Initial Environmental Examination

June 2014

People's Republic of China: Gansu Baiyin Integrated Urban Development Project

Prepared by the Government of Baiyin Municipality for the Asian Development Bank.

CURRENCY EQUIVALENTS

(As of 20 May 2014)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.1639
$1.00	=	CNY6.10

ABBREVIATIONS

ADB	–	Asian Development Bank
AP	–	affected person
BPMO	–	Baiyin Project Management Office
CNY	–	Chinese Yuan
CSC	–	construction supervision company
DFR	–	draft final report
EA	–	executing agency
EIA	–	environment impact assessment
EMP	–	environmental management plan
EMS	–	environmental monitoring station
EPB	–	Environment Protection Bureau
EPD	–	Environment Protection Department
FB	–	Financial Bureau
FSR	–	feasibility study report
FYP	–	Five-Year Plan
GDP	–	gross domestic product
GHG	–	greenhouse gas
GRM	–	grievance redress mechanism
IA	–	implementing agency
LAR	–	land acquisition and resettlement
LIEC	–	loan implementation environmental consultant
LIP	–	Liuchuan Industrial Park
LMC	–	Liuchuan Industrial Park Management Committee
MOF	–	Ministry of Finance
NDRC	–	National Development and Reform Commission
O&M	–	operation and maintenance
PFO	–	project facility operator
PMO	–	project management office
PPCU	–	project public complaint unit
PPMS	–	project performance management system
PPTA	–	project preparatory technical assistance
PRC	–	People’s Republic of China
PSA	–	poverty and social assessment
RP	–	resettlement plan
SPS	–	Safeguard Policy Statement
WTP	–	water supply plant
WWTP	–	wastewater treatment plant

WEIGHTS AND MEASURES

kg	–	kilogram
km	–	kilometer
m^2	–	square meter
m^3	–	cubic meter
mg/l	–	milligrams per liter
Mg/m^3	–	milligrams per cubic meter
mu	–	Chinese land measuring unit (1 hector = 15 *mu*)
ha	–	hectare (10,000 m^2)
MW	–	megawatt (1 million watts)
t	–	ton (1,000 kg)

NOTE

In the report, “$” refers to US dollars.

Table of Contents

List of Tables

I. EXECUTIVE SUMMARY

A. Background

1. This Project Initial Environment Examination (project IEE) report was prepared for the proposed Gansu Baiyin Integrated Urban Development Project (the project) in Baiyin Municipality of Gansu Province, the People's Republic of China (PRC). The project IEE is prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of the domestic environmental impact assessment (DEIA) prepared by Lanzhou University (the EIA Institute), Feasibility Study Report (FSR) of the project components, water and soil conservation plan, workshop reports, social and economic assessments under the Project Preparatory Technical Assistance (PPTA), and project policy dialogue discussions between the ADB missions, the PPTA consultant, Gansu Provincial Government (GPG) and Baiyin Municipal Government (BMG).

2. Baiyin is a medium-sized city in Gansu province (Gansu), one of the 12 less-developed provinces and autonomous regions targeted under the Western Development Strategy of the People's Republic of China (PRC). The city was originally established as a national copper mining base in the 1950s but its socioeconomic development suffered major setbacks after continuous copper exploitation and depletion, and environmental degradation. Since the Eleventh Five-Year Plan 2006–2010, Baiyin received special support from the national and provincial governments to jumpstart its industrial transformation.[1]The goal was to transform Baiyin from a resource-exhausted mining city into a new industrial center through technology upgrading and diversification of existing production chains, while achieving efficient use of resources and reducing adverse impacts on the environment.

3. Baiyin's industrial transformation aims to facilitate inclusive and environmentally sustainable urban development. Although the Phase I project supported Baiyin to start its economic diversification, the city faces emerging urban development challenges. The main project area is located in a 23-km^2 planned area of Liuchuan Industrial Park (LIP Phase 1) of the poverty-stricken Jingyuan County[2], one park of the "one zone and six parks" comprising Baiyin Industrial Concentrated Zone, which is a strategic industrial base of the Lanbai ("Lanzhou–Baiyin") Core Economic Zone. It aims at attracting transfer of large and medium industrial enterprises from the eastern coastal region of the PRC, focusing on rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacture, warehousing, logistics, and construction material industries. Master planning and regulatory planning of the project area has been completed, and land formation, construction of some roads, a resettlement area, and some industrial plants and ancillary buildings has started.

4. The built-up area of the LIP is currently 5 square kilometers. As of March 2014, 16 enterprises and institutions have settled in the park. The area is spacious, has little value for farming and is close to water sources and power supply. It is a favorable location for industrial zone development. However, to enable large-scale industrial development, the site is in urgent need of infrastructure such as road access, water supply and wastewater treatment.

5. Master planning and regulatory planning of the project area has been completed, and land formation, construction of some roads, a resettlement area, and some industrial plants and ancillary buildings has started. The proposed ADB financed project will invest in a road and key urban infrastructure and services in the area to provide transport, water service for drinking and industrial processing, and wastewater treatment to improve the environment, and locals' quality of life. This will

[1] In 2008, Baiyin was listed as one of 18 national resource-exhausted cities which received special support for economic transformation under the Eleventh Five-Year Plan. Baiyin was also designated as a circular economy pilot city in 2009 and a resource-based city transformation demonstration area in 2011.

[2] Jingyuan County's per capita gross domestic product in 2012 was CNY11,884, 54% of Baiyin's average. Gansu provincial government under its 12 FYP designates the Lanbai Core Economic Zone to accelerate the development of the industrial economic corridor from the provincial capital of Lanzhou to Baiyin.

significantly improve the investment environment to attract more enterprises to move into the project area. Moreover, the development of LIP will provide significant job opportunities.

6. To complement the infrastructure construction for industrial development, the project will also strengthen vocational education and training capacity, enhance environmental management for industrial transformation, and enhance road safety and traffic management in Baiyin District. The project will further scale up the outcome of the Phase I project by accelerating environment-friendly industrial transformation in Baiyin.

B. Project Design

7. **Lessons learned and special features**. The project design incorporates lessons learned from ADB's five urban sector projects in Gansu. These are (i) keeping impacts of land acquisition and resettlement to a manageable level, and (ii) rigorously reviewing technical designs to avoid oversized infrastructures.[3] Together with and building on the Phase I project, the project will demonstrate a sustainable model of urban development through industrial transformation for other resource-exhausted cities in the PRC. Individual special features of the project include: (i) comprehensive support for skills training and vocational education for industrial transformation; (ii) enhanced environmental management through detailed environmental management system (EMS); and (iii) installation of an intelligent transport system (ITS) to address bottlenecks on transportation management.

8. **Impact, Outcome, Outputs.** The impact of the project will be accelerated industrial transformation and economic diversification in Baiyin. The expected outcome will be environmentally sound and socioeconomically inclusive industrial development in Baiyin. Project outputs include:

(i) basic urban infrastructure in LIP Phase 1, comprising: (a) a new water supply facility with treatment capacity of 60,000 cubic meters per day, a 14-kilometer (km) water transmission pipeline, a 9.2-km water distribution pipeline network and other related facilities; (b) a new wastewater treatment facility with treatment capacity of 35,000 cubic meters per day, a 57-km wastewater collection pipeline network and related facilities; (c) 1 new road of 6 km;

(ii) strengthening of TVET capacities for local skilled/non-skilled workers in Jingyuan County;

(iii) ITS in the Baiyin District, including (a) an integrated traffic operation platform; (b) an adaptive signal control system; (c) an electronic-police system; and (d) a comprehensive violation processing system. Also, for medium-term and long-term development, a large-scale traffic data collection and dissemination system will be built; and

(iv) project management and institutional capacity building, including effective project management, environmental management of the industrial area, and the sustainable operation and maintenance of project facilities.

9. The capacity development component will have a subcomponent to assist the LIP achieve sustainable environmental management. The environment management system (EMS) subcomponent will work to ensure that environmental management of the LIP is performed to international best practices and obtain LIP ISO14001 certification as well as "eco-industrial park" status under the Ministry of Environment and NDRC programs. The LIP EMS will serve as a demonstration and model for the many other existing and proposed industrial parks of Baiyin and Gansu Province. The subcomponent

[3] ADB assistance associated to urban development in Gansu province include: *Gansu Baiyin Urban Development Project* (Loan 2407-PRC, ongoing); *Lanzhou Sustainable Urban Transport Project* (Loan 2601-PRC, ongoing); *Gansu Tianshui Urban Infrastructure Development Project* (Loan 2760-PRC, ongoing); *Gansu Urban Infrastructure Development and Wetland Protection Project* (Loan 2903-PRC); and *Gansu Jiuquan Integrated Urban Environment Improvement Project* (Loan 3003-PRC).

also includes the development of an Emergency Planning and Response Plan for the LIP as well as an Environmental Management Information System (EMIS). Strengthening of TVET provision and related capacities in Baiyin Municipality and Jingyuan County are also included in the design of the project as a sub-component of Capacity Building activities.

10. **Implementation Arrangements.** Baiyin Municipal Government (BMG) is the project executing agency (EA). The EA is responsible for communication with ADB, loan on-lending and repayment, as well as supervision and guidance of the BPMO and LMC during the project implementation. A Project Leading Group (PLG) chaired by the vice mayor of BMG provides overall guidance to the preparation and implementation of the project.

11. The Baiyin Project Management Office (BPMO) will (i) ensure provision of counterpart funding, (ii) engage and supervise engineering and environmental design institutes, tendering company and the project management consulting service during project implementation, and (iii) report on progress. The BPMO assists the EA and its Project Leading Group (PLG) with policy guidance, institutional coordination, and overall monitoring of project progress in accordance with ADB guidelines and Loan Agreement. BPMO is also responsible for the preparation and implementation of the institutional development component.

12. The Liuchuan Industrial Park Management Commission (LMC), Baiyin Municipal Traffic Police Detachment and Baiyin Municipal Public Transport Company, and Baiyin Mining and Metallurgy Professional Technology Institute and Jingyuan County Bureau of Human Resources and Social Security will be the LMC for infrastructure components associated with the LIP, the intelligent transport system (ITS) component, and the technical and vocational education and training (TVET) component respectively. Baiyin Mining and Metallurgy Professional Technology Institute and Jingyuan County Bureau of Human Resources and Social Security will implement the TVET component.

C. Project Benefits

13. **Direct project beneficiaries**. The implementation of the Project and the development of LIP is expected to generate 70,000 temporary jobs and 92,000 permanent jobs in the long term, benefiting urban and rural surplus labor in Baiyin and Jingyuan County directly. The TVET component will improve local vocational education and provide more skilled labor to LIP. In addition, the ITS component will benefit the urban population of 276,500 of Baiyin directly and a population of over 510,000 in the remainder of Baiyin.

14. **Reduced water pollution.** The project will improve the water quality of the project area and the Dasha River by providing wastewater collection and treatment to the new industries in the LIP. A few existing industries that have inadequate wastewater treatment will now have their wastewater collected and treated properly but there are many pollutant sources along the Dasha River beyond the influence area of the LIP project. Since the proposed wastewater collection and treatment system will mainly service the new LIP tenant industries, the project is mainly avoiding future pollution rather than addressing existing pollution sources. Since 100% reuse of treated wastewater effluent is planned, the degree of pollution avoidance is increased as there will not even be treated effluent impacts to the Dasha River once WWTP is fully operational and reuse systems are in place. It is estimated by the EIA institute that the reduction of COD, BOD_5, ammonia, TN, TP and SS through the proper operation of the WWTP will be 3832.5t/a, 1405.3t/a, 472.67t/a, 523.77t/a, 33.21t/a and 2427.3t/a respectively.

15. **Reliable water supply.** The project water supply subcomponent will increase the capacity and security of water supply to LIP and provide vital support to the development of LIP. Sufficient capacity is being provided for the first phase industries locating in the LIP while nearby villages are being supplied with improved water supply through the Jingyuan County Drinking Water Safety Project that will be

completed in 2014. These complementary projects improve industrial water supply and nearby villages for domestic supply.

16. **Air pollution.** In a similar fashion to the water pollution section, the LIP will work to comply with the new Ambient Air Quality Standard GB3095-2012 going into effect in January 2016 by applying best management practices through the LIP EMS. The ITS will enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks thereby reducing traffic-related air pollution.

17. **Water conservation**. The proposed wastewater management scheme for the LIP calls for 100% reuse of WWTP effluent for landscape irrigation and industrial reuse. Other water conservation programs will be encouraged within the various industries through the LIP environmental management system (EMS). The EMS will promote reductions in water use through the application of industrial best management practices and pollution prevention techniques.

18. **Environmental Demonstration Project**. The EMS subcomponent under the project will ensure safe, environmentally friendly and sustainable operations in the LIP. It will enhance environmental management and emergency response capacity of the LIP to minimize environmental pollution and mitigate negative impacts of environmental incidents, and to comply with the final recommendations of the planning EIA that was prepared for the LIP. The mid-term objective (2018) of the subcomponent is to achieve ISO 14001 EMS certification for LMC. The proposed EMS for LIP is intended to contribute to LIP's accreditation as an eco-industrial park under PRC Standard for Sector-Integrated Eco-Industrial Parks (HJ 274-2009), targeted by 2025.

19. **Poverty and social benefits**. The Project, by its nature of improving environment and public services, is classified as general intervention regarding poverty reduction impact. The Project will not entail disparities and inequalities between the poor and non-poor for their access to the project outputs and the access to the resultant social and economic benefits. The water supply and wastewater treatment facilities will not only serve the industrial park, but also residents within the LIP. By 2030, LIP is expected to offer 92,000 permanent jobs and 70,000 temporary jobs. Over 50% of the local surplus labor will improve their skills and receive new jobs from LIP by receiving different types of vocational training through the TVET project component. The ITS component will generate great social benefits, such as reducing the number of urban traffic violations, and reducing casualties and property losses arising from traffic accidents. It is estimated that the total amount of direct and indirect financial losses arising from traffic accidents and violations in Baiyin City exceeds 200 million yuan per year. It is estimated after intelligent traffic management systems are provided, the number of traffic violations will be reduced greatly, thereby reducing financial losses and the probability of major traffic accidents.

20. **Gender benefits.** The project is designed to meet the criteria for effective gender mainstreaming category. Results from the household survey and focus group discussions indicated that improved public infrastructure are important benefits of the project to women as well as job creation opportunities. The project will significantly improve their access to social services, and provide new employment and income opportunities. The project will be an important way to help the BMG implement their Women's Development Plan of Baiyin (2011-2020), which proposes specific development objectives and strategies in respect of women and health, women and education, women and economy, women's participation in decision-making and management, women and social security, women and environment, and women and law to promote women's development and gender equality.

D. Anticipated Environmental Impacts and Environmental Management Plan

21. The project underwent appraisal during project preparation and was classified as Category B by ADB, requiring an initial environmental examination (IEE). Domestically, the wastewater component and road component were classified as Category A in accordance with the Guideline on EIA Classification for Construction Projects issued by the PRC's Ministry of Environmental Protection (MEP 2008), requiring an environment impact assessment (EIA). The water supply component was Category B, requiring a simplified, tabular environment impact statement. A consolidated domestic environmental impact assessment (DEIA) was prepared for the entire project. The domestic safeguards documents were approved by the Gansu environment protection department (GEPD) in May 2014. In addition, a project IEE in English was prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of the DEIA prepared by Lanzhou University (the EIA Institute), Feasibility Study Report (FSR) of the project components, water and soil conservation plan, a strategic EIA prepared for the LIP, water resources assessment report, workshop reports, social and economic assessments under the Project Preparatory Technical Assistance (PPTA), and project policy dialogue discussions between the ADB missions, the PPTA consultant, Gansu Provincial Government (GPG) and Baiyin Municipal Government (BMG).

22. The potential impacts (positive and negative) and risks were screened during the IEE in order to (i) identify the relative significance of potential impacts from the activities of the proposed infrastructure; (ii) establish the scope of the assessment which assists in focusing on major, critical, and specific impacts; and (iii) enable flexibility in regard to consideration of new issues, such as those reflect the requirements of both the PRC's environmental laws, regulations and standards, and ADB's Safeguard Policy Statement.

23. **Construction Phase.** The major anticipated impacts caused by the infrastructure component for LIP during construction phase include: noise, air pollution (mainly fugitive dust), wastewater discharge, soil erosion, solid waste disposal, interference with traffic and municipal services, permanent and temporary acquisition of land, involuntary resettlement, and occupational and community health and safety.

24. **Loss of land, resettlement.** In total, the Project will occupy 1,158.31 mu[4] of state-owned land (including 830.96 mu of stated-owned barren hills, 6 mu of irrigated land owned by Lantong Farm, and 321.35 mu of collective-owned land acquired already) and acquire 397.74 mu of collective-owned land permanently, including 286.87 mu of irrigated land, 32.57 mu of housing site land and 78.3 mu of idle land. The Project will affect 3 groups of 2 villages in the project area. A total of 1,019.05 mu will be occupied permanently, including 403.74 mu of collective land and 615.31 mu of state-owned land. 155 mu will be occupied temporarily. A total of 8,074.41 m² residential housing will be demolished, and the Project will affect a total of 111 households/entities with 563 persons. Among these, LA will affect 53 HHs/entities (including one Farm) with 263 persons. House demolishing will affect 35 HHs with 156 persons including 23 HHs with 99 persons also affected by land acquisition. Temporary land use will affect 46 HHs with 243 persons, and house demolition will affect 35 households/entities with 156 residents.

25. **Soil erosion prevention measures.** Soil erosion is predicted to be significant during project implementation if no measures are implemented. Contractors will be required to prepare and implement a Site Drainage and Soil Erosion Management Plan in compliance with the engineering and vegetation measures defined in the Water and Soil Conservation Plan. The soil erosion inspection and monitoring program defined in the EMP will confirm adequacy of these measures. The inspection and monitoring

[4] "mu" is a Chinese measuring unit for land and equals to 667 square meters.

results will be submitted to the BPMO, IAs, local EPB and Water Resources Bureau to serve as basis for project implementation progress reports and acceptance of construction.

26. **Surface water pollution**. Inappropriate storage and handling of petroleum products and hazardous materials, or accidental spills, disposal of domestic wastewater from construction camps, and wash-down water from construction equipment and vehicles may contaminate adjacent surface water or groundwater resources. Infrastructure and river intake works, as well as pipeline works, will disturb surface soils and could affect surface water in the project area through increased sedimentation, resulting from cutting and filling operations, excavation of pipeline trenches, and bridge construction across Dasha River. Measures are included in the EMP to protect water bodies from the various infrastructure construction activities including use a Spill Containment Plan, temporary wastewater treatment systems for domestic wastewater and contaminated site runoff, and material storage protection. Water quality (for pollutants such as SS, CODcr, oil, and grease) in the Dasha River will be monitored during construction in accordance with the EMP monitoring program to identify and confirm results of the impact assessment and effectiveness of adopted mitigation measures.

27. **Air Pollution.** Anticipated sources of air pollution from construction activities include: (i) dust through blasting, excavation, moving equipment, traffic on unsealed roadways, loading and unloading operations, stockpile stacking and land reclamation operations; (ii) vehicle emission from construction vehicles (gaseous CO, CH, and NO2) and heavy diesel machineries and equipment; and (iii) asphalt flue gas during road pavement. There is no sensitive receptor within 200m near the proposed location of the asphalt mixing station. After diffusion, the impact from asphalt flue gas resulting from mixing is not significant. A series of mitigation measures are defined in the EMP for reducing the impact of air emission.

28. **Noise.** A significant increase in noise is expected during construction, due to various construction and transportation activities. Construction activities will involve excavators, bulldozers, graders, stabilizers, concrete-mixing, drills, stone-crushing, rollers and other heavy machinery. Noise during pipeline construction will be generated by the trench excavator, roller and compaction machine. However, the noise impacts will be temporary and localized. There are few sensitive receptors near the water and wastewater infrastructure projects but there are scattered residences near the road project. A detailed series of mitigation measures will be implemented to meet the PRC construction site noise limits and to protect sensitive receptors, including regulating hours of construction. Temporary noise protection will be used when necessary. The EMP monitoring plan includes monitoring of noise at sensitive areas at regular intervals and if noise standards are exceeded, equipment and construction conditions shall be checked, and mitigation measures shall be implemented to rectify the situation. The EMP also includes the conduct of monthly interviews with residents living adjacent to construction sites to identify community complaints about noise, and seek suggestions from community members to reduce noise annoyance. Community suggestions will be used to adjust work hours of noise-generating machinery.

29. **Solid Waste**. Sources of solid waste during construction include municipal waste from worker camps and construction solid waste, including debris, sand, stones, broken brick, wood waste, scrap metal, scrap steel, etc. The domestic garbage will be collected regularly and delivered to the place designated by local sanitation agency for proper disposal. The contractor will develop solid waste transport and disposal plan consulting with the local Housing and Urban-rural Development Bureau or relevant agencies.

30. **Biological Resources**. No area of the project site is within a legally protected site or a site proposed for protection. The project site does not include critical habitats with recognized critically endangered or endangered species. No rare and endangered species were identified and recorded in the project area during the domestic EIA process. The Dasha River is not able to sustain aquatic life of

ecological significance or high biodiversity due to its polluted state. Flora to be affected in project area includes mostly shrubs, common seasonal crops, and weeds. The impact on flora is mainly through land use changes. The current land properties are as: cultivated land (8.78hm^2), and wasteland (46.99hm^2), flood plain (9.2hm^2) and woodland (5.6hm^2). The project will increase vegetation coverage along the proposed roads and in the plants. Greening measures will also be taken for the spoil sites. Other protection and mitigation measures specified include proper backfill, compaction and re-vegetation requirements, compensatory planting of an equivalent or larger area of affected trees and vegetation in compliance with the PRC's forestry law, and use of only native plant species of local prevalence will be used for re-vegetation. The EMP specifies that contractors shall identify, demarcate and protect sites where small animals, reptiles, and birds of common species live such as vegetated roadside areas, trees, inner areas of bridges and river riparian zones, etc.

31. **Public utilities and community health and safety.** Traffic may be affected as construction traffic in project area increases, causing temporary inconvenience to traffic, residents, commercial operations, and institutions. Some construction sites will be located close to residential communities, presenting a threat to public health and safety. The construction may also contribute to road accidents through the use of heavy machinery on existing roads. Construction may cause unexpected interruptions in municipal services and utilities because of damage to pipelines for water supply, drainage, and gas supply, as well as to underground power cables and communication cables (including optical fiber cables). Mitigation measures include development of a traffic control and operation plan, survey of underground utilities and other facilities, information disclosure and construction site protection.

32. **Occupational health and safety**. Construction industry is considered to be one of the most hazardous industries. Intensive use of heavy construction machinery, tools, and materials present physical hazards including noise and vibration, dust, handling heavy materials and equipment, falling objects, work on slippery surfaces, fire hazards, chemical hazards such as toxic fumes and vapors, etc. Contractors will implement adequate precautions to protect the health and safety of their construction workers. The occupational health and safety risks will be managed by applying measures in the following order of preference: avoiding, controlling, minimizing hazards, and providing adequate protective equipment. The contractors must designate an Environmental Health and Safety Officer and produce an Environmental Health and Safety Management Plan. This plan will outline detailed provisions for clean water, handling of sewage and wastewater, solid waste management, personal protection equipment, emergency preparedness and response, safety communication. A detailed training program will also be prepared and implemented.

33. **Operation Phase**. The major potential impacts of the infrastructure component for LIP Phase 1 during operation phase include traffic noise, vehicle emissions, noise from pump stations, odor from wastewater treatment plant, accidental failure of WWTP and risk of spills caused by traffic accidents with impacts on rivers and groundwater, occupational health and safety related to the water treatment and wastewater treatment processes and sludge disposal.

34. **Wastewater pretreatment**. Wastewater generated in the LIP industries will be subject to PRC requirements for pretreatment of the wastewater prior to discharge to the wastewater collection system. The PRC has general industrial pretreatment standards as well as sector specific pretreatment standards. Failure of the LIP industries to comply with the relevant pretreatment standards presents a risk to the sewerage network as well as operations of the WWTP. The LMC and Baiyin EPB will be monitoring and validating the proper operation of LIP industrial pretreatment systems. Monitoring data and compliance assessments will be included in the environmental management information system (EMIS). The need for proper pretreatment is also flagged as loan assurance.

35. **WWTP Odor**. The odor produced in the WWTP is mainly from pre-treatment, such as coarse screen, lift pump room, fine screen, grit chamber and sludge treatment. The major pollutants of odor are NH_3 and

H_2S. The Screen chamber, aerated grit chamber and distribution chamber will be covered. The gases will be delivered to the blower room using draft fan and imported to the G-BAF tanks for biological treatment. The removal rate by G-BAF tanks is estimated as 50%. The emission rates of NH_3 and H_2S are estimated as 0.0757kg/h and 0.0035kg/h respectively.

