) are substantially 30m away from the ROW. In the daytime, the first row of residential buildings on both sides of the road will produce different levels of impacts and the impact on rest of the residents is particularly obvious at night. Therefore, measures must be strictly taken to minimize the impact of construction noise on the environmental protection target. When the project is completed, the impact of construction noise will no longer exist, so the adverse impact of the construction noise on environment is temporary.

Reasonable and scientific construction site layout is a major way in reducing construction noise. Place the fixed noise sources on the construction site collectively to reduce the scope of noise impact. Arrange construction time reasonably in accordance with the provisions of the *Emission Standard of Environment Noise for Boundary of Construction Site* (GB12523-2011). Forbid construction operation with high-noise machinery at night (22: 00~6: 00). Adjust construction time as appropriate or take temporary noise reduction measures like setting up temporary noise barrier (i.e., temporary wood sound barrier) or adopting semi-underground construction and so on when performing construction near residential area. For worksite requiring continuous construction operation, the Contractor shall contact in time the environmental protection department according to specific situation to apply for nighttime construction certificate as per regulations and strive for public support as much as possible by issuing announcement.

At sensitive areas within 50m on both sides of the proposed road like centralized dwelling district of Hejiayakou, Liujiawan, and Xinwuzui, the construction fence height shall be increased or housing demolition shall be carried out in advance.

3. Air environment

Impact analysis: the pollution to ambient air during the construction of the Project is mainly from: first, the fugitive dust produced by lime-soil mixing, concrete mixing and vehicle transport during construction; and second, the asphalt smoke produced by pavement. The road dust caused by transport vehicle has an impact within 20-50m.During demolition, dust cloth fence is applied for enclosed construction and watering is conducted for dust fall, so that the impact range of demolition dust may be controlled in an enclosed area. Besides, the earth-rock excavation and infrastructure construction create a certain amount of fugitive dust. The impact distance of smoke pollutants emitted when conducting asphalt pavement is around 100m from the downwind; but according to the construction organization, the asphalt pavement operation time is short and its impact is temporary.

In summary, ambient air pollutants, mainly including road dust caused by transport vehicle and construction dust, are generated during the construction links like land leveling, subgrade construction, pavement, material transport, handling and mixing and asphalt pavement. Therefore, different levels of impacts on the air environment for the surrounding resident households will be produced during the construction period, but the impact is temporary.

Prevention and control measures:

(1) The Project site management shall strictly refer to the construction site management principle of “Six Musts” and “Six Mustn’ts”. Six Musts include the wet work, the barrier circling on urban road, the road hardening, provision of washing facilities, provision of sufficient cleaning workers, and cleaning the construction site regularly; and Six Mustn’ts include vehicles living without mud, slag vehicle not overloaded, no throwing or littering of construction sediment, no concrete mixing on site, no water left on the ground, and no waste burning on site, so that the construction site dust pollution can be effectively controlled.

(2) Provide dust-proof measures like construction barrier at concrete mixing station, or mix concrete inside building to effectively control dust pollution.

(3) Water in due time the construction site on non-rainy days, including the road section in construction and major transportation road. Watering frequency shall be determined by the site supervision personnel according to the actual situation.

(4) Powder material like cement, lime shall be packed in tanks or bags, bulk transportation of such material is prohibited, dust scattering in transportation is prohibited; while in storage, they shall be stored in warehouse or covered with tarpaulin.

(5) Provide dust-proof mat at exits of construction site; clean the body and tires of transport vehicles out of the construction site. Forbid overload of soil, sand, stone; the loading height shall not exceed that of the carriage plate and the loaded material shall be covered with tarpaulin to prevent them from falling along the way.

(6) In case of a wind velocity above level 4 when it is prone to producing dust, it is suggested that the Contractor should temporarily stop earth-rock excavation and take measures like covering, wetting the stockpile to effectively reduce dust pollution;

(7) Collect and transport the construction waste in time, and cover those which cannot be collected and transported temporarily; tightly cover vehicles transporting sand, stone, cement, earth which are apt to produce dust to prevent falling and leaking.

(8) Provide dust mask for construction personnel to reduce health damage by dust.