36. **Treated Wastewater Reuse System**. The wastewater treatment plant has been designed to allow for 100% recycling of the treated wastewater effluent, meeting PRC Class 1A wastewater standards. The WWTP is being equipped with a treated effluent storage tank (volume of 3,000m^3) to allow for management of the wastewater reuse distribution systems, consisting of both piped water reuse distribution as well as tanker trucks. The storage tank will also be used in case of WWTP malfunctioning as emergency storage tank. Such a storage system is necessary to balance the treated water production with the treated water reuse, which are not always matched in time or volume. Although the system will eventually be capable of handling 100% of the treated wastewater effluent, a discharge pipeline is constructed to the Dasha River in the interim period until 100% reuse can be achieved (by 2019).

37. **WWTP Solid Waste and Sludge**. The solid wastes during operation of WWTP include screenings, grits, sludge and domestic solid wastes generated by the working staff. The LIP has received an agreement from the operator of the new Jingyuan County Landfill No. 2 which is under construction, that allows the WWTP sludge to be disposed in the new landfill after dewatering. The design capacity is of the new landfill is 820,000 m^3, with an expected life of 10 years (2015-2024). The landfill will be in operation before the WWTP is put in operation, and will be equipped with leachate collection and treatment facilities. If the LIP pretreatment system is successful in maintaining good operations of the industrial pretreatment systems and the LIP WWTP operates properly, the beneficial reuse of the sludge will also be considered in the future. The domestic EIA recommended landfill disposal mainly on the basis of other WWTPs in the PRC and the sludge quality problems in these facilities.

38. The **impact of water extraction on regional water resources** has been assessed through regional water balance analysis in the context of the Yellow River water allocation plan. The results are also summarized in the water resources assessment report. The assessment confirmed that the Yellow River water extraction rate for the project's water treatment plant will remain within the approved extraction quota for Jingyuan County. The proposed supply amount is 60,000 m^3/d for 2020 and 200,000 m^3/d for 2030, with a design abstraction guarantee rate of 97%. The Yellow River has an average annual flow of 920 cubic meters per second (m^3/s) and a historic minimum flow of 236 m^3/s. The amount proposed to be withdrawn will thus not exceed 1 percent of the Yellow River at maximum extraction rate and minimum flow. The water quota is transferred internally from irrigation savings due to the promotion of drip irrigation to replace flood irrigation. There will no additional quota for Jingyuan County. A water quota transfer and usage agreement has been signed between Liuchuan Industry Park Committee, Liuchuan Irrigation Project Management Bureau and Jingyuan County Water Affairs Bureau. The proposed water supply subcomponent will not increase additional water quota of Jingyuan County. This is confirmed in the water resources assessment report approved by the Gansu province water resources authorities.

39. **Sediment Disposal at Primary WTP**. The annual average Yellow River source water sediment concentration is 4 kilograms per cubic meter (kg/m^3); however in summer it reaches ~35 kg/m^3. Common practice for high sediment water is to provide preliminary treatment to settle out the sediment and the preliminary WTP is designed for sedimentation and sand drying beds. The sediment from the preliminary WTP will be transported to the barren mountain adjacent to the WTP. Routine monitoring for sediment quality will be undertaken by the plant operator. The area will be protected from public access and routine soil conservation and protection measures taken to ensure that the material does not impact surrounding land. This requirement is flagged as project assurance.

40. **Disinfection Facilities**. At the secondary WTP, the LDI evaluated various treatment process options and selected the following: pre- chlorination, coagulation with poly-aluminum chloride, sedimentation, filtration by V-filter, and clean water tank with chlorine gas disinfection. This is standard process for Yellow River water which typically has high turbidity. According to the LDI the treated water quality will meet the national "Drinking Water Health Standards" GB5749-2006. There is a risk of leakage and spills during transporting, storing and handling. Transport vehicles and personnel should be qualified and trained with hazardous chemical substance transportation. Chlorine leak detector will be equipped in the chlorine storage room and feed room. Emergency showers will be located in the chlorine storage room with breathing devices and other rescue materials. The ventilation system inside the chlorination room and storage room will be designed according to the state regulations. An emergency response plan, as part of the emergency preparation and response plan of the Liuchuan Industry Park will be developed and implemented.

41. **Noise.** Noise modeling at the two WTPs and the WWTP indicated that the use of noise suppression equipment can keep noise levels to acceptable limits meeting PRC standards at the boundaries of the facilities. As such, there is no need for a protection zone around any of these facilities related to noise impacts. For the Xihuan Road project, traffic noise prediction values for sensitive sites along the road in short, medium and long terms were modeled. According to the prediction results, noise levels are predicted to exceed the standard in medium and long terms, in particular in nighttime. Noise attenuation and protection measures have been defined in the EMP, including: (i) the speed of vehicles will be controlled at 50km/h in the park; and (ii) noise insulation windows will be installed at sites (84 households) where noise levels are predicted to exceed the PRC standards in the short-term. Total cost for the insulation windows is estimated at 373,000 CNY, which is included in the contract package of the road (RD-C02).

42. **Induced and cumulative impacts**. The potential concern that the project may induce uncontrolled industrial development within LIP has been addressed through the conduct of a planning EIA for the LIP Phase 1 (23-km2), which was approved by the Gansu Province EPD in 2012. The planning EIA concludes that the LIP Phase 1 is feasible from an environment point of view, but defines clear requirements to safeguard the environment during LIP development and operation, including: (i) industries introduced to the LIP must comply with national industry development policy, clean production and circular economy, promoting resource use efficiency;[5] (ii) the introduction of high water consuming industries must be strictly controlled; (iii) an EIA including water resources assessment is a pre-requirement for each enterprise planning that enter the park; (iv) each enterprise in the park as well as the LIP as a whole (through the LMC), must avail of emergency preparedness and response plans; and (v) LMC should establish an environmental protection division and develop strict environmental management and supervision procedures and plans. These requirements will be complied with through the establishment of an environment management system (EMS) for the LIP, coordinated by LMC. The EMS subcomponent will work to ensure that environmental management of the LIP is performed to international best practices and obtain LMC ISO14001 certification as well as “eco-industrial park” (EIP) status of LIP under the Ministry of Environment and NDRC programs. The EMS component under the project will have a budget of CNY 2.6 million ($430,000), which will provide support for: (i) developing environmental management and early response policies and procedures, targeting ISO 14001 certification of LMC by 2018; (ii) strengthening supervision, monitoring and reporting of environmental activities in the LIP by LMC, including basic equipment, environmental management information system (EMIS), emergency preparedness and response, and training; (iii) developing a road map for national EIP accreditation of LIP by MEP or NDRC by 2025.

[5] The PRC Government’s 'Circular Economy' initiative is a Sustainable Consumption and Production (SCP) program that strives to meet these challenges through cleaner production, industrial ecology and life-cycle management.

E. Information Disclosure, Consultation and Participation

43. In the framework of the environmental due diligence, meaningful consultation was conducted with key stakeholders and potentially affected people. In the first round of consultation, a total of 120 questionnaires were distributed by the EIA Institute to 115 affected persons (APs) from different age groups, gender, educational backgrounds and 5 project affected organizations. Of these, 118 questionnaires were returned (114 APs and 4 organizations) with a return rate of 98.3%.

44. In the second round of consultation, consultation meetings were undertaken by the EIA Institute together with the PPTA Environmental Consultant on 16th Jan 2014 under the support of LMC to present the main anticipated impacts and proposed mitigation measures as defined in the draft FSR, DEIA and project IEE and collect the public feedback. During the second round, 100% of the APs and stakeholders supported the project. Consulted people believed that the Project will benefit the local economy, the quality of life, the environment, and especially the County's economic and industrial diversification and transformation. Negative opinions about the Project focused on noise and air pollution associated with project construction, the need to ensure sustainable and reasonable long term development plan of the LIP, and introduction of low pollution industries to protect the regional environment. The mitigation measures defined in the EMP as well as the proposed EMS address these specific concerns to a certain extent. The due diligence conducted during PPTA as well as the planning EIA for LIP confirmed sustainability of the LIP development Phase 1 (23-km^2) and indicated that Phase 2 (50-km2) is most likely feasible. However, a review of LIP development plans beyond the 50-km^2 will be required to ensure resource use efficiency and sustainability, also accounting for mid- to long-term climate risks.

45. Information was disclosed to affected people through newspaper and posters within the LIP. This project IEE will be disclosed on ADB's project website. Public consultation conducted during project preparation indicated that potentially affected people had a positive attitude toward the Project.

F. Grievance Redress Mechanism

46. A grievance redress mechanism (GRM) has been defined to deal with public complaints related to project activities during project implementation and operation. The BPMO will establish a Project Public Complaint Unit (PPCU). The PPCU will instruct contractors and construction supervision companies (CSCs) if people complain about the project. The PPCU will coordinate with the county EPB and other government divisions, if necessary, and will be supported by the Loan Implementation Environmental Consultant (LIEC), hired under the Project Implementation Consultant Support (PIC). The PPCU will establish a GRM tracking and documentation system, including procedures to retrieve data for reporting purposes to the BPMO and ADB.

G. Key EMP Implementation Responsibilities

47. The BPMO will have main EMP coordination responsibility. BPMO will appoint an environmental management lead (EML) to coordinate environmental issues associated with each infrastructure component, subcomponent and contract package. The EML will take charge of (i) coordinating the implementation of the EMP and developing implementation details; (ii) supervising the implementation of mitigation measures during project construction and operation; (iii) ensuring that environmental management, monitoring, and mitigation measures are incorporated into bidding documents, construction contracts and operation management plans; (iv) submitting annual EMP monitoring and progress reports to ADB; (v) coordinating the local grievance redress mechanism (GRM); and (vi) responding to any unforeseen adverse impact beyond those mentioned in the DEIA, the project IEE and the EMP. The EML will be technically supported by the LIEC and they will jointly check the overall implementation of environmental management provisions of the EMP.

H. Risks and Assurance

48. Environmental risks, and the assurances required to address these risks, have been identified in the project IEE. The majority of environmental risks relate to design features and operational plans which will avoid or mitigate impacts, but which rely on the implementers' commitment and capacity to implement and consistently follow-up. The remainder relate to the likelihood of unexpected negative impacts. The major risks are listed below:

i. Failure of the LIP industries to comply with the industrial wastewater pretreatment standards;
ii. Failure to establish water source protection zone at the Yellow River water extraction point;
iii. Inadequate capacity of the executing agency (through its BPMO) and LMC in environment management, which could result in inefficient project and EMP implementation; and
iv. Inadequate environment, health, and safety procedures in the LIP and inadequate environment management capacities of LMC.

49. Commitments by the executing agency and the LMC will be incorporated into the project agreements as covenants to ensure that the measures are implemented in a timely and complete fashion, including (i) a commitment to complete reuse facilities within LIP Phase 1 by 2019, and 100% re-use of treated effluent from the WWTP for landscape irrigation and industrial processes, and to explore opportunities for beneficial WWTP sludge reuse, (ii) a commitment to establish source protection zone at the water extraction works of the WTP, and (iii) a commitment to develop an environment management systems (EMS) for the LIP including ISO14001 certification of LMC by 2018, and EIP accreditation by 2025 (target).

50. The overriding assurance required is that the executing agency and the local government bodies as appropriate will ensure that the full range of effective measures set out in the project IEE and EMP are undertaken, and guarantees that the environmental management provisions and the environmental monitoring plan will be implemented effectively during project implementation, and that the implementation reports of the environmental management and monitoring plan in accordance with ADB requirements will be submitted in a timely fashion. Part of this monitoring and management commitment will be a commitment to implement and maintain an appropriate GRM. The assurance also will cover re-use of treated wastewater, appropriate treatment and disposal of wastewater sludge.

F. Conclusion

51. The project IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all adverse environmental impacts associated with the project will be prevented, eliminated, or minimized to an acceptable level. The project is feasible from an environment safeguards point of view. The public consultation indicated that the majority of the potential APs supported the project and project components and believed they would benefit the local economy, raise residents' living quality, improve local environmental conditions, and effectively protect the local environment. The overall findings of the DEIA and the project IEE are that some negative impacts on air, water, soil and acoustic environment are expected, in both construction and operation phases. Any adverse environmental impacts and risks associated with the project can be prevented, eliminated, or minimized to an acceptable level, if all the mitigation measures and monitoring requirements defined in the EMP are strictly implemented during detailed design, construction and operation, and the environmental management and institutional capacities of BPMO and the operators of project facilities (OPFs) are strengthened through implementation of the comprehensive training and capacity building program. The development and implementation of the LIP environmental management system (EMS) will be a critical aspect to ensure environmentally friendly operations of the project infrastructure and entire industrial park.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK AND STANDARDS

A. Policy Framework

52. In 1999, the PRC Government proposed the Western Region Development Strategy (WDS) to expedite the Western Region's development. Baiyin is a prefecture-level city in northeastern Gansu Province, the upper reaches of the Yellow River. It is bordered by Ningxia Hui Autonomous Region in the east and Inner Mongolia in the north. The capital city of the province, Lanzhou is adjacent to its west.

53. The following plans and policies are relevant to this project and form the basis and rationale for this project.

(i) Gansu Circular Economy Development Master Plan (2009)
(ii) Decision on Further Support Economic and Social Development of Gansu Province (2010)
(iii) PRC 12th Five-Year Plan for Social and Economic Development
(iv) Gansu 12th Five-Year Plan for Social and Economic Development
(v) Baiyin 12th Five-Year Plan for Social and Economic Development
(vi) Baiyin 12th Five-Year Plan for Environmental Protection
(vii) Jingyuan County 12th Five-Year Plan for Social and Economic Development
(viii) Baiyin Municipality Master Plan (2010-2020)
(ix) Jingyuan County Master Plan (2010-2020)
(x) Lanzhou-Baiyin Economic Zone Development Plan (2011)
(xi) Baiyin Industry Cluster Master Plan (2013)
(xii) Liuchuan Industry Development Plan (2013)

54. The national 12th Five-Year Plan imposes increased investment on large-scale industrial projects located within the Western Region as a means of enhancing its endogenous economic growth power. One of eleven designated key economic zones in the Western Region is the Lanxige or 'Lanzhou-Xining-Golmud' economic zone (**Figure II-1**). Baiyin Municipality is located within this economic zone. The policy focus for the zone is that of a circular economy that makes use of regional energy and mineral resource advantages but taking into account ecological sensitivity. This zone is intended to be the PRC's first "green economic zone."

55. Gansu Province has a relatively weak economic base, and it is appropriate to concentrate its limited manpower, material and financial resources in the development of key areas. Gansu Province proposed a regional policy of "the center drives two wings". Lanbai economic zone, where Baiyin Municipality is located, is the core area of Gansu Province's key construction area. Gansu provincial government proposed to take Lanbai Economic Zone, consisting of Lanzhou Municipality and Baiyin Municipality, as the core of the provincial construction area to play a central leading role in the province, and even the whole northwest region. It will enlarge and strengthen such dominant industries as petrochemical, non-ferrous metallurgy, equipment manufacturing, new materials, bio-pharmaceuticals, etc., and construct a transport hub and logistics center in the Northwest.

56. ***Lanzhou – Baiyin Economic Zone Development Plan*** **(2011)** proposed that Baiyin Municipality would be constructed to be the industrial development center of Lanzhou Economic Zone. Baiyin Industry Cluster, together with the main urban area and new urban area of Lanzhou will constitute a joint central core in the economic zone. Liuchuan Industrial Park has been designated as the key industrial park in Gansu Province's layout for large scale industrial projects.

57. The ***Baiyin 12th Five-Year Plan for Social and Economic Development*** emphasized the importance of development of circular economy and targeted Baiyin Industry Cluster to reach total revenue of 50 billion CNY in 2015.

58. The ***Baiyin 12th FYP for Environmental Protection*** sets total amount pollutant control targets for 2015, and promotes environmental-friendly development of the industry cluster, including Liuchuan Industry Park. The 12th FYP also requires at least 60% of the industrial parks should have the ISO 14001 Environmental Management Systems (EMS).

59. Liuchuan Industry Park was set up in 2007, with a planning area of 50km^2 in short term (2013-2020) and 100km^2 in long term (2020-2030). The location of the LIP is shown in **Figure II-2**. The ***Liuchuan Industry Park Development Plan (2013-2020)*** by Jingyuan County Government identifies industry development strategy and also sets targets of energy efficiency and environmental protection.

60. ADB intervention in Baiyin fits well with ADB's goal of poverty reduction in its member countries. By promoting sustainable and environment-friendly urban development, the project aligns with ADB's PRC country partnership strategy 2011–2015, and is consistent with ADB's water and urban operational plans which focus on inclusive and environmentally sustainable growth, improved quality of life for developing a livable city, and mainstreaming efficiencies in water use.[6]

61. **Water Resources Management of Yellow River**. The proposed water intake facility will abstract raw water from the main stream of Yellow River, which is governed by a series of water abstraction regulations/plans:

(i) Water Allocation Plan of Yellow River (State Council of PRC, 1987(61)), defines the basis and principals of Yellow River water allocation and use. The total amount of 3.04 billion m3 quota was established through this allocation plan.
(ii) Regulation on Water Regulation of Yellow River (Decree No. 472 of State Council of PRC, 2006), which is the first administrative legislation on Yellow River governance and established the long-term management mechanism of Yellow River to promote efficient water resources allocation.
(iii) Integrated Water Resources Plan of Yellow River Basin (2012-2030) (approved by State Council of PRC, 2013).

[6] ADB. 2012. *Country Partnership Strategy: People's Republic of China, 2011–2015*. Manila; ADB. 2012. *Water Operational Plan, 2011–2020*. Manila; ADB. 2012. *Urban Operational Plan*, 2012-2015. Manila.

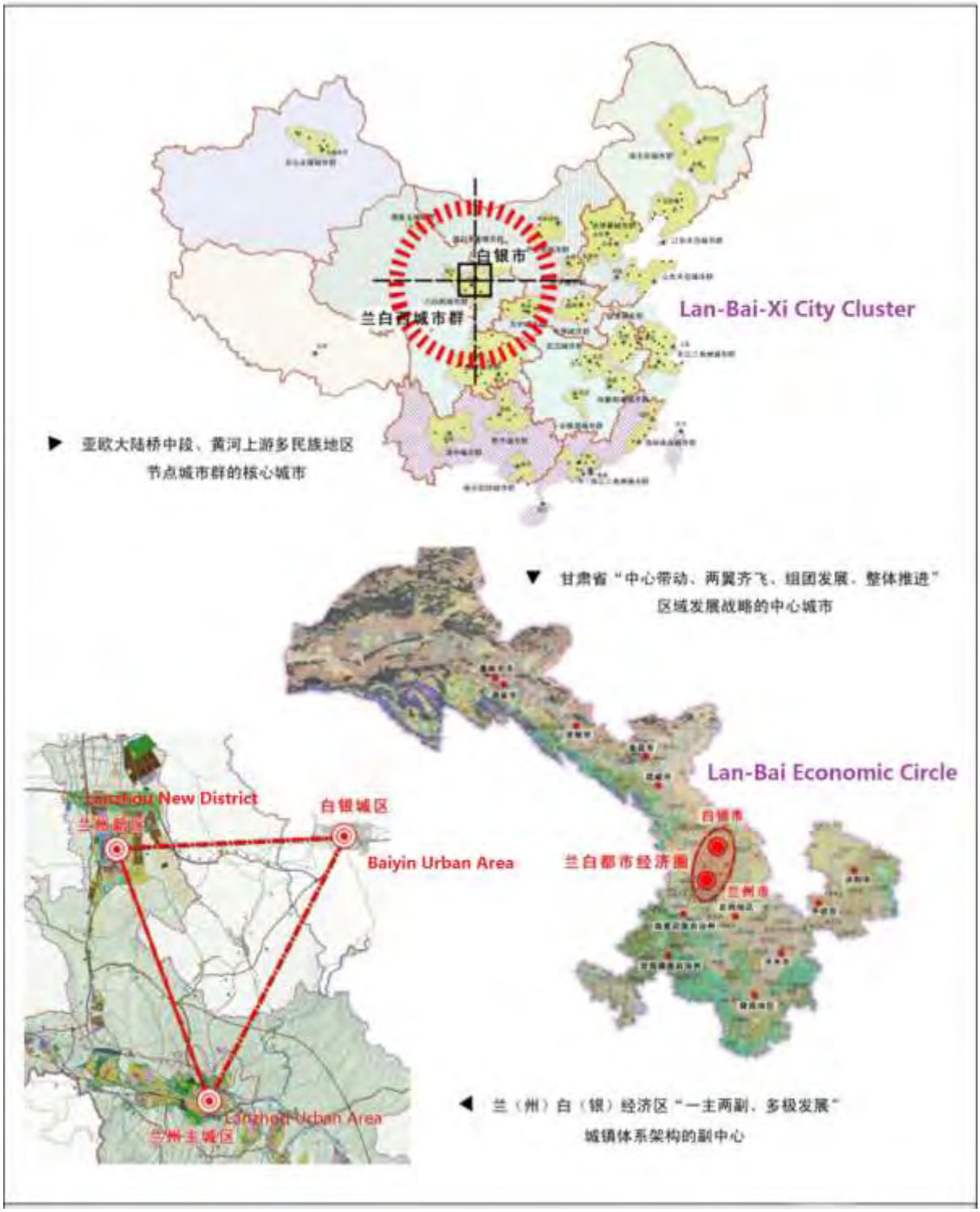


Figure II-1: Location of Baiyin Municipality *(Source: Baiyin Development Zone Master Plan, 2013)*

Figure II-2: Baiyin Industrial Cluster *(Source: Baiyin Development Zone Master Plan, 2013)*

B. Legislative Framework for environment impact assessment in the People's Republic of China

62. The EIA management procedure has been established in the PRC since early 1990s. The domestic environment impact assessment (DEIA) upon which this project IEE is based has been prepared under the provisions of the PRC's EIA Law of 2003 and the PRC Management Guideline on EIA Categories of construction Projects (2008) and the PRC. The Interim Guideline on Public Participation in EIA (2006) has also been a significant development that provides for opportunities to involve the public in the EIA process. This was further strengthened by the Requirements on Preparation of Environmental Impact Report Summary (2012[51], MEP), which requires the summary of DEIA reports should be disclosed on local EPB websites. The primary national laws and regulations that governed the EIA studies of the proposed project are provided in **Table II-1** and **Table II-2**, respectively.

Table II-1: Applicable Environmental Laws

No.	Title of the Law	Year Issued
1	Environmental Protection Law	1989
2	Environmental Impact Assessment Law	2003
3	Water Law	2002
4	Water Pollution Prevention and Control Law	2008
5	Air Pollution Prevention and Control Law	2000
6	Noise Pollution Control Law	1999
7	Solid Waste Pollution Prevention and Control Law	2005
8	Water and Soil Conservation Law	2011
9	Forest Law	1998
10	Wild Fauna Protection Law	2004
11	Cleaner Production Promotion Law	2002
12	Urban and Rural Planning Law	2008
13	Land Administration Law	2004
14	Circular Economy Promotion Law	2009

Source: Project preparatory technical assistance.

Table II-2: National Administrative Regulations

No.	Regulation	Year Issued
1	Regulation on EIA of Plans and Programs	2009
2	Regulation on Environmental Protection Management for Construction Projects	2003
3	Directive on Strengthening Wetland Protection and Management	2004
4	Environmental Protection Supervision Rules for Construction Projects	1998
5	Regulation on Culture Heritage Protection	2003
6	Regulation on Protection of Wild Flora	1997
7	Requirements for the EIA Summary of Construction Project	2010
8	Regulation on Classification of Construction Project Environmental Protection Management (MEP)	2009
9	National Biodiversity Strategy and Action Plan (2011-2030)	2010
10	Requirement for Social Risk Assessment of Large Investment Projects	2012
11	The National Biodiversity Strategy and Action Plan (2011-2030)	2010
12	National regulation for public disclosure of EIAs (NDRC)	2012

Source: Project preparatory technical assistance.

63. The implementation of environmental laws and regulations is supported by a series of associated management and technical guidelines (**Table II-3**).

Table II-3: Applicable Environmental Guidelines

No.	Guideline	Year/Code
1	Guideline on Jurisdictional Division of Review and Approval of EIAs for Construction Projects	2009
2	Guideline on EIA Categories of Construction Projects	2008
3	Interim Guideline on Public Consultation for EIA	2006
4	Technical Guideline on EIA: Outline	HJ2.1-2011

No.	Guideline	Year/Code
5	Technical Guideline on EIA Regarding Surface Water	HJ/T 2.3-1993
6	Technical Guideline on EIA Regarding Atmospheric Environment	HJ 2.2-2008
7	Technical Guideline on EIA Regarding Acoustic Environment	HJ 2.4-2009
8	Technical Guideline on EIA Regarding Ecological Impact	HJ 19-2011
9	Technical Specification on Water and Soil Conservation Plan	GB50433-2008
10	Technical Specification on EIA Regarding Road Construction	JTGB03-2006
11	Technical Guideline on Environmental Risk Assessment for Construction Project	HJ/T 169-2004
12	Industrial Restructuring Directory (2011)	Revised in 2013

Source: Project preparatory technical assistance.

64. The environmental quality standard system that supports and evaluates the implementation of the environmental protection laws and regulations in the PRC is classified into two categories by function (i.e., pollutant emission/discharge standards and ambient environmental standards). The relevant main standards applicable to the project are shown in **Table II-4.**

Table II-4: Applicable Environmental Standards

No.	Standard	Code
1	Surface Water Quality Standard	GB 3838-2002
2	Urban Ambient Acoustic Quality Standard	GB 3096-2008
3	Ambient Air Quality Standard	GB 3095-1996/2012
4	Integrated Emission Standard of Air Pollutants	GB 16297-1996
5	Integrated Wastewater Discharge Standard	GB 8978-1996
6	Underground Water Quality Standard	GB/T 14848-93
7	Domestic Drinking Water Quality Standard	GB 5749-2006
8	Emission Standards of Environment Noise for Boundary of Site Noise	GB 12523-2011
9	Noise Limit of Industrial Enterprises	GB 12348-2008
10	Emission Standard of Air Pollutants for Coal-burning Boiler	GB 13271-2001
11	Standard for pollution control on hazardous waste storage	GB 18597-2001
12	Standards for pollution control on the storage and disposal site for general industrial solid wastes	GB18599-2001
13	Emission Standards for Odor Pollutants	GB 14554-93

Source: Project preparatory technical assistance.

65. According to the Interim Regulation on Gansu Public Participation in Environmental Impact Assessment of Construction Project, the project owner should invite 2-3 stakeholders as environmental supervisors (i.e., community representatives). These have already been identified for this Project, and are included in the EMP (supervision function).

C. International Agreements

66. The PRC is a signatory of a large number of international agreements relevant to environment protection. Those with direct application to the project, along with the date of signing by the PRC, include:

(i) *Kyoto Protocol to the United Nations Framework Convention on Climate Change,* 23 February 2005. To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries;
(ii) *Montreal Protocol on Substances That Deplete the Ozone Layer,* 1 January 1989. To protect the ozone layer by controlling emissions of substances that depletes it.
(iii) *United Nations Framework Convention on Climate Change,* 21 March 1994. To achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with the climate system.
(iv) *UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage,*

1985. To integrate the practice of heritage conservation in PRC with that being done around the world.

D. Applicable ADB and PRC Policies and Assessment Categories

67. **ADB's Safeguard Policy Statement (SPS 2009)** provides the basis for this project IEE. All projects funded by ADB must comply with the SPS. The purpose of the SPS is to establish an environmental review process to ensure that projects undertaken as part of programs funded under ADB loans are environmentally sound, are designed to operate in line with applicable regulatory requirements, and are not likely to cause significant environment, health, or safety hazards.

68. The project underwent appraisal during project preparation and was classified as Category B by ADB, requiring an initial environmental examination (IEE). Domestically, the wastewater and road subcomponents was classified as Category A in accordance with the Guideline on EIA Classification for Construction Projects issued by the PRC's Ministry of Environmental Protection (MEP) in 2008, requiring an environment impact assessment (EIA). The water supply subcomponent was Category B, requiring a simplified, tabular environment impact report. A consolidated domestic environmental impact assessment (DEIA) was prepared by Lanzhou University and approved by Gansu Provincial Environmental Protection Department in May 2014. In addition, a planning EIA for Liuchuan Industry Park Master Plan was prepared by Gansu Institute of Environmental Science and approved by Gansu Provincial Environmental Protection Department (Ganhuan [2012]95). In addition, a project IEE in English was prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of the DEIA prepared by Lanzhou University (the EIA Institute), Feasibility Study Report (FSR) of the project components, water and soil conservation plan, a strategic EIA prepared for the LIP, water resources assessment report, workshop reports, social and economic assessments under the Project Preparatory Technical Assistance (PPTA), and project policy dialogue discussions between the ADB missions, the PPTA consultant, Gansu Provincial Government (GPG) and Baiyin Municipal Government (BMG).

E. Evaluation Standards for Sub-components

69. In PRC EIA requirements, ambient levels of air, noise, and water quality in the proposed works area determine the appropriate category for point source or impacting emissions and effluent standards for the construction and operational phases of infrastructures.

70. ADB's Safeguard Policy Statement (2009) requires projects to apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as World Bank Group's Environmental, Health and Safety (EHS) Guidelines[7]. The EHS guidelines are based on best practice construction and operational procedures.

71. **Air Quality**. The PRC ranks air quality into three classes according to "Ambient Air Quality Standard" (GB3095-1996, amendment in 2000), with Class I having the best air quality and Class III the worst air quality. The ambient air quality in the assessment area of this project has been assigned to meet GB 3095-1996 Class II standards. A new standard has been issued in 2012 (GB 3095-2012), replacing GB 3095-1996, and will become effective on January 2016. The new standard combines Class II and III and introduces $PM_{2.5}$ standards. It also makes more stringent NO_2 standards. However, the

[7] World Bank Group 2007, Environmental, Health and Safety Guidelines –General EHS Guidelines, World Bank, Washington (as well as industry sector specific guidelines.)

World Bank EHS guidelines are also used in assessment of this project, of which the specific standard values are shown in **Table II-5**.

Table II-5: Ambient Air Quality Class II Standard (unit: mg/m^3)

Pollutant	Averaging Period	PRC Class II (mg/m^3)		EHS (mg/m^3) (World Bank Group 2007)
		Standard (GB3095-1996)	Standard (GB3095-2012)	
SO_2	Annual average	0.06	0.06	n/a
	Daily average	0.15	0.15	0.125-0.05 (0.02 guideline)
	Hourly average	0.50	0.50	n/a
PM_{10}	Annual average	0.10	0.07	0.07-0.03 (0.02 guideline)
	Daily average	0.15	0.15	0.075-0.15 (0.05 guideline)
NO_2	Annual average	0.08	0.04	0.04 guideline
	Daily average	0.12	0.08	n/a
	Hourly average	0.24	0.20	0.20 guideline
CO	Daily average	4.0	4.0	n/a
	Hourly average	10.0	10	n/a
TSP	Annual average	0.20	0.20	n/a
	Daily average	0.30	0.30	n/a
$PM_{2.5}$	Annual average	n/a	n/a	0.015-0.035
	Daily average	n/a	0.15	0.0375-0.075
	Hourly average	n/a	0.35	n/a

Source: Ambient Air Quality Standard (GB 3095-2012)

72. Fugitive emission of particulate matter (such as dust from construction sites) is regulated under PRC's Air Pollutant Integrated Emission Standard (GB 16297-1996), which sets 120 mg/m^3 as the maximum allowable emission concentration and ≤ 1.0 mg/m^3 as the concentration limit at the boundary of construction sites, with no specification on the particular matter's particle diameter.

73. The odor from wastewater treatment plant should follow Urban Sewage Treatment Plant Pollutant Discharge Standards (GB 14554-93). The maximum allowable emission concentrations for NH_3, H_2S and odor are 1.5 mg/m^3, 0.06 mg/m^3, 20 (dimensionless).

74. **Water Quality.** For water quality assessment, the determining standard will be Surface Water Ambient Quality Standard (GB3838-2002), which is comparable to, and thus considered, an internationally accepted standard. It defines five water quality categories for different environmental functions. Category I is the best, suitable for head waters and National Nature Reserves. Category II is suitable for drinking water sources in Class I protection areas, habitats for rare aquatic organisms, breeding grounds for fish and crustaceans, and feeding grounds for fish fries. Category III is suitable for drinking water sources in Class II protection areas, wintering grounds for fish and crustaceans, migration routes, water bodies for aquaculture and capture fishery, and swimming activities. Category IV is suitable for general industrial use and non-contact recreational activities. Category V is the worst which is only suitable for agricultural and scenic water uses.

75. According to the "Surface Water Function Zones in Gansu Province (2012-2030)", the Yellow River at Baiyin section in the project region is classified as Category III. Dasha River is a seasonal stream that flows into Yellow River, meaning that the Category III standard is also applicable to Dasha River. The key parameters for Category III standard is set out in **Table II-6**.

Table II-6: Surface water ambient quality standard for Category III

(unit: mg/L, pH is dimensionless)

No.	Item	Category III	No.	Item	Category III
1	pH	6-9	12	Se≤	0.01
2	DO≥	5	13	As≤	0.05
3	$KmnO_4$ Index	6	14	Hg≤	0.0001
4	COD≤	20	15	Cd≤	0.005
5	BOD_5≤	4	16	$Cr6^+$≤	0.05
6	NH_3-N≤	1	17	Lead≤	0.05
7	TP≤	0.2	18	Cyanide≤	0.2
8	TN≤	1.0	19	Volatile Phenol≤	0.005
9	Cu≤	1.0	20	Oil≤	0.05
10	Zn≤	1.0	21	Anionic surfactant≤	0.2
11	Fluoride≤	1.0	22	Sulfur≤	0.2
			23	Fecal coliform (a/L) ≤	10000

Source: Surface Water Ambient Quality Standard (GB3838-2002)

76. Discharge of wastewater from construction sites is regulated under PRC's Integrated Wastewater Discharge Standard (GB 8978-1996), which is an internationally recognized as defined in the EHS Guidelines of the IFC. Class I standards apply to discharges into Category III water bodies under GB 3838-2002. Class II standards apply to discharges into Categories IV and V water bodies. Class III standards apply to discharges into municipal sewers going to municipal WWTPs with secondary treatment.

Table II-7: Wastewater discharge standards for construction sites and dredged sediment disposal sites according to GB 8978-1996

Parameter	Class I	Class II	Class III
	(for discharging into Category III water body)	(for discharging into Categories IV and V water body)	(for discharging into municipal sewer)
pH	6 ~ 9	6 ~ 9	6 ~ 9
SS mg/L	70	150	400
BOD_5 mg/L	20	30	300
COD mg/L	100	150	500
TPH mg/L	5	10	20
Volatile phenol mg/L	0.5	0.5	2.0
NH_3-N mg/L	15	25	---
PO_4^{2-} (as P) mg/L	0.5	1.0	---
LAS (= anionic surfactant) mg/L	5.0	10	20

Source: Wastewater Discharge Standard (GB 8978-1996)

77. The proposed WWTP is designed based on Class 1A of *Urban Sewage Treatment Plant Pollutant Discharge Standards (GB18918-2002)*. The reuse of treated effluent and sludge for various purposes is considered. The relevant applicable standards include:

(i) *The Reuse of Urban Recycling Water: Water Quality Standard for Urban Miscellaneous Water Consumption* (GB/T 18920-2002);

(ii) *The Reuse of Urban Recycling Water: Water Quality Standard for Industrial Use* (GB/T 20922-2007);

Table II-8: Comparison of Urban Sewage Treatment Plant Pollutant Discharge Standards and Reuse Standard

Parameter	Unit	GB18918-2002 Class 1A	GB /T 20922-2007	GB/T 18920-2002
COD	mg/L	50	60	——
BOD_5	mg/L	10	10	10
SS	mg/L	10	30	——
Ammonia	mg/L	5（8）	10	10
TN	mg/L	15	——	——
TP	mg/L	0.5	1	——
Petroleum	mg/L	1	1	——

78. The Class 1A (GB18918-2002) is more stringent than GB/T 20922-2007 and GB/T18920-2002 that can satisfy reuse for landscaping irrigation and general industrial production purposes.

79. The project includes water supply facilities for LIP. Operation of the WTP and quality of the treated water to be supplied to residents will require compliance with the PRC Drinking Water Quality Standard (GB5749-2006), in which 106 parameters must be met (**Table II-9**).

Table II-9: Drinking Water Quality Standards (GB5749-2006)

No.	Parameter	Standard
	Routine Parameter of Drinking Water Quality	
	Microbiological parameter[8]	
1	Total coliform (MPN/100ml or CFU/100ml)	LD
2	Thermotoletant coliform (MPN/100ml or CFU/100ml)	LD
3	Escherichia Coli (MPN/100ml or CFU/100ml)	
4	Total plant count (CFU/ml)	100
	Toxicological parameter	
5	Arsenic (As, mg/L)	0.01
6	Cadmium (Cd, mg/L)	0.005
7	Chromium Hexavalent (Cr 6+, mg/L)	0.05
8	Lead (Pb, mg/L)	0.01
9	Mercury (Hg, mg/L)	0.001
10	Selenium (Se, mg/L)	0.01
11	Cyanide (CN-, mg/L)	0.05
12	Fluoride (mg/L)	1.0
13	Nitrate (mg/L)	10
14	Trichloromethane (mg/L)	0.06
15	Carbon tetrachloride (mg/L)	0.002
16	Bromate (when O3 is applied) (mg/L)	0.01
17	Formaldehyde (when O3 is applied) (mg/L)	0.9
18	Chlorite (when ClO2 is applied) (mg/L)	0.7
19	Chlorate (when compound chlorine dioxide is applied) (mg/L)	0.7
	Sensory Properties and General Chemical Parameter	
20	Chromaticity (Unit of platinum cobalt color)	15
21	Turbidity (diffusing turbidity unit) NTU	1
22	Odor and Taste	No odor, no taste
23	Appearance	None
24	pH	6.5≤X<8.5

8 MPN= Most Probable Number; CFU: Colony forming unit.

No.	Parameter	Standard
25	Aluminum (Al, mg/L)	0.2
26	Iron (Fe, mg/L)	0.3
27	Manganese (Mn, mg/L)	0.1
28	Copper (Cu, mg/L)	1.0
29	Zinc (Zn, mg/L)	1.0
30	Chloride (Cl-, mg/L)	250
31	Sulfate (SO4-mg/L)	250
32	TDS (mg/L)	1000
33	Total Hardness (CaCO3) (mg/L)	450
34	CODMn (mg/L)	3
35	Volatile phenols (phenol) (mg/L)	0.002
36	LAS (mg/L)	0.3
	Radioactivity Parameter9	
37	Total α radioactivity (Bq/L)	0.5
38	Total β radioactivity (Bq/L)	1
	Non-Routine Parameter	
	Microbial indicators	
39	Giardia cysts (count/10L)	<1
40	Cryptosporidium oocysts (count/10L)	<1
	Toxicological parameter (mg/L)	
41	Antimonium (Sb, mg/L)	0.005
42	Barium (Ba, mg/L	0.7
43	Beryllium (Be, mg/L)	0.002
44	Boron (B, mg/L)	0.5
45	Molybdenum (Mo, mg/L)	0.07
46	Nickel (Ni, mg/L)	0.02
47	Silver (Ag, mg/L)	0.05
48	Thallium (Ti, mg/L)	0.0001
49	Cyan chloride (CN- mg/L)	0.07
50	Chlorodibromomethane (mg/L)	0.1
51	Bromodichloromethane (mg/L)	0.06
52	Dichloroacetic acid (mg/L)	0.05
53	1,2-dichloroethane (mg/L)	0.03
54	Dichloromethane (mg/L)	0.02
55	THMs	1
56	1,1,1 - trichloroethane (mg/L)	2
57	Trichloroacetic acid (mg/L)	0.1
58	Trichloroaldehyde (mg/L)	0.01
59	2,4,6- trichlorophenol (mg/L)	0.2
60	Bromoform (mg/L)	0.1
61	Heptachlor (mg/L)	0.0004
62	Malathion (mg/L)	0.25
63	PCP (mg/L)	0.009
64	HCH (total amount, mg/L)	0.005
65	Hexachlorobenzene (mg/L)	0.001
66	Dimethoate (mg/L)	0.08
67	Parathion (mg/L)	0.003
68	Bentazone (mg/L)	0.3

9 Radionuclide phase analysis is conducted if radioactivity value exceeds limits, to determine if the water is drinkable.

No.	Parameter	Standard
69	Parathion-methyl (mg/L)	0.02
70	Chlorothalonil (mg/L)	0.01
71	Carbofuran (mg/L)	0.007
72	Lindane (mg/L)	0.002
73	Chlopyrifos (mg/L)	0.03
74	Glyphosate (mg/L)	0.7
75	DDVP (mg/L)	0.001
76	Arazine (mg/L)	0.002
77	Deltamethrin (mg/L)	0.02
78	2, 4 - dichlorobenzene oxygen ethanoic acid (mg/L)	0.03
79	Dichloro-diphenyl-dichlorothane (mg/L)	0.001
80	Ethylbenzene (mg/L)	0.3
81	Dimethylbenzene (mg/L)	0.5
82	1,1- dichloroethylene(mg/L)	0.03
83	1,2- dichloroethylene(mg/L)	0.05
84	1,2- dichlorobenzene(mg/L)	1
85	1,4- dichlorobenzene(mg/L)	0.3
86	Trichloroethylene(mg/L)	0.07
87	Trichlorobenzene(mg/L)	0.02
88	Hexachlorobutadiene(mg/L)	0.0006
89	Acrylamide (mg/L)	0.0005
90	Tetrachloroethylene (mg/L)	0.04
91	Toluene (mg/L)	0.7
92	DEHP (mg/L)	0.008
93	ECH (mg/L)	0.0004
94	Benzene (mg/L)	0.01
95	Styrene (mg/L)	0.02
96	Benzopyrene (mg/L)	0.00001
97	Chloroethylene(mg/L)	0.005
98	Chlorobenzene(mg/L)	0.3
99	Microcystin-LR(mg/L)	0.001
	Physical Properties and General Chemical parameters (mg/L)	
100	Ammonia Nitrogen(NH3-N, mg/L)	0.5
101	Sulfide (S, mg/L)	0.02
102	Sodium (Na, mg/L)	200

Table II-10: General Parameters and Requirements for Drinking Water Disinfectant

No.	Disinfectant	Exposure duration with Water	Limit in water supplied (mg/L)	Residue in water supplied (mg/L)	Residues in network end (mg/L)
103	Chlorine and free chlorine (mg/L)	≥30 min	4	≥0.3	≥0.05
104	Monochloramine (total chlorine, mg/L)	≥120 min	3	≥0.5	≥0.05
105	Ozone (O3, mg/L)	≥12 min	0.3	-	0.02/ ≥0.05 if chlorine is added
106	Chlorine Dioxide (ClO2, mg/L)	≥30 min	0.8	≥0.1	≥0.02

80. **Groundwater Quality**. The Category III standard of Groundwater Quality Standard (GB/T14848-93) is applicable for the project region (**Table II-11**).

Table II-11: Groundwater ambient quality standard for Category III (unit: mg/L, pH is dimensionless)

No.	Item	Category III	No.	Item	Category III
1	pH	6.5-8.5	15	Nitrate≤	20
2	Total Hardness ≤	450	16	Nitrite≤	0.02
3	$KMnO_4$ Index≤	3.0	17	NH4≤	0.2
4	Sulfate≤	250	18	Fluoride≤	0.05
5	Chloride≤	250	19	Hg≤	0.001
6	Fe	0.3	20	Se≤	0.01
7	Mn	0.1	21	As≤	0.05
8	Cu	1.0	22	Cd≤	0.01
9	Zn	1.0	23	$Cr6^+$≤	0.05
10	Mo	0.1	24	Fecal coliform (a/L) ≤	3.0
11	Co	0.05			
12	Volatile Phenol	0.002			
13	Anionic surfactant≤	0.3			

81. **Soil**. Soil quality in the PRC is divided into three classes according to the Environmental Quality Standard for Soils (GB 15618-1995). Class 1 represents the best and Class 3 the worst. The Class 2 is applicable for the proposed project area.

Table II-12: Environmental Quality Standard for Soils (Class 2)

Parameter	Maximum Allowable Concentration (mg/kg dry weight) Class 2 (GB 15618-1995)		
pH	＜6.5	6.5～7.5	＞7.5
Cadmium (Cd)≤	0.30	0.30	0.60
Mercury (Hg)≤	0.30	0.50	1.0
Arsenic (As) paddy ≤ Dry land ≤	30 40	25 30	20 25
Copper (Cu) farmland ≤ Orchard ≤	50 150	100 200	100 200
Lead (Pb)≤	250	300	350
Chromium (Cr) paddy ≤ Dry land≤	250 150	300 200	350 250
Zinc (Zn)≤	200	250	300
Nickel (Ni)≤	40	50	60

82. **Sludge disposal**. The quality of sludge going to landfill disposal should meet with the requirements stipulated in Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB 16889-2008), which requires the water content of sludge should not exceed 60%. With proper pre-treatment of industrial wastewater, the sludge is likely to comply with standards for reuse, including as soil conditioner (GB15618-1995), afforestation in gardens and windbreak plantation (GB23468-2009), fertilizer for agricultural use (GB4284-84), land improvement (CJ/T 291-2008), brick building (CJ/T 289-2008) and other land applications.

83. **Noise.** According to the Technical Specifications for *Urban Area Ambient Noise Applicable Area Classification (GB/T15190-94)*, areas serving for mixed industrial functions are classified as Class II except for the areas within 35m of both sides of the West Trunk Road (Class 4a is applicable for the assessment of roads as shown in the table below), and should comply with the corresponding provisions

in *Acoustic Ambient Quality Standard (GB3096-2008)* according to the classification of the area. The PRC standard is identical to the EHS guideline values.

Table II-13: Acoustic Ambient Quality Standards (Equivalent Sound Level: LAeq: dB)

PRC Standard Class	Applicable Area	GB3096-2008		EHS	
		Day	Night	Day	Night
0	Areas needing extreme quite, such as convalescence areas	50	40	55	45
1	Area mainly for residence, cultural and educational institutions	55	45		
2	Residential, commercial and industrial mixed area	60	50		
3	Industrial area	65	55	70	70
4	Area on both sides of urban road traffic trunk line	70	55		

Source: GB3096-2008, World Bank's EHS guidelines

84. Construction noise will be assessed against the standards in *Emission Standards of Ambient Noise for Boundary of Site Noise (GB 12523-2011)* and class II of *Emission Standard for Industrial Enterprises Noise at Boundary. (GB 12348-2008)*, which are set out in the table below.

Table II-14: Construction Site Noise Limits (Unit: Leq [dB (A)])

Period	Major Noise Source	Noise Limit	
		Day	Night
Construction	Bulldozer, excavators and loader; pile driving machines; concrete mixer, vibrator and electric saw; hoist and lifter	70	55
Operation	Pumps	60	50

85. Construction activities will cause vibration impact, and should comply with the "Standard for Urban Area Environmental Vibration (GB10070—88)".

Table II-15: Vertical (Z) Vibration Standard Value for Various Urban Areas (Unit: dB)

Scope of applicable area	Day	Night
Special residential area	65	65
Residential, cultural and educational area	70	67
Mixed area and commercial center	75	72
Industrial centralized area	75	72
Both sides of traffic trunk line	75	72
Both sides of railway main line	80	80

F. Assessment Areas, Sensitive Receptors

86. The assessment areas for air, noise, surface water and ecological impacts are defined by the technical guidelines for environmental impact assessment in the PRC, based on the environmental sensitivity of the project areas and vicinity as well as the nature of the project and its components.

87. The domestic EIA followed these guidelines in defining the assessment scopes. The assessment areas for the infrastructure component for LIP are shown in **Table III-16**. The assessment area for the planning EIA report of LIP covers the whole 23-km^2 (LIP Phase 1) and the project DEIA report covers the area influenced by the proposed infrastructure. This project IEE followed these areas of influenced defined in planning EIA and DEIA. The IEE did not assess sustainability of planned LIP expansion beyond Phase 2 (2030).