(9) Water the temporary storage yard regularly to reduce the impact of dust on the surrounding environment; set up closed enclosure with height no less than that of the piled up material around; divide the boundaries between the

material area and road and clean up the scattered materials in time to keep the road neat and clean the road in time.

(10) For soil piled up for over 48 hours in road and pipeline construction, take dust control measures such as using dust-proof covers.

(11) Transport vehicles for spoils shall have enclosed bucket; vehicle cleaning platform shall be provided on the inner side at the entrance and exit for transport vehicles and shall be equipped with proper drainage facilities; before leaving the construction site, vehicles shall have their tires and the bodies washed to remove the soil.

4. Surface water environment

Wastewater during the construction period mainly derives from construction wastewater, domestic sewage produced by construction personnel and wastewater produced by pipeline closed water test. The main pollutant of construction wastewater is SS, which may be reused after sedimentation, while that of domestic sewage includes SS, COD and oil, which upon treatment in sedimentation tank or septic tank may be discharged into water bodies or used as agricultural fertilizer for the surrounding area. The domestic sewage is prohibited to be directly discharged into nearby water bodies during the construction period.

Control measures:

(1) Construction wastewater in the Project is reused after treatment and is not directly discharged into local water bodies, and domestic sewage is discharged after treatment in septic tank or used as agricultural fertilizer, which in general will not impact the waters quality.

(2) The Contractor of the Project shall make simple processing to muddy water like filtering and sedimentation, and direct discharge is prohibited; the Owner shall strengthen construction management to perform civilized construction.

(3) Domestic waste, construction waste, maintenance garbage would produce pollution if directly discharged into the waters, therefore, they shall be recycled, sorted, stored and treated. The usable materials like most paper, wood, metal and glass wastes shall be reused or sold to garbage buyer, and the unusable shall be handed over to environmental health department for harmless treatment, incineration, landfill, stockpiling, etc.

(4) Residual and waste oils produced in construction shall be collected, recycled and disposed with different vessels; aggregate wash water and concrete batch plant wash water produced in subgrade construction after sedimentation and treatment shall be reused for watering the construction site to reduce dust.

(5) Leakage and pressure test shall be performed after the connection of pipeline works and clean water shall be used in the pressure test of pipes; the pollutant in water from pressure test is mainly SS, which may be collected as dust suppression water or landscaping water after sedimentation.

(6) Well-up water produced in the excavation of WWTP structures shall be used in construction after sedimentation.

5. Impact on groundwater

Impact analysis: the Project mainly includes new road works, wastewater interceptor works and WWTP works, of which the construction in general will not lead to changes in groundwater level and will not block the groundwater flow.

Control measures:

(1) Strengthen sewage and production wastewater treatment during construction; the domestic sewage of construction personnel shall be used for agricultural irrigation or recycling after pre-treatment and the production wastewater after sedimentation shall be used for dust suppression in the construction.

(2) Bulk yard shall be covered to prevent water and soil loss from polluting groundwater.

(3) The Contractor shall make scientific schedule and carry out reasonable construction to shorten the construction period and further reduce the impact of pumping and discharging of groundwater.

(4) Organize construction by sections to prevent the additive effect on the falling groundwater level due to the excessive concentration of dewatering wells in some section.

(5) Increase the number of drain wells as appropriate, choose reasonably the locations of drain wells to minimize the distance from the pipeline in construction so as to reduce the impact scope of falling groundwater level.

(6) Construction of the foundation of sewage wells shall be arranged in non-flood season to reduce the adverse impact of a lower groundwater depth on construction.

6. Solid waste

Impact analysis: the Project involves demolition of buildings and structures, i.e., dwellings of farmers in majority, within the engineering land acquisition range, with a demolition area of 96,807m^2. The solid waste during the construction period mainly includes construction waste (including the brick rubble, concrete, mortar, pile head and packaging materials) and the demolition waste produced is about 6.58×10^4m^3.Construction waste produced during the construction period shall be transported to Linshui Bureau for Environmental Health for unified treatment.

Control measures:

(1) Domestic waste produced in construction shall be classified and collected and shall be collected, transported and disposed collectively by local environmental health department.