Table II-16: Assessment areas of the infrastructure component

Environmental Media	Assessment Area	
	Road	WWTP and WTP facilities
Air	Within 200m on both sides from the road center line; (5×5)km^2 along the dominant wind direction	(5×5)km^2 from the center of the WWTP /WTP on all 4 sides
Noise	Within 200m on both sides from the road center line	Within 200m from the 4 sides of WWTP/WTP boundaries; within 200m of the pipes
Surface water	500m upstream of the proposed bridge cross Dasha River	From 500m upstream of the WWTP effluent outfall to 2km downstream; From 3000m upstream of the water extraction point to 300m downstream.
Groundwater	N/A	Within 20km^2 of the WWTP site
Ecology	Within 200m both sides of the road center line	Within 200m of the plant boundaries of all 4 sides and within 50m both sides of the pipes
Environmental risk management	500m upstream of the proposed bridge cross Dasha River	(3×3)km^2 of the chloride dosing room and storage room
Physical cultural resources	Construction " footprint"	Construction " footprint"
Occupational health & safety	Construction " footprint"	Construction " footprint"
Community health & health safety	Within 200m on both sides from the road center line	Within 500m from the WWTP/WTP boundaries

Source: draft DEIA

88. The sensitive receptors within the assessment areas for the road, WWTP and WTP, wastewater collection pipelines, water transmission and distribution pipelines are presented in **Table II-17** to **Table II-18**, **Figure II-3** to **Figure II-5**. The residents within LIP will be moved to the centralized community in the south of the park. This resettlement community is under construction and part of it has been completed. Some villagers have settled in the newly built houses. However, the resettlement progress is closely linked with the development of the industrial park. The exact schedule for land acquisition and resettlement that is not caused by the project, but which may be required within LIP Phase 1 boundaries, is still uncertain.[10] Therefore, all residents in the industrial park are still identified as sensitive receptors/ during this assessment.

[10] The project's resettlement plan covers only direct impacts from land acquisition and resettlement, i.e., impacts directly related to project interventions. Future land acquisition and resettlement may be required for households living within LIP boundaries when new industries are established.

G. Assessment Period

89. The duration of impact assessed in this project IEE covers the construction and operation phases of the project.

90. For the road subcomponent, construction is estimated to start in April 2016 and to end in September 2018. The assessment period for construction stage will cover these 30 months. The assessment period for operation stage will cover up to 2034 based on traffic volume forecast.

91. For the WWTP and wastewater collection subcomponent, construction is estimated to start in April 2014 and end in December 2017. The assessment period for the construction stage will cover these 45 months. Operational impact will be assessed based on the assumption that the WWTP reaches its design capacity.

92. For the water supply subcomponent, construction is estimated to start in September 2015 and end in December 2019. The assessment period for the construction stage will cover these 57 months. Operational impact will be assessed based on the assumption that the WTP reaches its design capacity.

Table II-17: Sensitive Receptors of Water and Wastewater Subcomponents

Sensitive receptor	Location	Surroundings within 200m	APs	Distance	Environmental Aspect
Nanshanwei Village	K0~K2+400	68 households, including 18 households are within 35m	325	2-193m	Noise, air quality
Zhangjiachuan Village	K2+880~K6+640	16 households, including 4 households are within in 35m	80	3-188m	
Dasha River	K1+720	Small tributary	-	-	Surface water
Ecological impact	Along the road	Wasteland	-	-	Ecological resources

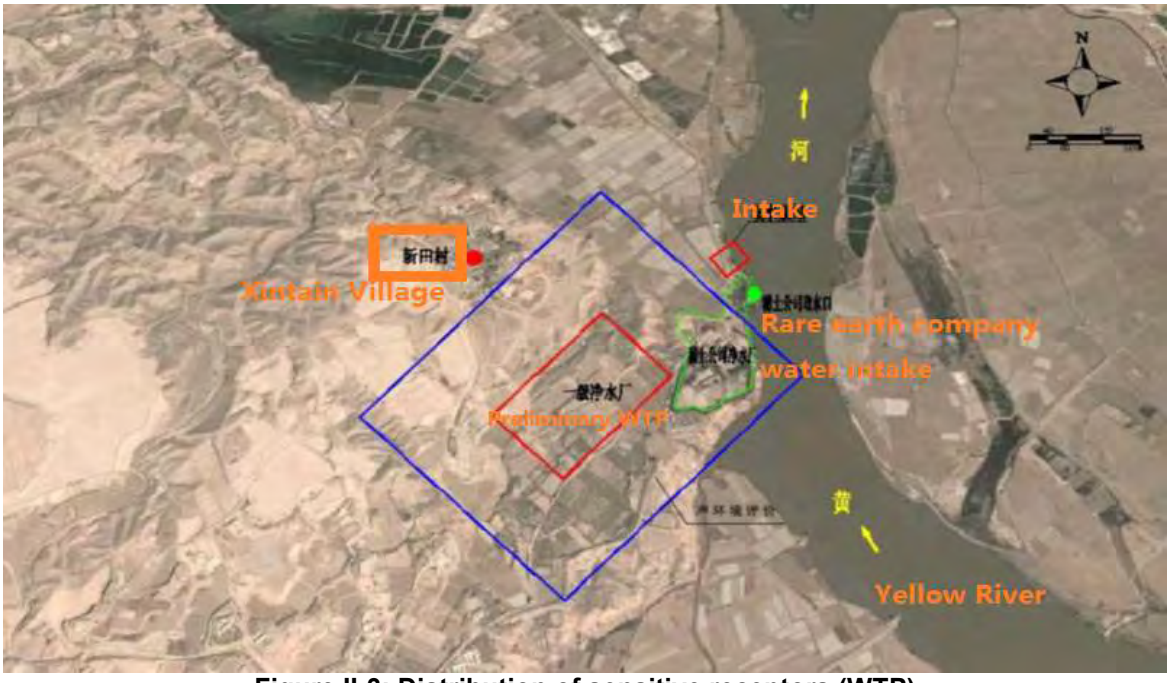


Figure II-3: Distribution of sensitive receptors (WTP)

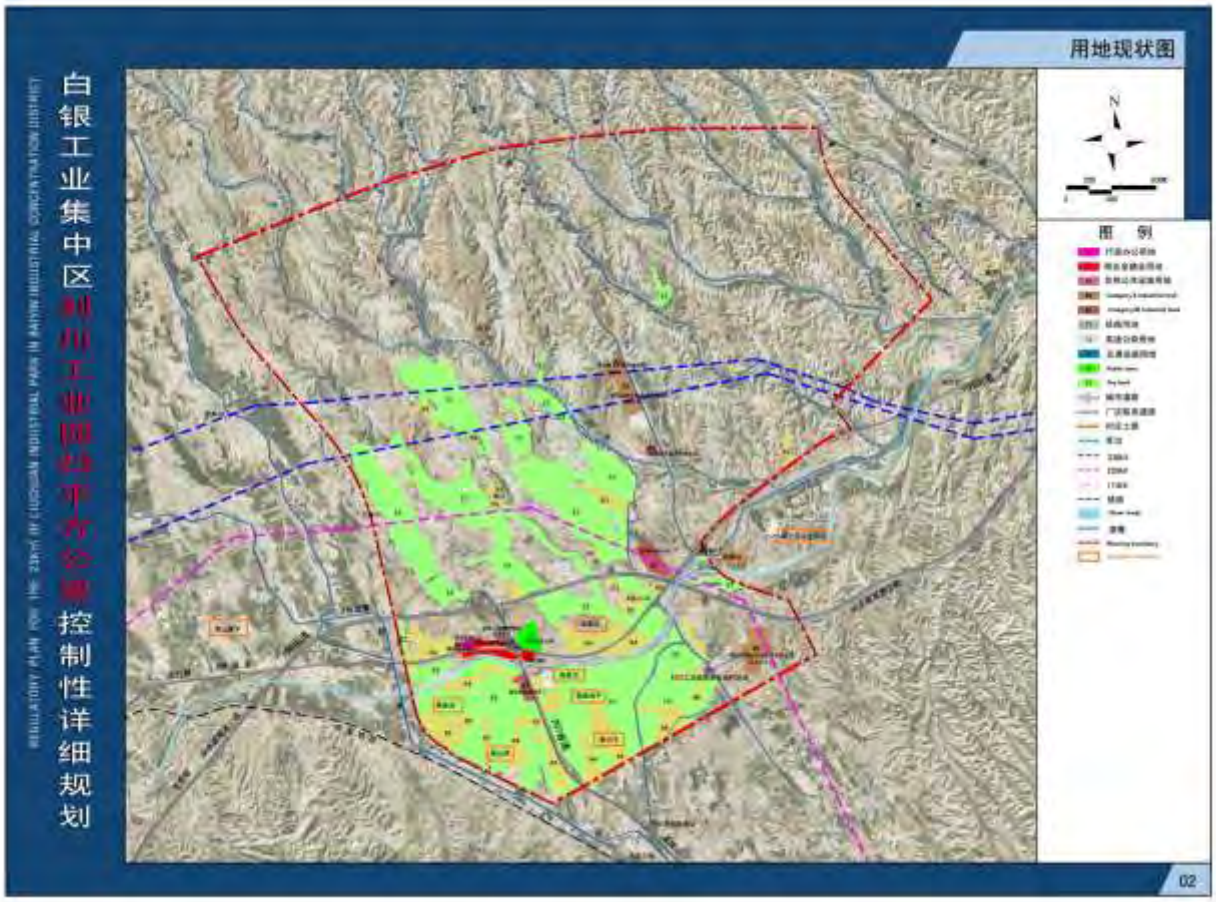


Figure II-4: Current land use and distribution of sensitive receptors (WWTP/ Secondary WTP)

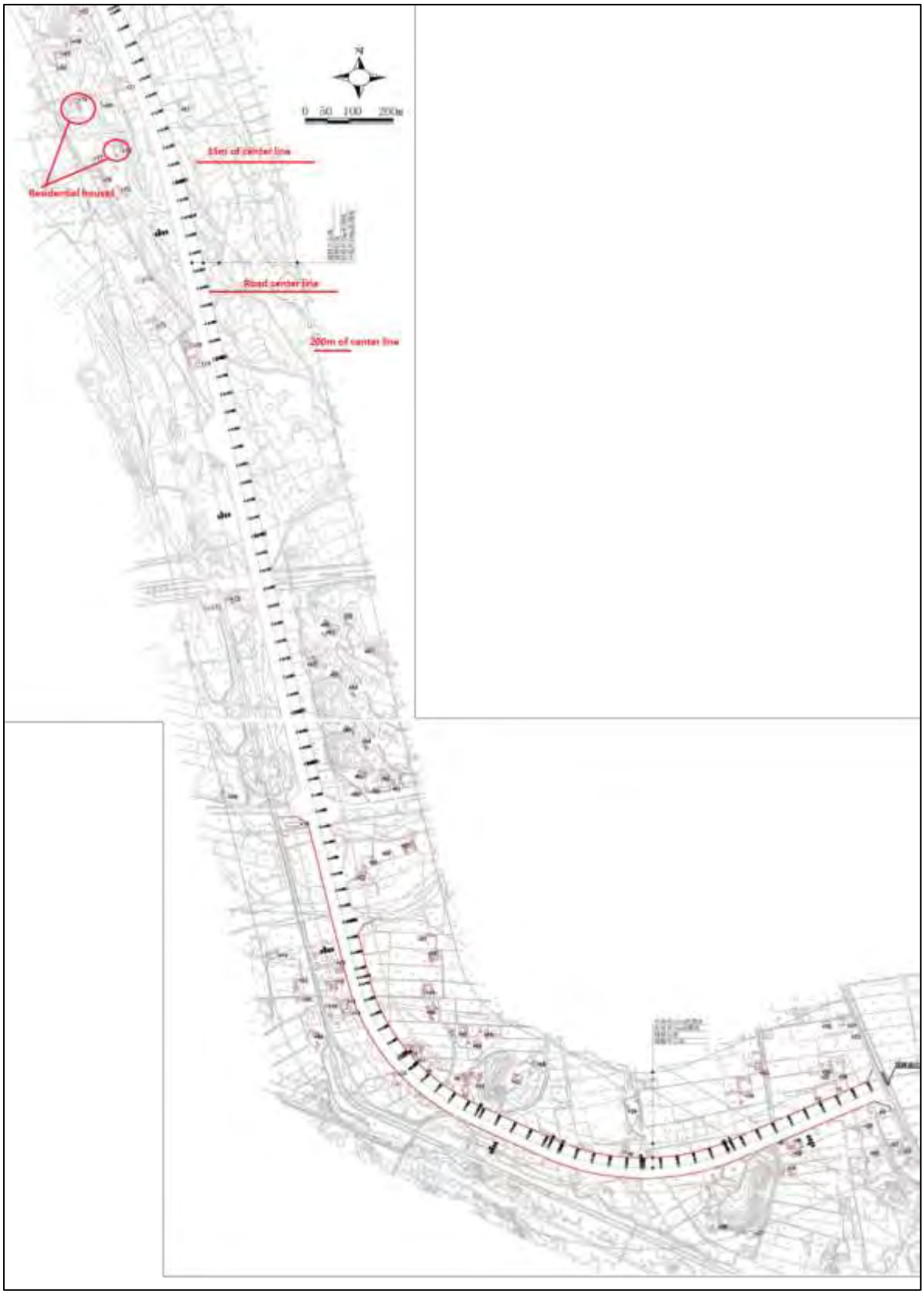


Figure II-5: Distribution of identified sensitive receptors (Road)

Table II-18: Sensitive Receptors of Water and Wastewater Subcomponents

Subcomponents	Aspects	Sensitive Receptors	Direction	Location	Description	Environmental Targets
WWTP and sewage collection pipes	Water	Dasha River	S	520m	Small tributary	Class III of (GB3838－2002)
		Yellow River	E	emergency outlet	Large river	
	Air and acoustic environment	Gansu Rare Earth Company community	S	706m	600 residents	Class II of (GB3095-1996)and Class II of (GB3096-2008)
		Zhangjiatai Village	SW	1513m	150 residents	
		Wujiachuan Preliminary School	SW	2263m	150 students and teachers	
		Lujiatai Village	SW	2411m	200 residents	
	Ecological	Vegetation	On site	-	-	
Preliminary WTP and transmission line	Water	Yellow River	E	Water intake	Large river	Class III of (GB3838－2002)
		Water intake of Rare Earth Company	-	80m upstream of the intake	Abstraction of 4.3 million m^3/a	
		Dasha River	-	cross	Small tributary	
	Air and acoustic environment	Xintian Village	N	210m	80 residents	Class II of (GB3095-1996)and Class II of GB3096-2008)
		Gansu Rare Earth Company community	-	Both sides of the transmission lines	600 residents	
		Zhangjiatai Village	SW	1513m	150 residents	
Secondary WTP and distribution pipelines	Air and acoustic environment	Gansu Rare Earth Company community	SE	1248m	600 residents	Class II of (GB3095-1996)and Class II of GB3096-2008)
		Zhangjiatai Village	SE	1094m	150 residents	
		Nanshan Village	S	2325m	500 residents	
		Wujiachuan Preliminary School	S	1042m	150 students and teachers	
		Fujiatai Village	S	1249m	200 residents	
		Nanshanwei Village	SW	2377m	350 residents	
	Ecological	vegetation	On site	-	-	

III. DESCRIPTION OF THE PROJECT

A. Rationale and Justification of the Project

93. The PRC has made remarkable progress in economic development and poverty reduction since 1980, but such progress has not been balanced across different regions. Located in the country's northwestern region, Gansu Province has lagged behind in the economic development and remains one of the poorest and least developed provinces in the PRC.[11] In 2011, the poverty rates in Gansu Province were 9.4% for urban and 20.4% for rural households, significantly higher than the national averages of 3.3% and 8.1%. Development barriers facing Gansu include a harsh natural environment, remote inland location, underdeveloped infrastructure, and lack of investment. Such wide regional disparities prompted the Government of the PRC to launch the Western Development Strategy (WDS), with the aim to promote balanced economic growth and to raise the living standards in the region.[12] The strategy focuses on developing infrastructure, protecting the environment, and strengthening economic cooperation and trade with neighboring provinces and countries.

94. Baiyin is a medium-sized municipality in Gansu Province. The municipality was originally established as a national copper mining base in the 1950s. Since the 1990s, its socioeconomic development suffered major setbacks after continuous copper exploitation and depletion. The natural environment has been deteriorated as result of inappropriate human interventions, such as exploitation of mineral resources and overgrazing. Its traditional leading industries faced serious challenges. Many medium and large enterprises had obsolete equipment, backward technology, aging products, and a heavy burden. Since the Eleventh Five-Year Plan (11 FYP, 2006–2010), Baiyin received special support from the national and provincial governments to jumpstart its industrial transformation.[13] The goal was to transform Baiyin from a resource-exhausted mining city into a new industrial center through technology upgrading and diversification of existing production chains, while achieving efficient use of resources and reducing adverse impacts on the environment. In 2008, ADB approved the Gansu Baiyin Urban Development Project (Phase I project), providing assistance on urban road construction and district heating supply to support the initial stage of economic diversification in Baiyin District and Pingchuan District.[14] Although Baiyin's industrial output continued to grow by 18.9% annually from 2008 to 2012, its urban infrastructure is still inadequate to support its economic diversification through industrial transformation. Baiyin's economy still lags behind as its per capita gross domestic product in 2012 remained at CNY25,231, only 66% of the national average of CNY38,354.

95. Baiyin's industrial transformation aims to facilitate inclusive and environmentally sustainable urban development. Although the Phase I project supported Baiyin to kick start its economic diversification, the municipality faces emerging urban development challenges. The water supply and wastewater treatment facilities are inadequate. Uneven urban–rural development broadens income disparities between two urban districts and three rural counties, thereby undermining inclusive socioeconomic growth. Limited opportunities for vocational capacity development also hinder the surplus labor force and laid-off workers to develop skills in support of the transition. Frequent traffic congestion

[11] In 2012, per capita gross domestic product in Gansu was CNY22,037, compared with the national average of CNY38,353, second lowest in the PRC after Guizhou. The average annual per capita disposable incomes of urban and rural households in Gansu were CNY17,157 and CNY4,507 respectively, both figures the lowest in the PRC, substantially lower than the national averages of CNY24,565 and CNY7,917 respectively.

[12] State Council of the PRC. 2000. The National Strategy for Development of the Western Region. Beijing.

[13] In 2008, Baiyin was listed as one of 18 national resource-exhausted cities which received special support for economic transformation under the 11 FYP. Baiyin was also designated as a circular economy pilot city in 2009 and a resource-exhausted city transformation demonstration area in 2011.

[14] ADB. 2008. Report and Recommendation of the President to the Board of Directors: Proposed Loan to the People's Republic of China for Gansu Baiyin Urban Development Project. Manila. The project will be financially closed in early 2014.

and road hazards in the urban district adversely affect logistics and people's quality of life. The Phase I project does not support these sectors. Located in a water stressed region of the PRC,[15] Baiyin needs innovative approaches to support its industrial transformation and meet its sustainable socioeconomic growth targets.

96. The main project area is located in a 23-km^2 planned area of Liuchuan Industrial Park (LIP) of the poverty-stricken Jingyuan County[16], one park of the "one zone and six parks" comprising Baiyin Industrial Concentrated Zone, which is a strategic industrial base of the Lanbai ("Lanzhou – Baiyin") Core Economic Zone. It aims at attracting transfer of large and medium industrial enterprises from the Eastern Region, focusing on rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacture, warehousing, logistics, and construction material industries. The area possesses advantages in terms of land, energy, water, and labor resources. It is comprised mainly of wasteland and low hills, with little farmland and few inhabitants. There are provincial level road and railway links. Water supply is available from the Yellow River some 15 kilometers away.

97. Master planning and regulatory planning of the project area (23-km^2) has been completed, and land formation, construction of some roads, a resettlement area, and some industrial plants and ancillary buildings has started. The proposed ADB financed project will invest in a road and key urban infrastructure and services in the area to provide transport, water service for drinking and industrial processing, and wastewater treatment to improve the environment, and locals' quality of life. This will significantly improve the investment environment to attract more enterprises to move into the project area. Moreover, the development of LIP will provide significant job opportunities.

98. To complement the infrastructure construction for industrial development, the project will also strengthen vocational education and training capacity, enhance environmental management for industrial transformation, and enhance road safety and traffic management in Baiyin District. The project will further scale up the outcome of the Phase I project by accelerating environment-friendly industrial transformation in Baiyin.[17]

99. **Strategic fit**. The project will contribute to balanced regional development in the PRC, thereby supporting the PRC's 12 FYP, 2011–2015, which targets to attain the overarching goal of stable and relatively fast economic development by promoting livelihood improvement, environmental protection, and balanced socioeconomic development. By promoting sustainable and environment-friendly urban development, the project also aligns with ADB's PRC country partnership strategy 2011–2015, and is consistent with ADB's water and urban operational plans which focus on inclusive and environmentally sustainable growth, improved quality of life for developing a livable city, and mainstreaming efficiencies in water use.[18]

100. **Lessons learned and special features**. The project design incorporates lessons learned from ADB's five urban sector projects in Gansu. These are (i) keeping impacts of land acquisition and resettlement to a manageable level, and (ii) rigorously reviewing technical designs to avoid oversized infrastructures.[19] Together with and building on the Phase I project, the project will demonstrate a

[15] Baiyin's average annual precipitation is 180–450 mm, while the annual evaporation is 1,500–1,600 mm.

[16] Jingyuan County's per capita gross domestic product in 2012 was CNY11,884, 54% of Baiyin's average. Gansu provincial government under its 12 FYP designates the Lanbai Core Economic Zone to accelerate the development of the industrial economic corridor from the provincial capital of Lanzhou to Baiyin.

[17] The Phase I project contributes to economic transformation and improvement of quality of life in Baiyin. The project finances development of the South Baiyin Industrial Zone, which has been renamed as "Baiyin High-tech Industrial Development Zone". As of December 2013, all industrial areas are fully occupied or committed by the private sectors.

[18] ADB. 2012. *Country Partnership Strategy: People's Republic of China, 2011–2015*. Manila; ADB. 2012. *Water Operational Plan, 2011–2020*. Manila; ADB. 2012. *Urban Operational Plan*, 2012-2015. Manila.

[19] ADB assistance associated to urban development in Gansu province include: *Gansu Baiyin Urban Development Project* (Loan 2407-PRC, ongoing); *Lanzhou Sustainable Urban Transport Project* (Loan 2601-PRC, ongoing); *Gansu Tianshui Urban*

sustainable model of urban development through industrial transformation for other resource-exhausted cities in the PRC. Individual special features of the project include: (i) comprehensive support for skills training and vocational education for industrial transformation; (ii) enhanced environmental management through detailed environmental management system (EMS) for the LIP; and (iii) installation of an intelligent transport system (ITS) to address bottlenecks on transportation management.

101. Relative to improved environmental management of industrial areas, a web-based EMS was established for the Baiyin High-tech Industrial Zone under Gansu Baiyin Urban Development Project Phase I (Loan 2407-PRC). The basic principles and ideas were based on ISO 14001, including components of environmental entry, environmental management, and environmental information and enterprises information, and emergency response. Each enterprise in the industrial zone can access the system and upload basic pollutant emission information into the database.

102. The primary and short-term objective of the LIP EMS is to enhance environmental management and emergency response capacity of the LIP to minimize environmental pollution and mitigate negative impacts of environmental incidents. The mid-term objective is to achieve ISO 14001 EMS certification of LMC. The long-term vision is to achieve LIP accreditation by MEP as an eco-industrial park (EIP) and/or circular economy zone under NDRC.

103. The EMS will target pollutants of concern from existing and future industries in the LIP, and will include an environmental management information system (EMIS), an emergency warning system, and rescue and mitigation strategies and measures. The proposed scope of the subcomponent includes: (i) establishment of an EMS including EMS Center within the LIC under LMC including development of clear EMS management procedures, procurement and installation of office equipment, mobile environmental monitoring equipment; (ii) development of an emergency preparedness and response (EP&R) plan, including EPR management procedures, procurement of emergency responses equipment; (iii) establishment of an environmental management information system (EMIS) targeting pollutants of concern including EMIS software; and (iv) training and capacity building.

B. Impact, outcome, and outputs

104. The impact of the project will be inclusive and environmentally sustainable urban development in Baiyin. The expected outcome will be accelerated industrial transformation and economic diversification in Baiyin. Project outputs include: (i) basic urban infrastructure in LIP comprising: (a) a new water supply facility with treatment capacity of 60,000 cubic meters per day, a 14.3-kilometer (km) water transmission pipeline, a 13.9-km water distribution pipeline network and other related facilities/equipment (see Table III-2); (b) a new wastewater treatment facility with treatment capacity of 35,000 cubic meters per day, a 57-km wastewater collection pipeline network and related facilities/equipment (see para 120-130); (c) 1 new road of 6 km; (ii) industrial training infrastructure and equipment with related services to strengthen capacity building for local skilled/non-skilled workers in Jingyuan County; (iii) ITS in the Baiyin District; and (iv) project management and institutional capacity building, including effective project management, environmental management of the industrial area, and the sustainable operation and maintenance of project facilities.

C. Urban infrastructure Component

105. Liuchuan Industrial Park (LIP) is located at Jingyuan County, the east of Baiyin urban area (see **Figure III-1**). The current population of Liuchuan Township is 56,600. The built-up area of the industrial park is 5 square kilometers. Presently 16 enterprises and institutions have been settled in the park. The

Infrastructure Development Project (Loan 2760-PRC, ongoing); *Gansu Urban Infrastructure Development and Wetland Protection Project* (Loan 2903-PRC); and *Gansu Jiuquan Integrated Urban Environment Improvement Project* (Loan 3003-PRC).

area is spacious, has little value for farming and is close to water sources and power supply. It is a favorable location for industrial zone development. However, to enable large-scale industrial development, the site is in urgent need of infrastructure such as road access, water supply and wastewater treatment.

Figure III-1: Regional Map - Gansu Baiyin Integrated Urban Development Project

Figure III-2: Layout of the Proposed Infrastructure (in blue: LIP Phase 1, 23-km2)

Proposed site of WWTP

Dasha River

Proposed site of water intake

Proposed site of preliminary WTP

Proposed site of transmission line

Proposed site of secondary WTP

South of the proposed road

North of the proposed road

Photo III-3: Proposed site for the infrastructure and surroundings (2013)

a. Subcomponent 1: Water Supply Facilities

106. **Current situation and existing problems**. The current water source is surface water from the Yellow River, and the water intake is located 10 km away to the southeast of the LIP and on the southern bank of the Yellow River. Water intakes currently include (a) Mitan Town Dushi Village Water Intake which serves villages and provides water for irrigation; and (b) water intake at Santan Village, which pumps water to the rare earth company as is reserved for industrial and domestic water use. Operated many years, the current water supply system that supplies the rare earth company (Santan intake) has the following problems:

(i) The actual treated water supply is only 15,000 m^3/d instead of the designed 20,000 m^3/d due to the aging of the pipes which have reduced capacity and high leakage. The rare earth company consumes 9,000 – 13,000 m^3 of water per day; therefore the water available for other uses is limited and cannot fulfill the water demand of the planned area;
(ii) The existing water supply system was built in 1969 and upgraded in 1982. After more than 40 years of operation, the equipment no longer performs efficiently. The raw water is only clarified and treated with aluminum chloride; there is no filtration or disinfection;
(iii) The aging transmission pipeline is easily broken if the pressure is too high. The pipeline goes through arable land and was laid 5 m deep underground making it difficult to repair;
(iv) The location of the current intake has inadequate flood protection making it difficult and dangerous to extract water during the flooding season.

107. For the LIP to succeed, it must have a reliable water supply for the industries within its boundaries.

108. **Water Demand Forecast.** The service area is the 23-km^2 planned area of LIP in Jingyuan County by year 2020 (LIP Phase 1). Long-term plan for the LIP is 100-km^2 of which planning for 50-km^2 (Phase 2) is completed. The FSR discusses four water consumption prediction methods for LIP Phase 1 (2020). The forecast results are presented in **Table III-1**. The assumption for 7% water leakage is considered acceptable given the fact that all pipes in the LIP supply network will be less than 6 years old by 2020.

(i) Land Area: Total Land Area x Average Consumption per Unit of Land
(ii) Per Capita: Total Population x Integrated Water Consumption Index (L/person-days)
(iii) Land Classification: Use different consumption rates for different types of land, e.g. urban residential, industry, agriculture. Calculate individual consumption
(iv) Water by Category of Use: Different usage rates by residential, commercial, institutional, industrial, agriculture, roads and landscaping, unavoidable leakage.

Table III-1: Summary of Liuchuan Industrial Park Water Demand Forecast in Year 2020 (LIP Phase 1)

Water Use	Volume (m^3/d)	% of total
Domestic water use/demand (m^3/d)	4,080	7%
Industrial water use/demand (m^3/d)	45,840	77%
Leakages from main transmission	5,000	8%
Leakages from the pipeline network (m^3/d)	4,400	7%
Total	***59,320***	***100%***

Source: FSR

109. **Water supply facilities**. The component will consist of Intake and Raw Water Pumping Station on Yellow River at Santan Village, raw water transmission pipeline, preliminary water treatment facility for sediment removal, 14.3km transmission pipeline for the settled raw water, secondary water treatment facility, treated water pump station and distribution network in the LIP. Water will be abstracted from the Yellow River, about 10km southeast of the LIP, where a preliminary treatment facility will be located.

From there, the water will be pumped to a secondary water treatment facility located in the LIP with a treatment capacity of 60,000 m^3/d.

Table III-2: Water Supply Facilities under the Proposed Project

No.	Facilities	Description
1	Intake and Raw Water Pumping Station (Yellow River, Santan Village)	Layout of the pump room: length × width = 42.1×10.1m; intake flow: 0.92m^3/s (Year 2020) and 3.07 m^3/s (Year 2030). The pump station is proposed to have three horizontal single-stage double suction centrifugal pumps with two operational and one backup.
2	Raw Water Transmission Pipeline	Water is pumped through pipeline length 170 m, DN1,200, steel pipe to a preliminary treatment plant. In year 2030 two additional rows of DN1, 200 steel pipes are planned making a total of three.
3	Preliminary Water Treatment Plant	Total proposed area for the plant is 198 mu. The design consists of four circular, reinforced concrete, radial flow sedimentation tanks (diameter 60 m), lift pump station, sludge treatment facilities, warehouse for chemical storage and dosing and other mechanical facilities. For year 2030 eight additional sedimentation tanks are planned of the same size and design.
4	Settled Water Transmission Pipeline	DN1,200 steel pipe; 14.3km long, including 205m tunnel and 1.51km overhead
5	Water Treatment Plant (WTP)	Located inside the LIP with total area of 10 hectares (150 mu).The water treatment process is as follows: pre-chlorination, coagulation with poly-aluminum chloride, sedimentation, filtration by V-filter, and clean water tank with disinfection.
6	Treated Water Pump Station	A water booster pump station will be located next to the WTP and equipped with six single-stage horizontal centrifugal pumps, four in use and two stand-by.
7	Water Distribution Pipeline	DN400 – DN1,000, 13.9km, within LIP.

Source: FSR of 31 December 2013. DN = nominal diameter; km = kilometer; m = meter; m3/d = cubic meters per day; MPa = Mega-Pascal (1 MPa = 10 bar); PN = Pressure Nominal

110. **Intake.** The proposed intake and raw water pumping station will be located on the left bank of the Yellow River at Santan Village. The intake will take water directly from the river through a trash rack and filter to protect the pump impellers from dirt, debris, and ice. The raw water pumping station will have three horizontal single-stage double suction centrifugal pumps (two operational and one backup). Water will be pumped through a steel pipe (170 m, DN1,200) to a preliminary treatment plant. LMC plans to construct two additional rows of DN1,200 steel pipes in 2030 (for Phase 2 of LIP). The pump station floor level is 1.50 m higher than the estimated 100-year flood level which makes it relatively safe from the flood impact, also accounting for flow variations from current and possible future climate variability (see para 289-291).

111. **Preliminary Water Supply Plant.** The preliminary water supply plant will be used to remove most of the sediment from the raw water and reduce subsequent treatment load. The site is located on a land terrace above the Yellow River. Total proposed area for the plant is 198 mu (equivalent to 13.2 hectares). According to PRC CJJ40-2011 "High Turbidity Water Design Specifications" when using two-stage treatment processes the first-stage pre- sedimentation structures should have a larger volume for sediment and reliable solids processing facilities. The LDI evaluated (a) radial flow sedimentation tank; (b) advection sedimentation tank; and (c) inclined tube (plate) sedimentation tanks. All are suitable for gravity settling or chemical coagulation.

112. The design consists of four circular, reinforced concrete, radial flow sedimentation tanks (diameter 60 m), pressure pump station, sludge treatment facilities, warehouse for chemical storage and dosing and other mechanical facilities (**Figure III-5** and **Figure III-6**). For year 2030 (LIP Phase 2), eight additional sedimentation tanks are planned of the same size and design. According to the FSR, gravity settling is planned when source water sediment is less than 12 kg/m^3 settling and addition of coagulant when it is > 12 kg/m^3. This cut-off point for not using coagulant should be adjusted based on actual operating experience. The purpose of this facility is to remove as much sediment as possible because that makes

subsequent treatment operations easier and less costly. The drying beds will be used for sludge dewatering to take advantage of the high evaporation in Baiyin. The dried material is fairly innocuous in nature but with alum coagulant use, it cannot be used directly for agricultural use without careful planning and potentially mixing with other material. The sediment from the preliminary WTP will be transported to the barren area 100-200 meters above the WTP, designated by the local Land Resources Bureau. The area will be protected from public access and routine soil conservation and protection measures taken to ensure that the material does not impact surrounding land.

113. **Water Transmission Pump Station and Pipeline.** The Preliminary WTP is about 130 m lower elevation than the main WTP in the LIP so the LDI evaluated two options (one pump station or two pump stations) for pumping water from the preliminary treatment plant to the main water treatment plant located in the LIP and selected the single-stage booster pump station with design lift 146 m equipped with three sets of horizontal, single-stage, double-suction centrifugal pumps with two operating and one standby. The straight distance from the preliminary WTP to the secondary WTP is about 10 km. However the route selected is not the shortest (straight-line) distance in order to avoid going through unfavorable terrain and take full advantage of the geological conditions. The Project will support the installation of a single pipeline to cover demand of LIP Phase 1 (23-km^2). LIP plans to install another two pipelines alongside the first in year 2030. Thus the local government needs to secure the right-of-way for the year 2030 pipes, which is estimated at 30 m width along the pipeline route. The tunnel is being designed and constructed to accommodate the year 2030 piping.

114. **Secondary WTP.** The secondary water purification plant is located inside the LIP with total area of 10 hectares (150 mu, see **Figure III-4**). The location was selected for the following reasons: (a) close to the water distribution network inside the LIP; (b) geological foundation and bearing capacity is good; (c) the location is convenient for construction and operation management; and (d) convenient discharge conditions. The LDI evaluated various treatment process options and selected the following: pre-chlorination, coagulation with poly-aluminum chloride, sedimentation, filtration by V-filter, and clean water tank with chlorine gas disinfection (**Figure III-7**). This is the standard process for Yellow River water which typically has high turbidity. According to the LDI the treated water quality will meet the national "Drinking Water Health Standards" (GB5749-2006).

115. **Water Treatment Plant Solids Processing.** The solids from sedimentation tanks and filter backwash will go to a sludge conditioning tank for gravity settling and concentration. Then the solids go through one of two sets of horizontal spiral centrifuge and ancillary screw conveyor for dewatering processes, i.e. one operating and one stand-by. The resulting “sludge cake” with water content of 50-60% will be transported to Jingyuan County Landfill No. 2. The design capacity is of the new landfill is 820,000 m^3, with an expected life of 10 years (2015-2024). At the landfill the dry solids will be used as cover for the solid waste layers.

116. **Treated Water Pump Station.** A water booster pump station will be located next to the secondary WTP and equipped with six single-stage horizontal centrifugal pumps, four in use and two stand-by.

117. **Distribution System Piping.** The water distribution pipes with a total length of 57.25 km will be constructed within the LIP Phase 1. By end of 2013, some 10km were already installed under project roads within LIP. All pipes are new (less than 2 years old). The initial construction to be funded by the ADB Loan is 13.97 km. Pipe diameters are: DN400: 2.13 km; DN500: 2.6 km; and DN1,000: 4.48 km. LDI evaluated 3 different water supply pipeline materials and selected Ductile Iron, K9 class. Pipes will be installed by the trench excavation method (cut and cover). The system will be operated such that the minimum water pressure will be 0.28 MPa. Ultra-sonic flow meters with smart pressure transmitters will be installed on the pipelines.

Figure III-4: WTP Location, Water Distribution System in Year 2020

Source: Design Institute. Green identifies the pipe to be funded by the ADB Loan.

118. **Operation and Maintenance.** A water supply company will be set up under the LMC to be responsible for the operation and maintenance of the water supply facilities and water tariff collection. The company will also be in charge of operating the project wastewater treatment plant (WWTP). The WTP will be equipped with a laboratory capable of examining the 42 key water quality parameters defined in the National Standard for Drinking Water. In addition, water samples taken from the clean water tank of the WTP will be sent to an accredited laboratory twice per year for an examination of the 106 key water quality parameters defined in the PRC regulation. Residual chlorine will be closely monitored. There will be special power lines from the transformer station to the water treatment plant so no stand-by generators are required based on the regulations. The LDI has included facilities to store and add Powdered Activated Carbon as an adsorbent if organic water pollution occurs.

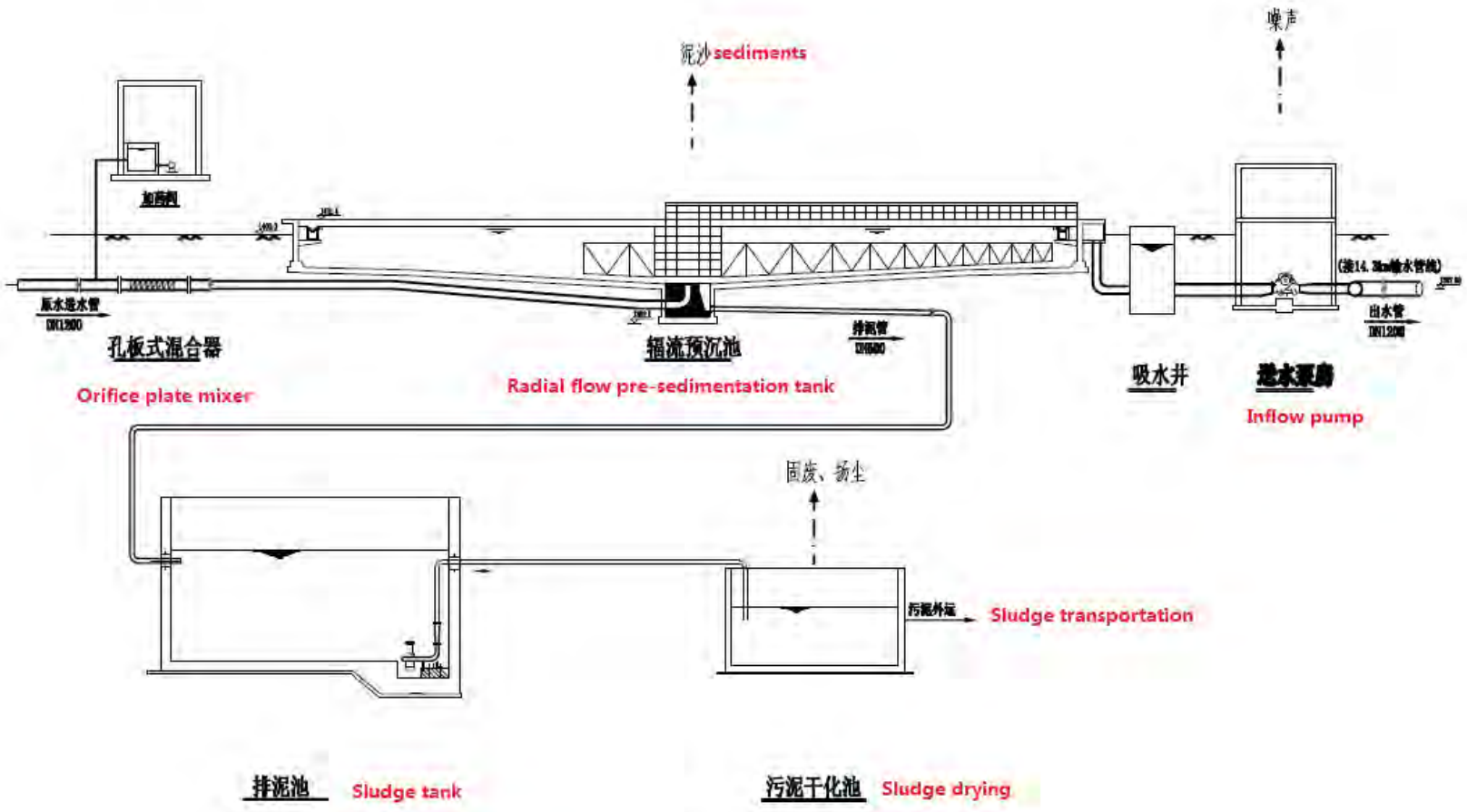


Figure III-5: Process Diagram of Preliminary Treatment Plant

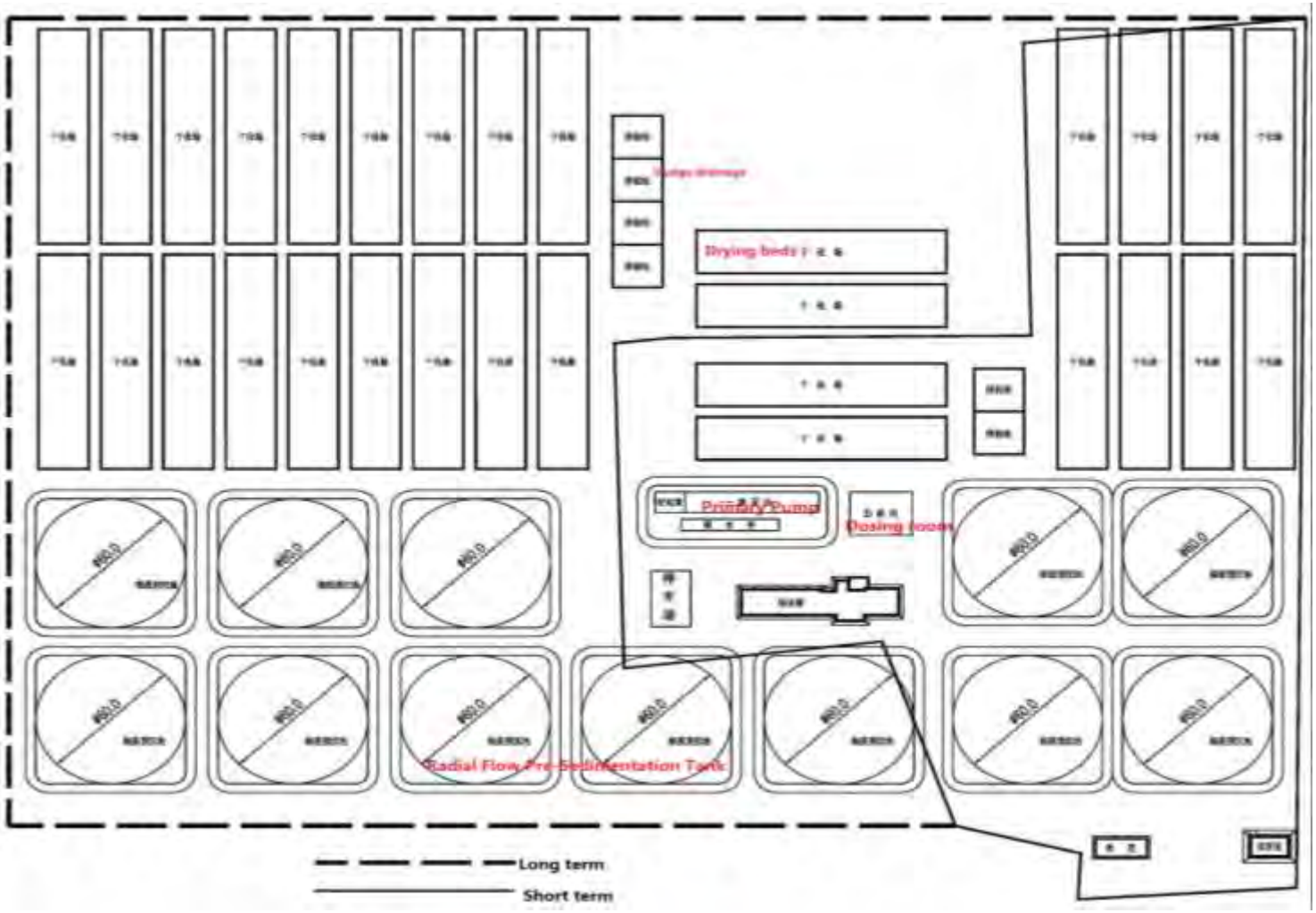


Figure III-6: Layout of Preliminary Treatment Plant

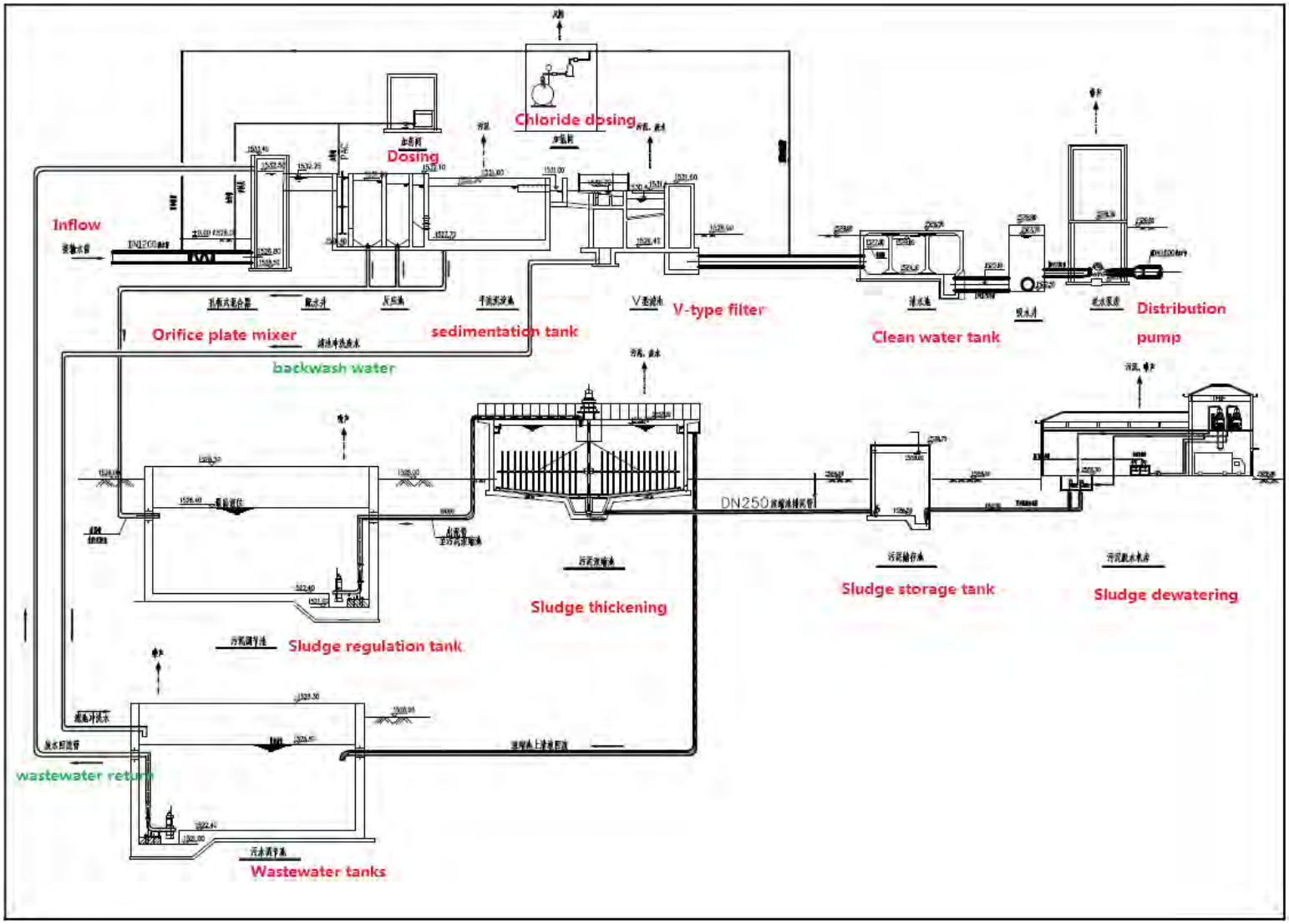


Figure III-7: Process Diagram of Secondary Treatment Plant

b. Subcomponent 2: Wastewater Collection and Treatment Facilities

119. The wastewater collection and treatment system will collect and treat (a) sewage from residential homes and offices; and (b) wastewater from industries. It will not include stormwater; separate wastewater and stormwater networks are being implemented in the Liuchuan Industrial Park (LIP) in accordance with the "Regulation for Urban Sewage and Stormwater Collection and Treatment" issued by the PRC State Council on 16 October 2013 (effective on 1 January 2014). The service area is the 23-km^2 planned area of LIP Phase 1 in Jingyuan County by year 2020. **Table III-3** shows the results of wastewater flow projection. Based on the flow projection, the plan is to build a new WWTP with treatment capacity of 35,000 m^3/d, using the G-BAF technology for secondary wastewater treatment.[20] Some industries, including aluminum processing or the co-generation plant, will have significant water losses during the production process (for cooling purposes), as high as 50%. All industries within LIP will be required to connect to the wastewater collection system and the WWTP.