(2) Upon completion of works, dismantle the temporary facilities in the construction area, remove construction waste and all sorts of sundry, clear up and level up the domestic waste, simple toilet, and sump, perform disinfection for these with carbolic acid and caustic lime, and restore the construction site.

(3) The contractors shall specially designate personnel to take charge of the collection of production waste; the scrap iron, scrap steel, waste wood pieces shall be stacked at the location specified; random piling and stacking is prohibited; wastes shall be collectively reclaimed and subject to centralized treatment.

(4) In the process of transportation, the domestic waste and building materials shall be enclosed or covered to prevent garbage, sandstone, earth from falling along the way or into the river.

13.4 Environmental Impact and Environmental Protection Measures during the operation period

1. Ecological environment

The natural vegetation will be permanently occupied by the proposed road works with the nature of land use changed, and through natural succession or artificial cultivation, it will be gradually restored to secondary vegetation type with corresponding vegetation features, but the quality of secondary vegetation is superior to the original vegetation. When the road in put into service, the construction of the LETDZ will be stepped up, furthering the reduction of original vegetation in local region.

During the operation period, the ecological landscape impact is the major impact of works on ecological environment. When the roads and wastewater interceptors are put into service, the status of land use will be changed leading to the variation in the landscape of original rural hills converted and the original landform for the construction of towns or industrial enterprises.

2. Acoustic environment

During the operation period, the traffic noise on new roads is the major noise impact. It is predicted and calculated by modeling that the regional noise level is 52.2~67.3dB (A) at night and 45.6~60.8dB (A) in the day for short term; 52.7~67.8dB (A) in the day and 46.1~61.3dB (A) at night for medium term and 53.5~68.5dB (A) in the day and 46.8~61.9dBdB (A) at night for the short term.

Noise Prevention Measures: according to the principles for noise control, noise control measure at sensitive sites is mainly to set sound-proof windows at 5 locations with a total area of 1840m^2, total investment of about CNY 920,000.Soundproof windows shall be provided according to the demolition conditions and the actual noise monitoring results at sensitive sites along the road after construction.

Article 12, Chapter 2 of the Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise provides that the urban planning department shall, in determining architectural layout, provide a reasonable noise-proof distance between the buildings and traffic artery in accordance with national acoustic environmental quality standard and civil building design code and propose corresponding planning and design requirements; Article 37, Chapter 5 provides that for new noise-sensitive buildings on both sides of urban traffic artery, certain distance shall be reserved from the road in accordance with national regulations and traffic noise mitigation measures shall be taken; Article 5(2) of Technical Policies for the Prevention and Control of Ground Traffic Pollution (HF[2010] No.7) provides that for noise-sensitive buildings besides roads and tracks, the functions of rooms in a building shall be reasonably arranged to reduce traffic noise impact, for instance, kitchen and restroom and the like in residential apartment shall be located on the side facing the road or tracks.

According to the said principles, land use on urban roadsides shall be properly planned and the function of land use along the road shall be strictly controlled; Based on the predicted noise value at varied distance and the predicted distance at which traffic noise meets the standard, it is suggested that acoustic-sensitive buildings like residential areas, schools and hospitals shall not be placed at the first row facing the road within 20m of the road centerline. In addition to reasonable planning of land function on roadsides, architectural layout and sound-proof design shall be strengthened to ensure the inside environment of noise-sensitive buildings meets requirements for use.

Implement traffic control at night, restrict overspeed in sensitive sections at night; strengthen management on blaring horns; strengthen the maintenance and management of urban road and repair in time the damaged road; restrict the traffic of overspeed, overload vehicles and heavy-duty trucks.

Since Road No.2 to No.5 in the Project are all located in LETDZ, according to construction and development schedule this area will be developed during 2014~2016; currently land leveling is being carried out and some houses have already been demolished, it is suggested that housing demolition and resettlement should be carried out as soon as possible to reduce the noise impact of the Project.

3. Air environment

Impact analysis: during the operation period, the automobile exhaust has little impact on the quality of regional ambient air along the road, satisfying the Class II standard in *Ambient Air Quality Standard* (GB3095-2012).