120. **Wastewater Collection System**. The wastewater collection system will consist of (a) wastewater pipeline network west of Liuchuan Avenue with a total of 25.97 km, including DN300 RC pipe (5.2 km); DN400 RC pipe (8.744 km); DN500 RC pipe (4.901 km); DN600 RC pipe (2.681 km); DN800 RC pipe (3.643 km); DN1,000 RC pipe (0.8 km); and (b) Pipe network east of Liuchuan Avenue (including Liuchuan Avenue) with a total length of 20.07 km, including DN300 RC pipe (3.8 km); DN400 RC pipe (3.396 km); DN500 RC pipe (1.28 km); DN600 RC pipe (2.45 km); DN800 RC pipe (3.905 km); DN1,000 RC pipe (2.69 km); DN1,200 RC (1.76 km); DN1,400 RC pipe (0.785 km). Sewer pipes are gravity flow with a minimum rate of 0.6 m/s and maximum design flow rate of 5 m/s. Slopes are of the order of 0.2%.

Table III-3: Wastewater flow projection (LIP Phase 1)

	Year 2020 (m^3/d)	
Industries Planned for Liuchuan Industrial Park	**Water Consumption**	**Wastewater Discharge**
Gansu Hongtai Aluminum Co. Ltd	8,000	4,000
Coal-Chemical Integration Project	12,000	10,000
Baiyin Jiarui Ceramics Co. Ltd.	1,000	600
Baiyin Honglu Aluminum Co. Ltd.	6,000	4,000
Guangdong Foshan Polished Brick Plant	1,500	800
Cogeneration Plant	6,000	3,000
Shanghai Zhongjin Automobile Logistics	3,000	2,700
Liuchuan Rare Earth Company (Current)	8,340	5,000
Subtotal	*45,840*	*30,100*
Domestic	4,080	3,672
Total		**33,772**

Source: FSR &PPTA consultants

121. **Influent and Effluent Water Quality**. It is estimated that industrial wastewater is about 90% of the total wastewater flow (**Table III-3**). Thus the wastewater influent quality is crucial to selecting an appropriate treatment process. Design parameters for influent water quality were based on (i) PRC's Discharge Standard for Municipal Wastewater (CJ 3082-1999) for wastewater influent from industrial sources and industrial discharge standards for specific industries (GB26451-2011 for rare earth, GB25465-2010 for aluminum industry). Year 2020 wastewater loading and strength was estimated by applying a weighted average approach to the estimated discharge volume and wastewater strength (**Table III-4**).

[20] The G-BAF system is being successfully applied in the PRC, including (i) Shanghai Xinjiang Wastewater Treatment Plant (WWTP) located in Shanghai's Jinshan District; (ii) Shandong Tiexiong coking wastewater treatment works; (iii) Xinjiang Bayi Iron & Steel coking wastewater treatment works; (iv) Karamay oil refinery wastewater treatment works; (v) Wenzhou leather wastewater treatment works; (vi) Tianjin Petrochemical Company refinery wastewater treatment works; (vii) Beijing Wenyu water decontamination; (viii) Beijing Zhongnanhai water decontamination; (ix) Beijing river water decontamination; (x) Henan Yanshi wastewater treatment plant upgrade project; and (xi) Dongguan East Lake water purification works.

Table III-4: Estimated Wastewater Influent Concentrations for Year 2020 (LIP Phase 1)

Industry	Volume (m^3/d)		Unit	BOD_5	COD_{Cr}	SS	TN	NH_3-N	TP
Gansu Hongtai Aluminum Co. Ltd.	4,000	Strength	mg/L	---	200	70	30	25	2
		Loading	kg	0	800	280	120	100	8
Coal-Chemical Integration Project	10,000	Strength	mg/L	60	500	100	70	45	1.5
		Loading	kg	600	5,000	1,000	700	450	15
Baiyin Jiarui Ceramics Co. Ltd.	600	Strength	mg/L	80	130	400	15	12	3
		Loading	kg	48	78	240	9	7.2	1.8
Baiyin Honglu Aluminum Co. Ltd.	4,000	Strength	mg/L	---	200	70	30	25	2
		Loading	kg	0	800	280	120	100	8
Guangdong Foshan Polished Brick Plant	800	Strength	mg/L	80	130	400	15	12	3
		Loading	kg	64	104	320	12	9.6	2.4
Cogeneration Plant	3,000	Strength	mg/L	40	70	30	8	5	1
		Loading	kg	120	210	90	24	15	3
Shanghai Zhongjin Automobile Logistics	2,700	Strength	mg/L	230	400	410	55	25	6
		Loading	kg	621	1,080	1,107	148.5	67.5	16.2
Liuchuan Rare Earth Company	5,000	Strength	mg/L	----	100	100	70	50	5
		Loading	kg	0	500	500	350	250	25
Total Industrial	30,100	Loading	kg/d	1,453	8,572	3,817	1,483.5	999.3	79.4
Domestic Wastewater	3700	Loading	kg	851	1,480	1,517	203.5	92.5	22.2
Total Loading	33,800	Loading	kg	2,304	10,052	5,334	1,687	1,092	102
		Strength	mg/L	68	297	158	50	32	3

Source: TA Consultants

Note that: (a) the individual concentrations in the tables above are mostly higher values within the range; and (b) industrial wastewater (30,100 m^3/d) is about 89% of the total volume.

122. **Treatment Process.** The WWTP consists of coarse and fine screenings, aerated grit chamber, primary sedimentation, a regulating pool (basin), secondary treatment process, disinfection, coagulation and filtration, reuse/discharge (**Table III-5 and Figure III-8**). The WWTP will be designed to produce Class 1A wastewater. The plan is to reuse the wastewater effluent for industrial processes and landscape irrigation. However there needs to be a location to discharge excess wastewater in the event there is more volume than can be reused (see discussion in para. 256-258, Figure V-3 and Table V-12).

123. The LDI evaluated three secondary wastewater treatment processes: (i) A2O (anaerobic-anoxic-oxic); (ii) CASS (Cyclic Activated Sludge System), and (iii) BAF (Biological Aerated Filter). All three are biological wastewater treatment processes and their selection for consideration is based on the premise that the industries in the LIP will pre-treat their wastewater in accordance with PRC Standard CJ343 - 2010: Wastewater Discharges into Urban Sewerage Networks which sets discharge limits for 35 parameters including pH, heavy metals (10), COD, Ammonia Nitrogen, etc. all which can be toxic to the micro-organisms used in biological wastewater treatment. Based on the alternative analysis, the G-BAF system was selected. LDI identified these advantages for BAF compared to A2O and CASS: (i) no need for secondary clarifiers which reduces land requirements and capital costs; (ii) no return activated sludge making operations easier; (iii) produces less noise and less odor; and (iv) more stable at low temperatures.

124. The G-BAF technology uses functional macro-porous mesh suspended media which combined with efficient fixed microorganisms creates an anaerobic - anoxic - aerobic integrated micro-environment, facilitating the formation of nitrogen flora microenvironment. G-BAF uses a proprietary product called BCP that according to the supplier is a series of efficient microorganisms, which has a high degradation of ammonia and organic chemicals commonly found in industrial wastewater including refractory complex organic compounds, aliphatic hydrocarbons, aromatic compounds, phenolic compounds, fatty acids, tannery waste, pharmaceutical waste, ketones, and surfactants. With the use of nitrating agent, the BCP can help nitration reactions used in the treatment of high concentrations of ammonia wastewater. BCP is characterized by a tolerance of high organic load, fast cells growth, high utilization rate; all these

features help to stabilize the plant operation and applied to many other occasions. BCP active ingredients are microorganisms and enzymes. The chemical composition is proteins, starches, fats, polysaccharides and trace elements. The BCP micro-organisms can grow under either aerobic or anaerobic conditions and can function over a temperature range of 5 to 45 ^{0}C.

125. The G-BAF secondary treatment will be in four series, the first and third with flow upward, and the second and the fourth with down-flow. The media is modified polyurethane material in random sized lumps with side length of 30 ~ 50mm. There is no backwashing but the Middle Tank that follows the G-BAF bioreactor can re-circulate into the bioreactor when there are high concentrations of suspended solids. To deal with the risk of low (acidic) pH the G-BAF tank systems will be equipped with an alkali dosing system of 10% sodium carbonate solution into the Regulation Tank that can adjust the pH to 7 - 8.5. Micro-organisms need a source of carbon for growth. There is a risk of insufficient organic carbon where the wastewater is primarily industrial. A carbon dosing system will be installed using glucose as the carbon source. Glucose is readily available, easy to store, and has less safety concerns than other carbon sources such as methanol. The external carbon source will be added in the front of the anaerobic biological filter used for the de-nitrification process. The dosage will range from 0 to 50 g/m^3 as needed. The process flow diagram is shown in **Figure III-8**.

126. **Sludge.** The wastewater sludge treatment goals are set according to CJ3025-1993 "Urban Sewage Treatment Plant Sewage Sludge Discharge Standard" requirements: (a) protecting the environment; (b) adapting to local conditions to take a reasonable approach to the economics of the stabilization process which is to reduce (i) organic matter; (ii) sludge volume; (iii) subsequent sludge disposal costs; (iv) phosphorus; and (c) moisture content not exceeding 60% for sending to landfill. The LDI evaluated sludge disposal options and recommended sludge disposal at sanitary landfill after treatment. The LIP has received an agreement from operator of new Jingyuan County Landfill No. 2 under construction, that allows the WWTP sludge to be placed in the new landfill. The design capacity is of the new landfill is 820,000 m^3, with an expected life of 10 years (2015-2024). This landfill will be ready before the WWTP is in operation and will be equipped with a leachate treatment system. The LDI used year 2001 data from Guangzhou sewage treatment plant sludge composition and from a study by South China Agricultural University of Shenzhen Luofang municipal sewage sludge composition and concluded it is likely the sludge in the LIP will not be suitable because with 90% of the wastewater being industrial there are likely to be chemicals such as heavy metals present in the sludge that make it unsuitable for land application as compost or soil amendment for land reclamation.

127. The domestic EIA also recommended landfill disposal mainly on the basis of other WWTPs in the PRC and the sludge quality problems in these facilities. However the LIP will require industries to pre-treat their wastewater prior to discharge into the sanitary sewer. Industries will be monitored by the Baiyin Environmental Protection Bureau (BEPB) by in-line monitors at the point of discharge and by periodic sampling and laboratory analysis. The solid wastes during operation of WWTP include screenings, grits, sludge and domestic solid wastes generated by the working staff. If the LIP pretreatment system is successful in maintaining good operations of the industrial pretreatment systems and the LIP WWTP operates properly, the beneficial reuse of the sludge will also be considered in the future.

128. **WWTP Operation and Maintenance**. A wastewater treatment company will be set up under the LMC to be responsible for the O&M of the WWTP (same company as the WTP). An on-line monitoring system will be procured and installed at the inlet and outlet of the plant for continuously monitoring of the water quality with data transmitted to Baiyin Municipal EPB. Laboratory equipment will be procured for testing influent and effluent quality. Considering industrial wastewater will account for 90% of the influent, equipment for sludge testing will also be procured.

129. **Effluent Discharge and Re-use**. Although Dasha River is classified as category III water body, discharge to Dasha river is strictly controlled according to the original EIA approval from Gansu Provincial Environmental Protection Department ([2013]40) due to the existing pollution to Dasha River. The EIA approval document also requires that at least 60% effluent should be reused within LIP. Following intense policy dialogue with local environment protection authorities and ADB, the LDI decided to upgrade the design process from Class 1B to Class 1A discharge standard, which is the most stringent standard. As indicated in Table II-7, Class 1A can meet with the requirements of:

(i) The Reuse of Urban Recycling Water: Water Quality Standard for Urban Miscellaneous Water Consumption (GB/T 18920-2002);
(ii) *The Reuse of Urban Recycling Water: Water Quality Standard for Industrial Use* (GB/T 20922-2007);

130. The WWTP will be equipped with a treated effluent storage tank (volume of 3,000m^3) to allow for better management of the wastewater reuse distribution systems, consisting of both piped water reuse distribution as well as tanker trucks. Such a storage system is necessary to balance the treated water production with the treated water reuse, which are not always matched in time or volume.

131. The wastewater reuse system for irrigation, defined as associated facility, has been planned as shown in **Table III-5** and **Figure III-13**. The LMC is committed to construct the wastewater reuse pipelines covering LIP Phase 1 by 2019. This requirement will be flagged as loan assurance in the project agreement.

Table III-5: LIP Treated Wastewater Reuse Pipeline System in LIP Phase 1

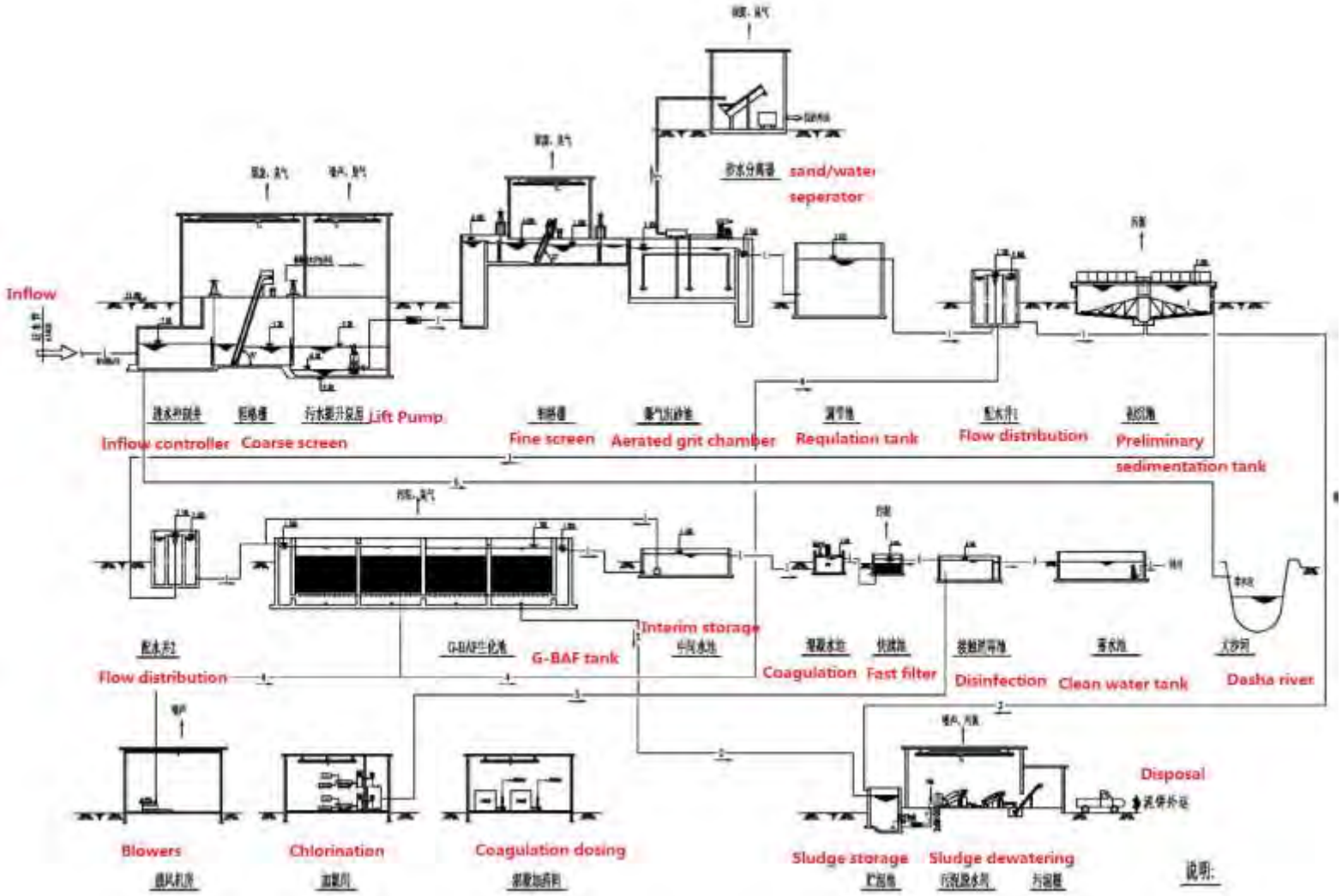
Reuse Water pipeline system plan 再生水管网建设规划 （2020）				
Section 管道区段	**Length 长度 (km)**	**Diameter管径**	**Construction Year建设年限**	**Financing Source资金来源**
Irrigation of Dasha River wetlands and Jinger Rd. sides 大沙河湿地景观带建设及经二路两侧绿化带建设	3		2014.3 -- 2015.6	Industrial Park 园区自筹
Irrigation Central Park in Liuchuan Industrial Park 刘川工业集中区中心公园	2.5		2015.8 -- 2016. 6	Industrial Park 园区自筹
Gateway Park and isolation belt construction 门户公园及隔离带建设	3		2016.8 -- 2017.6	Industrial Park 园区自筹
Mountain greening in southeast of the industrial park 园区东南山体绿化	3		2017.8 --2019.6	Industrial Park 园区自筹
Total water reuse pipeline system 总计管道长度	11.5			

Source: LMC

132. Other major future uses of treated wastewater will be industries:

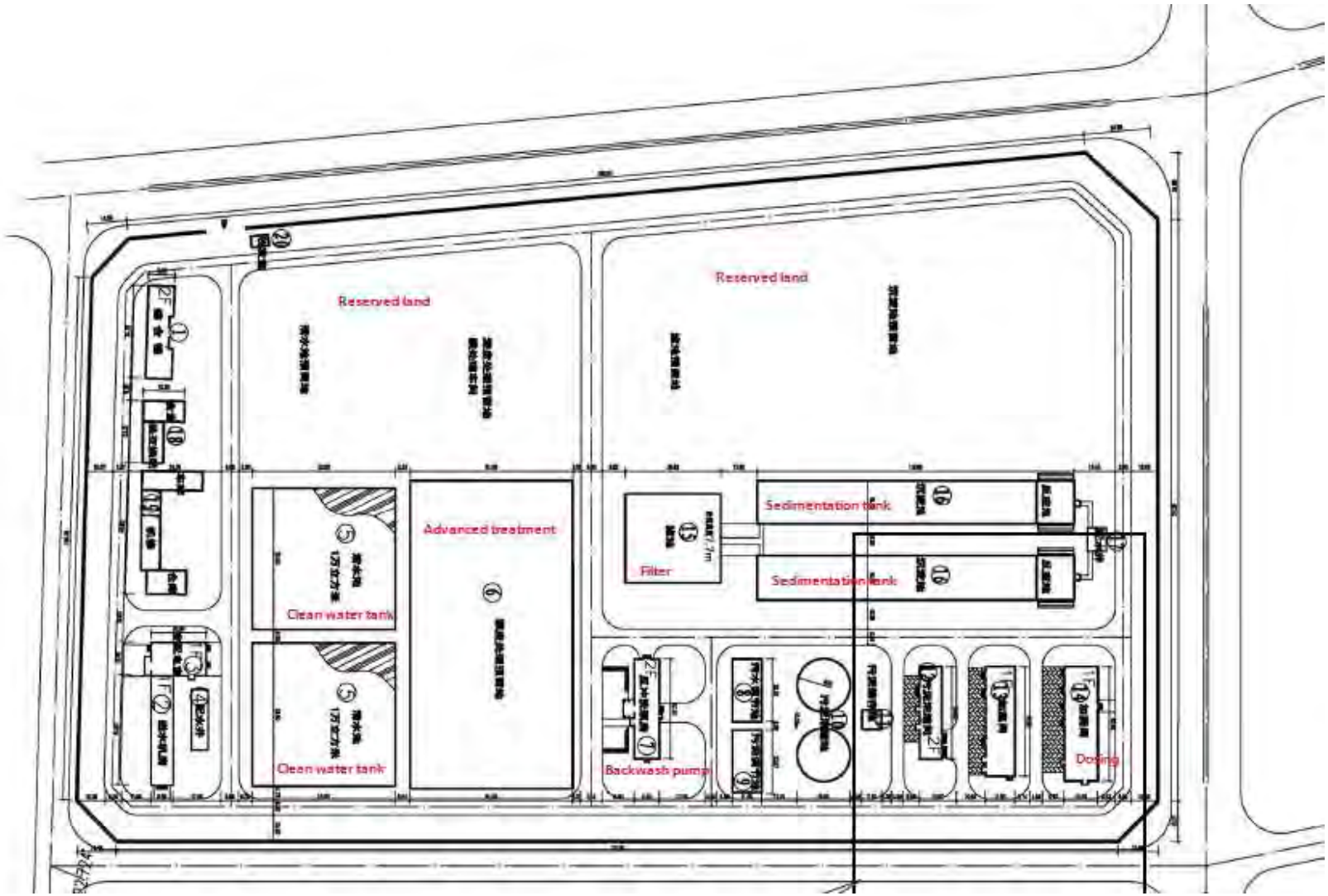
(i) A 2 X 1000MW thermal power plant will be built in the western site of the LIP to supply electricity for Hongtai Aluminum Plant. The preparation work is underway and its construction will start in 2016, with an estimated water consumption of 21,000 m^3/d;
(ii) Hongtai Aluminum Plant started construction in April 2013 with a total investment of 29 billion CNY. The expected water demand is 8000 m^3/d, of which 4000 m^3/d will be reused water;
(iii) Coal chemistry facilities are high water consumption industries. The expected water demand is 12,000 m^3/d, of which 7,700m^3/d is planned to be supplied by treated wastewater.

Figure III-8: LIP Treated Wastewater Reuse Piping System for Irrigation. *Source: LMC*



Source: FSR

Figure III-9: Wastewater Process Flow Diagram



Source: FSR

Figure III-10: Layout of the WWTP

c. Subcomponent 3: Road and auxiliary facilities

133. A total of 35 roads are proposed to form the industrial park road network. The road width ranges from 60 m for a trunk road to 20 m for a secondary/branch road. The proposed Xihuan (west ring) Road under the ADB financed project is an urban trunk road designed as part of the road network of the industrial park.

134. The function of Xihuan Road is as an urban road designed to urban Class II trunk road standard. The right of way width is 50 m with dual three motor-vehicle lanes. The design speed is 50 km/h. Utility services such as drainage, wastewater sewer and water supply, lighting and greening will be provided along with the road construction. The project scope will include (i) construction of 6.02 km road and associated utility services; (ii) construction of a 26 m long underpass beneath the G6 Expressway as part of Xihuan Road; and (iii) construction of a 60 m long bridge overpass above Dasha River as part of Xihuan Road. Key characteristics of technical standards are presented below and design parameters are selected in line with relevant national codes and design specifications.

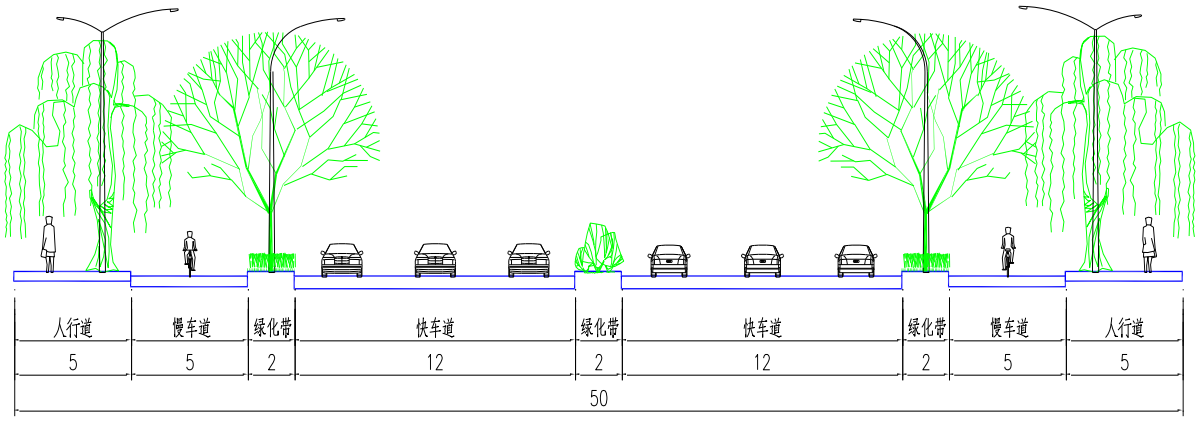
Table III-6: Major Design Parameters of Xihuan Road

	Unit	Xihuan Road
Class		Urban Trunk
Design traffic load capacity	pcu/h	4,410
Peak hour traffic flow in future year	pcu/h	3,122
Design speed	km/h	50
Length	m	6,022
Cross-section	m	6+5+2+24+2+5+6=50 m
Pavement Design Load		BZZ-100
Minimum horizontal curve radius	m	—
Maximum vertical slope gradient	%	3.26
Minimum vertical slope gradient	%	0.31
Pavement		Asphalt Concrete
Rainfall Return Period	Year	1
Bridge and Culvert		Urban – A Class
Seismic fortification intensity	^{o}C	8
Lighting Standard		Average Illumination: 28 Lux, Pavement Average illumination: 1.75 cd/m^2, Brightness uniformity: 0.4
Design Year		Design life for traffic reach saturation: 20 years, Pavement design life: 15 years

135. **Horizontal Alignment.** Total length of the road section is 6,010 m. For the horizontal layout, 4 turning points are set up, with a minimum radius curve of 500 m. The proposed road will intersect the existing G109, and the underpass G6 highway at k2+300 in the form of a box culvert, and cross Dasha River at k1+660 in the form of a simply-supported girder bridge.

136. **Vertical Alignment.** The vertical alignment is designed to meet the urban road design specifications and related flood control and drainage requirements. The minimum longitudinal gradient is 0.31% to satisfy the drainage requirements. The maximum longitudinal gradient is 3.26%; while a 2% cross fall of the pavement is for storm water runoff.

137. **Road cross section.** The selection of the road cross section is based on the road classification and the traffic volume. The proposed road is a dual 3-lane 24 m wide carriageway and with provision of non-motorized vehicle lane and sidewalk. The overall right of way width is 50 m, which is made up of 5 m sidewalk + 5 m NMV + 2 m divider + 12 m carriageway (one-way) + 2 m median divider +12 m carriageway (one-way) +2 m divider + 5 m NMV + 5 m sidewalk (**Figure III-11**).



Source: FSR

Figure III-11: Cross section of Xihuan Road

138. **Sub-Class and Protection Works.** The design was carried out with reference to geological surveys for roads within the same area. The total earthwork volume will be moderate for the proposed road. Substantial cutting will be present at the north section of the road. Earthworks fill and cut balance has been considered during the vertical alignment design. Simple slope protection measures are proposed in the FSR. Site formation will be undertaken in parallel with the road construction. Hence, temporary measures will be taken to stabilize the sub-class slope. Slope stabilization will be realized by compaction and vegetation, in coordination with overall site formation.

139. **Pavement.** Due to local deep frost soil, thicker sand and gravel base courses are adopted to prevent thermal frosting. Asphalt concrete pavement was recommended because it is relatively easy to be applied and repaired.

Table III-7: Proposed Road Pavement for Carriageway and NMV Lane

Pavement Type	Structure	Thickness (cm)	Remarks
Carriageway	Medium-Class asphalt concrete (AC-16)	5	Spread tack coat oil
	Coarse-Class asphalt concrete (AC-25C)	7	Spread tack coat oil
	5% cement stabilized sand and gravel	20	Spread prime coat oil
	Cement and lime stabilized sand and gravel	30	
	Total	62	
NMV Lane	Fine-Class asphalt concrete (AC-13C)	4	Spread tack coat oil
	Medium-Class asphalt concrete (AC-20C)	6	Spread prime coat oil
	5% cement stabilized sand and gravel	20	
	Cement and lime stabilized sand and gravel	20	
	Total	50	
Sidewalk	Sidewalk Tile	6	
	C20 cement concrete	10	
	5% cement stabilized sand and gravel	15	
	Total	31	

Abbreviations: NMV = non-motorized vehicle

140. **Intersection Treatment.** For all the road sections except where G6 expressway will be bisected, at-Class intersections are proposed in consideration of the function of roads serving all road users and to ensure easy access for pedestrians and cyclists. Signalization will be provided when a primary road intersects another primary road.

141. **Bridge.** One medium-sized pre-stressed concrete bridge is proposed for the road to cross existing Dasha River with a span of 3x20m as shown in **Figure III-12**.

142. **Municipal Utilities and Others.** Utility pipelines consisting of the drainage and wastewater system, water supply, lighting will be laid under the greenbelt and sidewalk on both sides of the road. The water supply and wastewater collection system are included under the first and second components of this project. Pipeline for these utilities are considered in a coordinated manner and space reserved.

143. **Drainage System.** The drainage system is designed as gravitational flow and connected into the drainage network at downstream. Class II reinforced concrete is proposed as the drainage pipe material and shallow burial will be adopted with depth of 1.3 m. Drainage manhole will be established at 40 m intervals.

144. **Lighting.** Street lights will be installed symmetrically along both sides of the road between MV and NMV lanes at intervals of 35 m. Lighting posts will be 10~12 m high. The average luminance will be no less than 28 lux,[21] and the lighting uniformity is designed at 0.62.

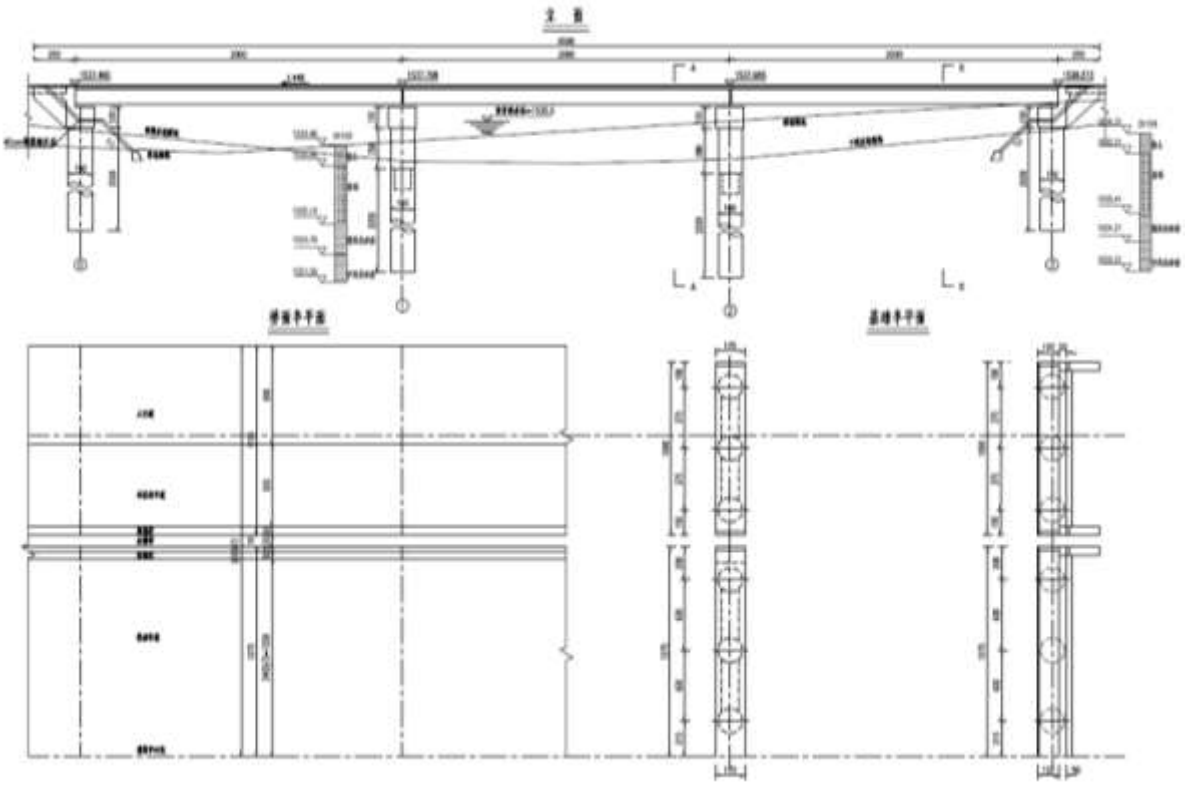


Figure III-12: Elevation View of the Bridge

[21] The standard measure of luminous power per area

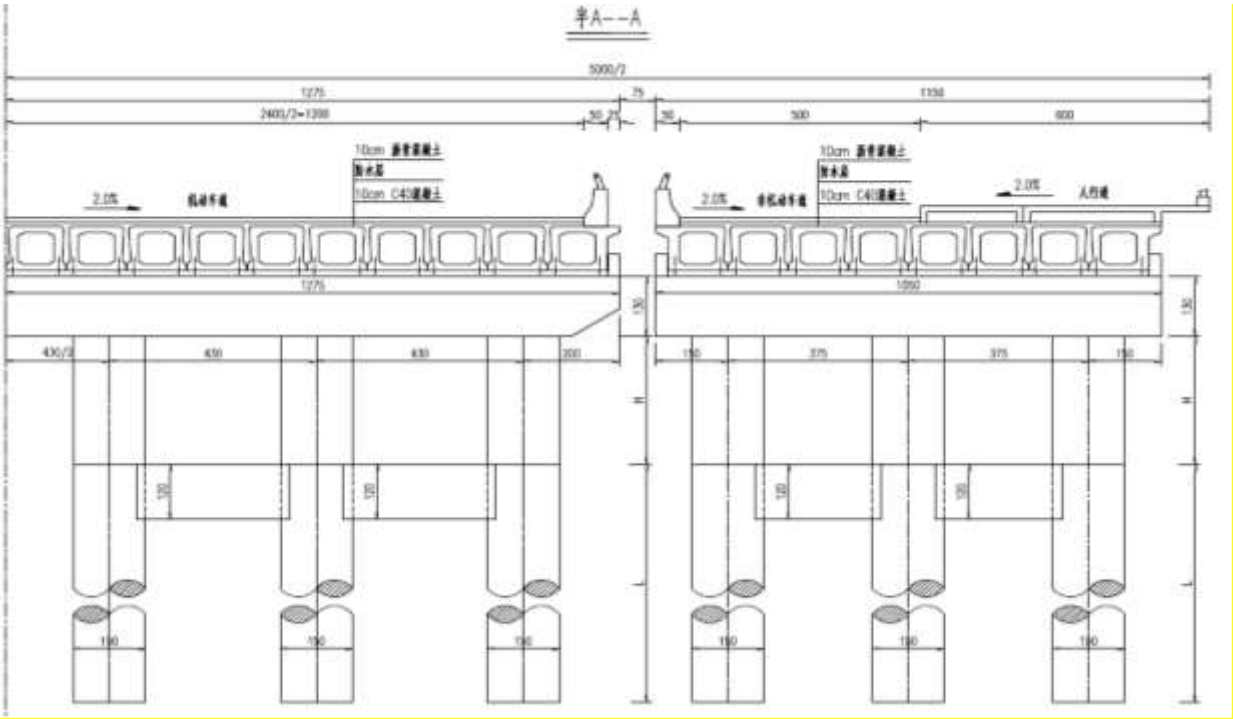


Figure III-13: Section View of the Bridge

145. **Box Culvert.** Four box culverts are proposed in parallel for the road to underpass the existing G6 Expressway. Separate culverts are designed for MV for two ways, NMV + sidewalk, as a small span box culvert is more cost-efficient and easy for construction. The main box culvert (MV) is designed as 24.74 m long and 12 m wide. A side culvert is designed at the same length and 9 m wide. In line with the design specifications, the height clearance is designed at 5 m.

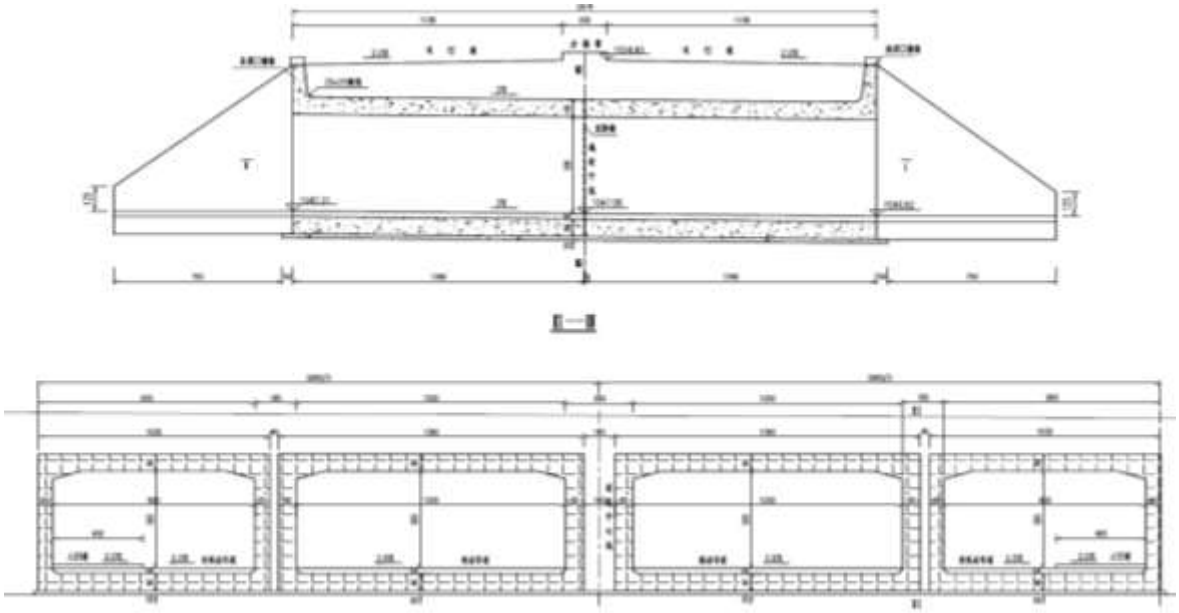


Figure III-14: Elevation View of Box Culvert

D. ITS Component

146. The component will include two sub-components, including (i) installation of a traffic management system in Baiyin's city center, including (a) a command center system; (b) ATC traffic signal control system; (c) electronic police system; and (d) traffic video monitoring system; and (ii) Baiyin intelligent bus dispatching operation management system, including (a) automotive equipment; (b) terminal equipment (based on three bus terminals and 30 electronic stop signs); (c) software support platform; (d) system integration installation service, including installation of above equipment and materials. The component will not involve civil works.

E. Project Management and Institutional Capacity Building

147. Gansu Provincial Government (GPG) has authorized Baiyin Municipal Government (BMG) to act as the executing agency of the project to take overall responsibility for project implementation. The Baiyin project management office (BPMO), established under the BMG and based on Baiyin development and reform commission, will handle overall coordination and management of the project. The key implementing agencies include Liuchuan Industrial Park Committee, Jingyuan County Human Resource and Social Security Bureau, Baiyin Traffic Police and Baiyin Public Transport Company will be the implementing agencies and take overall responsibility for implementing subprojects. Jingyuan County will set up a respective project leading group headed by a vice-county head. Each implementing agency will set up a unit that will supervise day-to-day activities and provide coordination support for the implementation of subprojects.

148. The project management and institutional capacity component will provide support through an international consulting firm recruited to provide technical advice to BPMO and all IAs in engineering design review, procurement, project management and supervision, including EMP implementation. The loan implementation consultant services (LIC) will include a national environment specialist to provide support to BPMO and LMC to coordinate EMP implementation. The capacity building and institutional development component will comprise five consulting services packages to support BMG, as an executing agency, and four implementing agencies (IAs) in project implementation and capacity development: (i) a project management consulting service and (ii) two individual startup consultants will be recruited for overall project management and capacity development; (iii) an external resettlement and social monitor will ensure compliance of external monitoring under the ADB Safeguards Policy Statements (2009); (iv, v) two specialized teams of technical vocational education and training (TVET) and environment management system (EMS) will support the BMG and respective implementing agencies to ensure quality outputs under the project. The TVET component is presented in the next paragraph; the EMS component is outlined in Section F, and detailed in **Appendix 2**.

149. The **TVET component** will have four major activities, namely: (i) development of a new subject for 3-year program at Jingyuan County Secondary Vocational School; (ii) strengthening of the existing short training courses and development of new short courses in Jingyuan County; (iii) strengthening of BHRSS's capacity to develop and manage labor market information and public employment services in Jingyuan County; and (iv) institutional strengthening of municipal HRSS. The TVET component will not involve civil works.

F. Environment Management System (EMS) and Eco-Industrial Park (EIP) Accreditation

150. The capacity development component will include a subcomponent to assist the LIP achieve sustainable environmental management. The EMS subcomponent aims at ensuring safe, environmentally friendly and sustainable operations in the LIP. The primary and short-term objective of the EMS subcomponent is to enhance environmental management and emergency response capacity

of the LIP to minimize environmental pollution and mitigate negative impacts of environmental incidents. The mid-term objective (2018) of the subcomponent is to achieve ISO 14001 EMS certification for LMC. The proposed EMS for LIP is intended to contribute to LIP's accreditation as an eco-industrial park under PRC Standard for Sector-Integrated Eco-Industrial Parks (HJ 274-2009) , targeted by 2025. EMS subcomponent outputs will include: (i) ISO 14001 certification of LMC, including EMS Center (within the LIP under LMC), clearly defined EMS policies and management procedures, office facilities and equipment; (ii) an emergency preparedness and response (EP&R) plan, including EPR management procedures, emergency monitoring and response equipment; (iii) environmental management information system (EMIS) targeting pollutants of concern, including EMIS software, data exchange and storage; and (iv) a training program including study tours on all EMS aspects. Outputs (ii) and (iii) are key requirements to achieve ISO 14001 certification, and are also key requirements defined in the planning EIA of the LIP, approved in 2012.

151. LMC will have overall responsibility for implementing the EMS subcomponent. LMC will establish an EMS oversight board which will include the LMC, Jingyuan County EPB and Baiyin EPB, with representatives from industries of LIP. The EMS subcomponent will be implemented over 1.5 years from August 2015 through January 2017 coinciding with the initial stages of the project implementation period. The subcomponent under the project will have a budget of $430,000. The details of EMS subcomponent are given in **Appendix 2**.

G. Implementation Schedule

152. The implementation period of the project will be from June 2014 to June 2019 as shown in **Table III-8**.

Table III-8: Implementation schedule

Task Name	Start	Finish	2014				2015				2016				2017				2018				2019			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
A. Design and Monitoring Framework																										
1. Wastewater component	**Feb 2014**	**Dec 2017**																								
Land acquisition and resettlement	-	-																								
Design and tender documentation	Feb 2014	Mar 2014																								
Tendering	Mar 2014	Apr 2014																								
Construction and equipment installation																										
Wastewater pipe network	May 2014	Dec 2015																								
WWTP	Jun 2014	Dec 2017																								
2. Water supply component	**Dec 2014**	**Nov 2019**																								
Land acquisition and resettlement	Dec 2014	May 2015																								
Design and tender documentation	Mar 2015	Oct 2015																								
Tendering	Jun 2015	Jan 2016																								
Construction and equipment installation	Sep 2015	Nov 2019																								
3. Road component	**Mar 2015**	**Sep 2018**																								
Land acquisition and resettlement	Mar 2015	Dec 2015																								
Design and tender documentation	Mar 2015	Dec 2015																								
Tendering	Jan 2016	Apr 2016																								
Construction and equipment installation	Apr 2016	Sep 2018																								
4. ITS component	**May 2014**	**Aug 2015**																								
Design and tender documentation	May 2014	Jun 2014																								
Tendering	Jul 2014	Aug 2014																								
Construction and equipment installation	Sep 2014	Aug 2015																								
5. TVET component	**Jun 2014**	**Dec 2017**																								
Design and tender documentation	Jun 2014	Aug 2014																								
Tendering	Sep 2014	Nov 2014																								
Construction and equipment installation	Dec 2014	Dec 2017																								
B. Management Activities																										
Develop contract packages and procurement plan	Apr 2014	Sep 2014																								
Consultant selection procedures	Apr 2014	Sep 2014																								
Environment management plan key activities	Jul 2014	Sep 2019																								
Gender action plan key activities	Jul 2014	Sep 2019																								
Social development action plan key activities	Jul 2014	Sep 2019																								
Environmental Management System																										
EMS Program – Consultancy	Aug 2015	Sep 2019																								
– EMS Milestones	Aug 2015	Jul 2019																								
Annual/Midterm review		Dec 2019																								
Project completion report		Dec 2019																								

Source: FSR&PPTA consultant

Note: The wastewater treatment component will be implemented under the advanced contracting and retroactive financing modality. The contract is 100% financed by the domestic counterpart fund but it is part of the project.

IV. DESCRIPTION OF THE ENVIRONMENT

.

A. General

153. The description of the pre-project environment (biophysical, ecological and socio-economic) establishes (i) the environmental setting within which the project will be implemented, and therefore needs to be designed to suit, and (ii) the environmental values which will be changed (either negatively or positively) by the project. Both of these roles are encompassed by the concept of the "baseline" environment. The baseline environmental surveys were determined by the kinds of components proposed and the environmental parameters which were relevant to their impact assessment.

B. Physical Setting

154. **Location.** Baiyin is a prefecture-level city in northeastern Gansu Province, the upper reaches of the Yellow River. It is bordered by Ningxia Hui Autonomous Region in the east and Inner Mongolia in the north (**Figure IV-1**). The capital city of the province, Lanzhou, is adjacent to its west. Baiyin has 2 urban districts and 3 counties, i.e. Baiyin District, Pingchuan District, Jingyuan County, Huining County, and Jingtai County. The Liuchuan Industrial Park (LIP) is located in central Jingyuan County, 20km to Baiyin urban district in the west and 15km to the county town of Jingyuan County (See **Figure IV-2**).

Figure IV-1: Location of Baiyin Municipality in Gansu Province

Figure IV-2: Location of Jingyuan County

155. **Regional topography, soil.** Located in the transition area from the Tengger Desert and the offshoots of *Qilian Mountains* to the Loess Plateau, the terrain of Baiyin basically slopes downward from southeast to northwest. Baiyin municipality lies on a loess plateau near the upper reaches of the Yellow River. This area of Gansu province in northern PRC is one of the most massive accumulations of loess in the world. The loess sequence is typically an alternation of silty or sandy loess with more clay-rich paleosols. There are four types of soil in the project area, including black loam, grey desert soil, loess soil and alluvial soil. The loess sequence is typically an alternation of silty or sandy loess with more clay-rich paleosols. Soil erosion in the proposed area, caused by wind and water, is significant and affects 95% of the land. The annual erosion in the area is 3,160 tons per km^2.

156. **Climate.** Baiyin municipality and Jiuqyuan County are in the typical inland continental climate zone controlled by Mongolian high-pressure systems. The region is arid, with an average of only 202 mm of annual precipitation, 66.0% of this falling during the summer season from July to September (**Table IV-1**). The sun's radiation in this area is very strong: the average annual evaporation rate is 2,065 mm. The winters are long and very cold. January is the coldest month, with an average temperature of -8◦C, and July, when the average temperature is 22◦C, is the hottest. The annual average temperature is 9.2◦C. The prevailing winds are from the northwest. The annual average wind speed is 2.2 meters per second (m/s).

Table IV-1: Major Climatic Features of Baiyin Municipality (1983-2012)

Meteorological element	Unit	Value
Average air pressure	Hpa	828.4
Annual average temperature	℃	9.2
Extreme maximum temperatures	℃	39.1
Extreme minimum temperatures	℃	-22.1
Annual average relative humidity	%	75
Minimum relative humidity	%	0
Annual rainfall	mm	202.3
Maximum daily rainfall	mm	77.3

Meteorological element	Unit	Value
Thunderstorm days	Day	21.9
Fog days	Day	1.4
Annual average wind speed	m/s	2.2
Annual sunshine hours	h	2660.0
Annual evaporation	mm	2065.8

157. **Seismicity.** According to the *Seismic Peak Acceleration Zoning Map of [the PRC]* (GB18306-2001) (1:400) (prepared by State Seismological Bureau, 2001), the peak acceleration of ground motion is 0.20g, and corresponding seismic basic intensity is VIII degree. The characteristic period of seismic response spectrum is 0.45s. All buildings and structures will be designed in accordance with the *Code for Seismic Design of Buildings* (GB 50011-2010) [22], and other codes for anti-seismic design of special structures, as relevant.

158. **Hydrology.** Jingyuan County is located in Yellow River watershed. The main stream of Yellow River in Jingyuan County is 174km long with a catchment area of 6,356.83 km^2 and an average flow of 920 cubic meters per second (m^3/s) and a historic minimum flow of 236 m^3/s. The average annual flow is 32.9 billion m^3, containing sediments of 0.7-4.0 kg/m^3. Long-term trend analysis from 1952 to 2011 for the Lanzhou hydrological station indicate that average streamflow and sediment load in the Upper reaches of the Yellow river display gently decreases (-1.33×10^8 m^3/a and -0.02×10^8 t/a).[23] The decrease of sediment load mainly resulted from various soil and water conservation measures and trapping in reservoirs built in the period from 1986 to 2011.

159. Zuli River is the largest tributary of Yellow River in Jingyuan County, with a total length of 48.2km and annual flow of 124.9 million m^3. However, this river cannot be used as drinking or irrigation water source due to its high salinity. In addition to Zuli River, there are 134 small tributaries of Yellow River in Jingyuan County. However, most of them are seasonal rivers without permanent flows.