Besides, after the implementation of road reconstruction works, the cement pavement is replaced by asphalt pavement. This improves the driving environment, so the engine operates in good status with less pollutant emissions. The works mitigates the pollution load of automobile exhaust to regional air environment instead of polluting the air environment.

The emissions of odor pollutants H_2S and NH_3 at the boundary of WWTP is much fewer than the limits of Class II standard for boundary in the *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002), and the downwind concentrations of H_2S and NH_3 are much lower than the limits of Class II standard in *Ambient Air Quality Standard* (GB3095-2012), resulting in small impact of WWTP on the ambient air quality.

Control measures: enforce strict exhaust emission inspection system and restrict traffic of vehicles with excess emissions; organize transport route scientifically; restrict traffic of ultra-limit slag cars; strengthen road management and road maintenance and keep road in good operation condition and reduce traffic jam. Strengthen landscaping on road sides and plant trees capable of absorbing (or adsorbing) toxic gases like CO, NO_2, etc. to reduce air pollution caused by road traffic.

Reasonably arrange the WWTP with the structures of major odor sources in the center of plant to ensure the surrounding environmentally sensitive areas beyond the protection distance will not be affected; provide mechanical ventilation facilities for the waste lift pump house and the sludge dewatering room of WWTP to eliminate the odor and improve the environment; control the odor emission by covering the pond of treatment facilities giving out odors to confine the odor in not fully open structures; use underground sludge reflux pump above which the landscaping is provided; adopt modified frame filter for pressure filtration and dewatering of sludge which will be transported with special vehicle to the waste disposal plant for landfilling and ensure the sludge is kept for a very short period of time in the plant; collect the sludge on a daily basis to control the production of odor; and specify the health protection distance from the odor boundaries of WWTP.

In the engineering design, UV efficient purification photolysis method technology is recommended for deodorization. The principle is to use high-energy UV ultraviolet to crack and oxidize the molecular chain of odor so as to change their structures in photolysis purification equipment, to crack and oxidize high molecular substances into low molecular innocuous substances like water and carbon dioxide. The deodorization and purification rate can reach above 99% without secondary pollution. Moreover, sludge sump shall be equipped with a cover. And cost of which is already included in the main works design.

According to calculation, 100m health protection distance is set from the boundaries of odor sources (oxidation ditch, secondary sedimentation tank, rotary filtering chamber, and sludge thickener) as centers.Within health protection distance, there are 7 households in the north of WWTP and 1 in the west, so it is suggested that these 8 households with 36 residents be relocated to meet the requirement of health protection distance.According to *General Plan of Linshui Economic and Technological Development Zone (2008-2030)*, The WWTP is located in the planned area which will be developed during 2014~2016 and the WWTP will be built in 2017, at that time all residential houses around it will have been demolished, so there will not be any residential houses remained then.

Wash or spray the temporary storage yard in the plant with chlorine water or bleaching fluid; conduct disinfection treatment for vehicles transporting sludge before leaving the plant area.

According to calculation, 100m health protection distance is set from the boundaries of odor sources (oxidation ditch, secondary sedimentation tank, rotary filtering chamber, and sludge thickener) as centers. Within health protection distance, there are 4 households in the north of WWTP and 1 in the west, so it is suggested that these 5 households be relocated to meet the requirement of health protection distance. Relocation cost is temporarily decided as CNY 100,000 per household and finally determined as per the standard in the land acquisition and housing demolition and resettlement plan issued by local government in respect of the Project.

Strengthen the management, control fermentation during sludge thickening and collect and transport dewatered sludge in time to reduce sludge stockpiling; during shut down for maintenance of various ponds, the sludge at the bottom will be exposed and give out odor, measures for removing sludge deposit shall be taken in time to prevent the effect of odor.

Strengthen the landscaping, provide greening isolation belt around the wastewater and sludge production area and the coarse screen of lift pump station in the WWTP, plant different species of tree to form multilayer of protection and isolation belt against odor and minimize the impact of odor and ensure the green land area in plant area and pump station of being no less than 30%.

4. Surface water environment

Impact analysis: when the road works is completed and the road is put into service, the road runoff is collected and sedimented by the storm water collection system established on both sides of the works and then drained into the river, having little impact on the water environment in project area.

The treated WWTP tailwater satisfy the requirements of Class IA standard in *Discharge Standard of Pollutants for Municipal Wastewater Treatment Plant* (GB18918-2002), so the discharge of tailwater is predicted to have little impact on Bajiao River.

Control measures: collect and sediment runoff on the road surface by the storm water collection system established on both sides of the works and discharge it into the river. Wastewater control measures of No.3 WWTP: adopt the combined process of “coarse grid + water collection tank + fine grid + rotational flow grit chamber + regulating tank + hydrolysis acidification tank + amended oxidation ditch + rotary filter tank” as treatment process for the wastewater on the water, apply “ultraviolet disinfection” process for disinfection, discharge wastewater when it reaches the Class 1A standard (GB18918-2002) and consider wastewater reuse.

The No. 3 WWTP wastewater meets the Class IA standard of GB18918-2002 after treatment in improved oxidation ditch and The No. 2 WWTP wastewater meets the Class IA standard of GB18918-2002 after treatment with “CASS” technology and is discharged in to Bajiao River.

5. Groundwater environment

Impact analysis: the impact on groundwater during the operation period of the Project is mainly from the WWTP wastewater leakage or the excessive discharge and the seepage from wastewater interceptors and wastewater pipelines.

Control measures:

(1) perform strict inspection on the design and construction quality during the project engineering to prevent groundwater pollution from the source and avoid any leakage from wastewater interceptors and wastewater pipelines due to defective material, tube making, welding and misoperation.

(2) Take anti-seepage measures (seepage coefficient ≤1.0×10-10cm/s) such as HDPE film + impervious concrete for the wastewater collection unit, treatment structures, sludge treatment unit and chemical adding room to prevent the pollution of groundwater environment. Provide anti-seepage treatment for the wastewater collection and transportation pipe network; enhance the monitoring means and perform regularly inspection during the production and operation to avoid possible leakage and seepage of wastewater.

(3) Enhance anti-seepage treatment for the pipe network, bond corner, bearing and joint while keeping proper records for the concealed works and perform regular leak detection and monitoring.

(4) Work out an anti-seepage plan by areas, conduct anti-seepage design targeted at different areas and take reasonable anti-seepage measures.

(5) Develop an emergency plan for the risk accidents of groundwater and identify the closure and intercepting measures that should be taken under the condition of risk accident.

5. Solid waste

The solid waste mainly includes transport materials falling onto the ground during vehicle driving, sludge, waste on the screen and grit produced by WWTP and domestic waste produced by the staff.

Clean up the road in time to collect the waste and hand it to local environmental health department for unified treatment; dispose the dewatered sludge by landfilling, for which the sludge is transported to Linshui domestic waste landfill for disposal together with the waste on screen of WWTP and the domestic waste of staff.

13.5 Induced and Cumulative Environmental Impact Assessment

The scope for induced and cumulative environmental impact assessment is Linshui County downtown and the time lasts to 2030, which is consistent with the general planning of Linshui County downtown. Linshui County downtown includes the industrial park, namely, the LETDZ.

The current constructed area of Linshui County downtown is 18km^2, this will reach 22km^2 by 2020, and 28km^2 by 2030.The induced and cumulative environmental impact due to the infrastructure construction in the process of urban expansion, the increase of pollutant discharge during the development of industrial park may be significant in the long run. These mainly manifest in the change of nature of land use, the decrease of vegetation and the deterioration of environmental quality.

Further induced and cumulative environmental impact assessment, looking into strategic plannings and environmental and social aspects, will be conducted during Project implementation period based on the current assessment.

13.6 Conclusion

In accordance with *Guidance Catalogue for Industry Structure Adjustment* (2005) (Order 40 of National Development and Reform Commission of the People's Republic of China), the Project is a government-supported project, in line with the industrial polies of China and local urban planning; and there is neither significant environmental constraint nor environment risk. The impact of project implementation on the environment may be avoided and mitigated provided that the environmental protection measures proposed in this report are carefully taken and the environmental management is strengthened during the construction period, the Project is feasible from the prospective of environmental protection.