160. Natural runoff in Liuchuan Industrial Park is very low. The Dasha River, in the south of the industrial park, is one of the small tributaries of the Yellow River. The channel of Dasha River is narrow. The main stream is 32.6km, with catchment area of 331km^2. The low flow during dry season is only 0.96m^3/s. There is no information on average flows.

161. The project area, with a water table at depths of below 15m, lacks significant groundwater resources.[24]

C. Ecological Resources

162. According to the ecological regionalization of Gansu Province, there are 3 ecological zones, 20 ecological sub-zones and 67 ecological function zones. Baiyin has three ecological function zones, including hilly agriculture and sand control zone in the north, mining and ecological function restoration zone in the central area and Yellow River irrigated agricultural zone. Jingyuan County is in the irrigated agricultural zone.

[22] The code is applicable to the seismic design and the isolation and energy dissipation design of the buildings suited on zones of seismic precautionary intensity 6, 7, 8 and 9.

[23] Zhao G, Mu X, Strehmel A, Tian P (2014) Temporal Variation of Streamflow, Sediment Load and Their Relationship in the Yellow River Basin, China. PLoS ONE 9(3): e91048. doi:10.1371/journal.pone.0091048

[24] The geotechnical investigation in the LIP area did not identify groundwater at depths of 15m in 97 out of 100 boreholes. Only along Dasha river was groundwater at depths of 4-5 meters identified.

163. Ecological resources in the planning area of Liuchuan Industry Park are rare, with a vegetation coverage of less than 5%. Under the influence of local topographical, geomorphologic and climatic conditions, grasslands and desert steppe are the dominant vegetation types with a small amount of shrubs. The vegetation composition is simple. Most are cold and wind resistant herbs and small shrubs. The major species include *Tamarix ramosissima Ledeb, Eleutherococcus gracilistylus, Salsola passerina Bunge, Achnatherum splendens, Stipa, Agropyron cristatum, Peganum harmala L. Artemisia frigida Willd* etc. The population of wild birds and animals is very small. Species of wild birds include the sparrow, magpie, and chough. The main species of mammals are the hare, bat, blue sheep, and field mouse. No rare, threatened, or endangered species have been recorded in the project area.

D. Physical Cultural Resources

164. No cultural heritage or archaeological sites are recorded within the project area. A geographical park was established in the south of Jingtai County, Baiyin Municipality to protect the Yellow River Stone Forest. This park is around 65km north of Jingyuan County, which is outside of the impact scope of this project.

E. Socioeconomic Conditions

165. Baiyin City is an important industrial city of Gansu Province and plays an important role in the province's economy. In 2012, the GDP of Gansu Province was 565.02 billion yuan and that of Baiyin City 43.377 billion yuan, accounting for 7.68%, and ranking 4th among the 14 prefecture-level cities of the province (**Table IV-2**). In 2012, the added value of primary industries of Baiyin City was 4.858 billion yuan, that of secondary industries 24.86 billion yuan and that of tertiary industries 13.659 billion yuan, accounting for 11.2%, 57.3% and 31.5% respectively, while the percentages of primary, secondary and tertiary industries of Gansu Province were 13.8%, 46.0% and 40.2% respectively.

Table IV-2: Economic Indicators of the Project Area (2012)

	Gross population (0,000)	Rural population (0,000)	GDP		Per capita disposable income of urban residents (yuan)	Per capita net income of farmers (yuan)	Cultivated area (0,000 mu)	Per capita cultivated area (mu)	Sown area (0,000 mu)	Percent to cultivated area (%)
			Total (00 million yuan)	Per capita (yuan)						
PRC	135404	64222	519322	38355	21986	7917	182489	2.84	166905	91.46
Gansu Province	2577.55	1578.75	5650.2	21921	17157	4507	16702	10.58	4259	25.5
Baiyin City	174.30	133.74	433.77	25274	18532	4497	456.85	3.42	359.25	78.64
Baiyin District	27.65	6.91	211.9	76637	19442	7461	13.43	1.94	6.94	51.68

Source: Statistical Yearbook 2013 of China, Statistical Yearbook 2013 of Gansu Province, Statistical Yearbook 2013 of Baiyin City

166. The townships of Jingyuan County vary greatly in economic and social development level. For example, in 2011, the county's per capita net income of farmers was 4,108 yuan, ranging from 5,050 yuan (Wulan Town) to 2,090 yuan (Ruoli Xiang). Among all townships, 3 townships are above 5,000 yuan and 5 townships below 3,000 yuan. A basic rule is that townships with excellent irrigation facilities are richer (**Table IV-3**).

Table IV-3: Statistics of Per Capita Net Income of Farmers in Jingyuan County (2011)

Division	Per capita net income of farmers		Division	Per capita net income of farmers		Division	Per capita net income of farmers
County average	4108		**Liuchuan Xiang**	4345		Shimen Xiang	2790
Wulan Town	5050		Dongsheng Xiang	4135		Xinglong Xiang	2760
Dongwan Town	5000		Beitan Xiang	4085		Shuanglong Xiang	2740
Beiwan Town	5000		Wuhe Xiang	4070		Yongxin Xiang	2290
Pingbao Xiang	4750		Jing'an Xiang	3535		Ruoli Xiang	2090
Santan Xiang	4700		Dalu Xiang	3525			
Mitan Xiang	4630		Gaowan Xiang	3280			

Source: National Economic Statistical Data of Jingyuan County (2011)

167. At the end of 2012, Baiyin City had a resident population of 1.7192 million, accounting for 6.67% of provincial resident population, including an urban population 714,200 and a rural population 1.005 million, accounting for 41.54% and 58.46% respectively. In 2012, the city's registered population was 1.743 million, 23,800 than more resident population, indicating a net population outflow of 23,800. Compared to 2011, the agricultural population of 2012 dropped sharply by 60,800, while nonagricultural employed population rose by 9,400 only, indicating a significant population outflow in the past two years, and the main part of this population outflow was urban registered population.

168. Jingyuan County has the second largest population among the districts and counties of Baiyin City, with a registered population of 469,900 in 2012, second only to Huining County. By gender, male population is 241,200 and female population 228,700, accounting for 51.33% and 48.67% respectively; by employment, agricultural population was 415,000 and nonagricultural population 55,000, accounting for 11.67% and 88.33% respectively. In 2012, the county's population inflow was 7,649 and population outflow 21,757.

Table IV-4: Population and Labor Distribution of Baiyin in 2012

	Baiyin City	**Baiyin District**	**Pingchuan District**	**Jingyuan County**	**Huining County**	**Jingtai County**
Gross population (0,000)	174.30	27.65	20.08	46.99	56.41	23.17
Rural population (0,000)	133.74	6.91	9.96	43.79	54.53	18.55
#Rural labor force	83.26	4.18	6.17	26.23	33.98	12.70
- Rural employed population	71.12	3.42	5.22	22.41	29.34	10.73
- Students aged 16 years or above	6.25	0.36	0.39	1.96	2.70	0.84
- House-workers	4.59	0.28	0.43	1.21	1.68	0.99
- Other	1.30	0.12	0.13	0.65	0.26	0.14
Urban population	40.56	20.74	10.12	3.20	1.88	4.62
#Urban labor force[25]	[26]*30.88*	*15.79*	*7.70*	*2.44*	*1.43*	*3.52*
- Urban employed population	[27]23.98	*12.26*	*5.98*	*1.89*	*1.11*	*2.73*
- Urban organizational employees[28]	15.32	*6.29*	*4.10*	*1.69*	*1.81*	*1.45*

Source: Statistical Yearbook 2013 of Baiyin City

169. **Education.** The overall situation of education in Baiyin City is that primary education is good, but vocational and higher education is weak. At the end of 2012, Baiyin City had 3 secondary technical

[25] The urban labor force data of the districts and counties is estimated from the percentage of urban labor force to urban population.
[26] This data is calculated the percentage of urban labor force to urban population.
[27] "Urban employees" refer to all persons working in a paid manner in urban areas.
[28] "Urban organizational employees" refer to all persons working in a paid manner at state organs, government agencies, social organizations, public institutions and urban enterprises (source: Statistical Yearbook 2013 of Baiyin City).

schools, with 342 full-time teachers and 8,520 students. In 2012, 26,440 students were enrolled by colleges and universities, and 6,637 by secondary technical schools, accounting for 79.9

170. **Poverty.** In 2012, Baiyin City had a poor population of 452,900, accounting for 35.86% of rural population, distributed mainly in extremely dry mountain areas, closed down or reduced capacity coal mines, and sandstorm resettlement areas, involving 64 townships and 559 villages, in which 30 townships and 276 villages are province-level key counties and villages for development-oriented poverty. If the city's urban MLS population of 74,800 is included, the city has a poor population of 527,700 (**Table IV-4**).

171. In 2012, Jingyuan County had a poor population of 161,500 and a poverty incidence of 37.89%. If the county's urban MLS population of 7,900 is included, the county has a poor population of 169,400, distributed mainly in dry mountain areas, high-lift areas, and areas along the Yellow River, because high-lift areas are short of water resources, and areas along the Yellow River are exposed to frequent natural disasters, such as hailstones, frosts and sandstorms.

Table IV-5: Poor Population of the Project Area in 2012

Division	Gross population (0,000)	Rural population (0,000)	Poor population (0,000)	Rural poverty incidence
PRC	135404	64222	9899	15.41%
Gansu Province	2577.55	1578.75	1060	67.14%
Baiyin City	174.3	126.28	45.29	35.86%
Jingyuan County	48.11	42.62	16.15	37.89%

Note: Poor population here excludes urban poor population.

F. Environmental Quality Baseline

172. Environmental baseline monitoring within the construction footprint of the LIP and at the Yellow River raw water extraction and primary treatment plant was conducted by Baiyin Municipal Environmental Monitoring Station during November 2013. The monitoring locations are given in **Figure IV-3** and **Figure IV-4**. The monitoring results are summarized below.

Figure IV-3: Baseline monitoring locations (LIP Phase 1) *Source: Domestic EIA report, PPTA consultant*

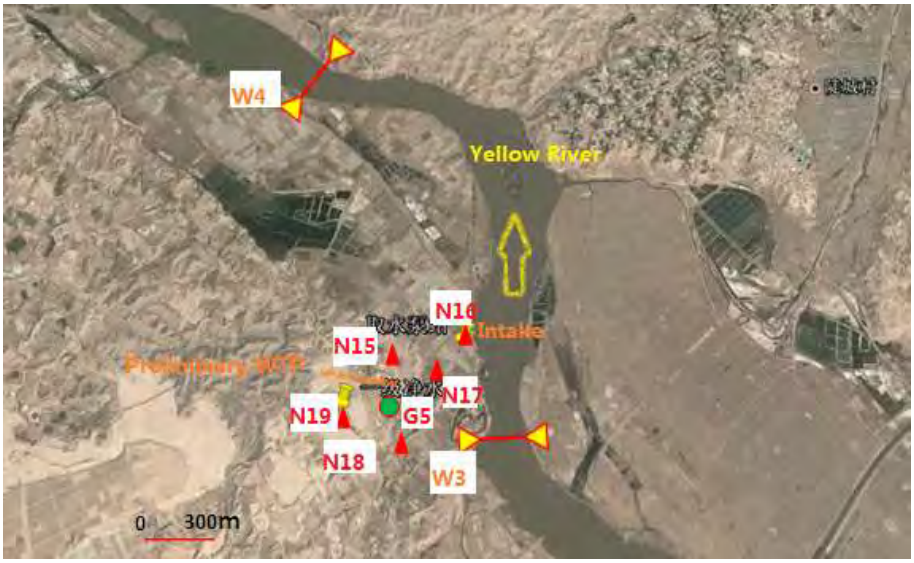


Figure IV-4: Baseline Monitoring Locations for Intake and Preliminary WTP Source: *Domestic EIA report*

173. **Surface water Quality.** Water quality testing was carried out on Dasha River and Yellow River to assess the existing situation on the receiving waters (Dasha River) and water source quality for the water supply (Yellow River).

174. Considering the requirements of the Class III water function zone (Yellow River and Dasha River), and pollutants from the proposed facilities, a total of 24 items were monitored, including pH, water temperature, DO, permanganate index, BOD_5, COD_{cr}, ammonia nitrogen and total phosphorus, total nitrogen, petroleum hydrocarbons, volatile sulfide, anionic surfactants, phenols, cyanides, fecal coliform bacteria, fluoride, selenium, zinc, copper, cadmium, arsenic, mercury, lead, hexavalent chromium were monitored. The water samples were taken on 5th-6th November 2013 (twice each day). **Table IV-6** provides the monitoring results.

175. The water quality testing indicates that at W1 (upstream on Dasha River above proposed WWTP), the total phosphorus, total nitrogen, cadmium, and lead did not meet the requirements of Class III standards for surface water quality (GB3838-2002). At W2 (downstream on Dasha River below proposed WWTP), same parameters exceeded the requirements of Class III water quality, and COD also exceeded standard levels. This is attributed to improperly treated domestic and industrial waste in the upstream areas. It is noted that there is little base flow in the small drainage basin.

Table IV-6: Surface Water Quality Monitoring Results

Units: mg/l (pH value is dimensionless, bacterial /l)

Items	Dasha River		Yellow River		GB3838-2002 Class III
	W1	W2	W3	W4	
pH	8.21	8.18	7.95	8.23	6-9
DO	8.23	7.8	8.45	8.75	5
Permanganate index	6.98	7.95	2.65	2.18	6
BOD_5	2.18	2.48	2.5	2.38	4
COD	18.75	22.75	11.75	10.75	20
Ammonia nitrogen	0.800	0.71	0.459	0.38	1
Total phosphorus	0.29	0.33	0.04	0.03	0.2
Total nitrogen	2.49	2.21	2.27	2.14	1
Petroleum hydrocarbons	0.02	0.02	0.02	0.02	0.05
Volatile phenol	0.002	0.00	0.0003	0.0003	0.005
Sulfur compounds	0.02	0.02	0.02	0.02	0.2
Anionic surfactant	0.05	0.05	0.05	0.05	0.2
Cyanide	0.004	0.00	0.004	0.004	0.2
Fecal coliform bacteria	0	0.00	3,075	2,200	10,000
Fluoride	0.23	0.17	0.21	0.21	1
Se	0.0005	0.00	0.0005	0.0005	0.01
Arsenic	0.0037	0.00	0.0011	0.0011	0.05
Cd	0.06	0.07	0.0003	0.0003	0.005
Zinc	0.05	0.05	0.05	0.06	1
Copper	0.07	0.08	0.01	0.004	1
Mercury	0.00003	0.00	0.00002	0.000028	0.0001
Lead	0.31	0.30	0.01	0.01	0.05
Hexavalent chromium	0.009	0.18	0.006	0.004	0.05

Source: Domestic EIA report

176. At the proposed water intake location on the Yellow River, the water monitoring sections were located on the Yellow River 500m upstream and 2000m downstream from the proposed intake pump station, shown as W3 and W4 on **Figure IV-4**.

177. The monitoring results indicated that except for the total-nitrogen, other items monitored were within the thresholds setting for Class III water body (GB3838-2002). The incompliance of total nitrogen is mainly attributed to point-source pollution from the industrial and residential sewage directly discharging into the river and non-point pollution from agriculture. Such nitrogen problems are

widespread in the PRC especially during low flow months of the year in agricultural areas cause by overuse of fertilizers. It is noted that the phosphorus levels are fairly high also. There are many urban planning efforts underway to improve the treatment of industrial and domestic wastewater, while rural efforts to address non-point source pollution are somewhat lagging being urban point-source pollution control initiatives.

178. The design of the WTP is based on the water quality data from the Wujiawan water intake station located approximately 10 km upstream of the proposed water intake (shown in **Table IV-7**).

Table IV-7: Water Quality at Wujiawan Water Intake Station

Parameter		GB3838-2002 Class III	October 2012	January 2012
Water Temperature	℃	/	13	2
pH	mg/L	6-9	8.26	8.13
Dissolved Oxygen (DO)	mg/L	≥ 5	8.5	9.5
Potassium permanganate index	mg/L	≤ 6	2.4	1.9
Chemical Oxygen Demand (COD)	mg/L	≤ 20	10.1	15.6
5 Day Biochemical Oxygen Demand (BOD_5)	mg/L	≤ 4	<2.0	<2.0
Ammonia (NH_3-N)	mg/L	≤ 1.0	0.09	0.47
Total Phosphorus (TP as P)	mg/L	≤ 0.2	<0.02	0.04
Total Nitrogen	**mg/L**	**≤ 1.0**	**1.78**	**2.54**
Copper	mg/L	≤ 1.0	<0.05	<0.05
Zinc	mg/L	≤ 1.0	<0.05	<0.05
Fluoride (F-meter)	mg/L	≤ 1.0	0.21	0.21
Selenium	mg/L	≤ 0.01	<0.002	<0.002
Arsenic	mg/L	≤ 0.05	0.002	0.002
Mercury	mg/L	≤ 0.0001	<0.0001	<0.0001
Cadmium	mg/L	≤ 0.005	<0.001	<0.001
Chromium (VI)	mg/L	≤ 0.05	<0.004	<0.004
Lead	mg/L	≤ 0.05	<0.005	<0.005
Cyanide	mg/L	≤ 0.2	<0.01	<0.01
Volatile Phenols	mg/L	≤ 0.005	<0.002	<0.002
Petroleum	mg/L	≤ 0.05	<0.05	<0.05
Anionic synthetic detergents	mg/L	≤ 0.2	<0.05	<0.05
Sulfide	mg/L	≤ 0.2	<0.02	<0.02
Fecal coliforms	mg/L	≤ 10,000	88,000	30,000

Source: FSR Table 5.1.2.3-9

179. This monitoring data is overall consistent with observed values at W3 and W4. With exception of TN, all parameters meet class III standard (GB3838-2002). These levels of nitrogen are not alarming and can be effectively managed at the LIP WTP.

180. **Ambient Air Quality.** Air quality was monitored at three locations at the southern portion of the LIP. A fourth location was monitored near the proposed West Ring (Xihuan) Road as shown in **Figure IV-3**. One location is arranged to monitor the current air quality at the proposed site for preliminary WTP. Daily average and –hour average concentration levels of total suspended particulates (TSP), PM_{10}, SO_2 and NO_2 were monitored during November 2013 on seven consecutive days. Considering the potential impacts from operation of roads and WWTP, CO, H_2S and NH_3 and odor were also monitored in the LIP. **Table IV-8** shows the monitoring results. The evaluation is based on Ambient Air Quality Standard GB3095-1996. This standard will be superseded by the Ambient Air Quality Standard GB3095-2012 in January 2016 and the new requirements are noted in the EMP of the project, especially for LIP operations. Monitoring location G1 is near the Hongtai Aluminum Plant. G2 is at the south of 109 Highway. G3 is at the residential community of Baiyin Rare Earth Company. G5 is located in the proposed preliminary WTP.

Table IV-8: Ambient air quality monitoring results and statistics

Items		Indicator	G1	G2	G3	G4	G5	GB3095 -1996
SO_2	Daily mean values	Conc. range (μg/m^3)	2~7	15~22	12~16	15~22	19~40	150μg/m^3
		Excessive rate (%)	0	0	0	0	0	
		Average (μg/m^3)	5	18.9	14.3	18.8	29	
		Maximum values of the standard rate (%)	4.67	14.67	10.67	14.67	26.67	
		Exceeded the maximum multiplier	——	——	——	——	——	
	1-hour values	Conc. range (μg/m^3)	7	12~23	21~44	12~23	24~66	500μg/m^3
		Excessive rate (%)	0	0	0	0	0	
		Average (μg/m^3)	7	17.3	31	17.3	41	
		Maximum values of the standard rate (%)	1.4	4.6	8.8	4.6	13.2	
		Exceeded the maximum multiplier	——	——	——	——	——	
NO_2	Daily mean values	Conc. range (μg/m^3)	4~54	15~21	19~40	15~21	4~28	120μg/m^3
		Excessive rate (%)	0	0	0	0	0	
		Average (μg/m^3)	23.4	17.1	30	17	19	
		Maximum values of the standard rate (%)	45	17.5	33.3	17.5	23.3	
		Exceeded the maximum multiplier	——	——	——	——	——	
	1 Hour values	Conc. range (μg/m^3)	4~75	15~24	4~78	15~21	17~31	240μg/m^3
		Excessive rate (%)	0	0	0	0	0	
		Average (μg/m^3)	24.2	19.5	20.1	17.1	23	
		Maximum values of the standard rate (%)	31.3	10	32.5	8.8	12.9	
		Exceeded the maximum multiplier	——	——	——	——	——	
CO	Daily mean values	Conc. range (mg/m^3)	——	——	——	0.98~1.61		4mg /m^3
		Excessive rate (%)	——	——	——	——		
		Average (mg/m^3)	——	——	——	1.32		
		Maximum values of the standard rate (%)	——	——	——	40.25		
		Exceeded the maximum multiplier	——	——	——	——		
	1 Hour values	Conc. range (mg/m^3)	——	——	——	0.76~2.31		10mg /m^3
		Excessive rate (%)	——	——	——	0		
		Average (mg/m^3)	——	——	——	1.58		
		Maximum values of the standard rate (%)	——	——	——	23.1		
		Exceeded the maximum multiplier	——	——	——	——		
PM_{10}	Daily mean values	Conc. range (μg/m^3)	291~371	45~100	296~370	45~100	45~82	150μg/m^3
		Excessive rate (%)	100	0	100	0	0	
		Average (μg/m^3)	325	72	338	72	59	
		Maximum values of the standard rate (%)	247.33	66.67	246.67	66.67	54.67	
		Exceeded the maximum multiplier	1.47	0.00	1.46	0.00	——	
TSP	Daily mean values	Conc. range (μg	336~456	253~353	363~456	253~353	148~223	300μg/m^3

Items		Indicator	G1	G2	G3	G4	G5	GB3095 -1996
		/m^3)						
		Excessive rate (%)	100	42.86	100	42.86	0	
		Average (μg/m^3)	385	290	412	290	192	
		Maximum values of the standard rate (%)	150	117.67	152	117.67	74.33	
		Exceeded the maximum multiplier	0.52	0.18	0.52	0.18	——	
NH_3	Time value	Conc. range (mg /m^3)	——	0.01	——	——		0.2mg /m^3
		Excessive rate (%)	——	0	——	——		
		Average (μg/m^3)	——	0.01	——	——		
		Maximum values of the standard rate (%)	——	5	——	——		
		Exceeded the maximum multiplier	——	0	——	——		
H_2S	Time value	Conc. range (mg /m^3)	——	0.002~0.009	——	——		0.01mg /m^3
		Excessive rate (%)	——	0	——	——		
		Average (mg/m^3)	——	0.0055	——	——		
		Maximum values of the standard rate (%)	——	90	——	——		
		Exceeded the maximum multiplier	——	0	——	——		
Odor.	Time value	Conc. range (mg /m^3)	——	Not detected	——	——		30
		Excessive rate (%)	——	0	——	——		
		Maximum values of the standard rate (%)	——	0	——	——		
		Exceeded the maximum multiplier	——	0	——	——		

Source: Domestic EIA report

181. For the air quality in the industry park, TSP and PM10 exceeded the current standards. The incompliance was mainly caused by construction works in the park, and windborne dust as a result of the sparse vegetation coverage. SO2, NO2 and CO complied with GB3095-1996 as well as the new GB3095-2012 standard at all monitoring points.

182. **Acoustic environment**. Baseline noise monitoring was carried out at various sites (**Table IV-9**). At the preliminary water treatment plant site on the Yellow River, five monitoring sites were arranged in the East, South, West and North of the border of preliminary water treatment plant, as shown previously on **Figure IV-3** and **Figure IV-4**. Data show that both day and night noise levels complied with both GB 3096-2008 category 2 standards, with exception of monitoring points N12 and N13, which exceeded the nighttime standard by 0.5-3.3 dB(A). These points are adjacent to N109 road and Jingzang Highway.

Table IV-9: Baseline acoustic environment monitoring

Unit: dB(A)

Location	Day				Night			
	Measured value		Standard values	Satisfy or not?	Measured value		Standard values	Satisfy or not?
	2013/11/05	2013/11/06			2013/11/05	2013/11/06		
N1	47.3	48.6	60	Yes	33.2	34.6	50	Yes
N2	45.6	44.2	60	Yes	35.2	34.7	50	Yes
N3	46.5	47.6	60	Yes	35.5	34.4	50	Yes
N4	45.7	45.8	60	Yes	34.3	35.3	50	Yes
N5	43.1	42.8	60	Yes	34	34.2	50	Yes
N6	45.2	46.4	60	Yes	34.2	35.7	50	Yes
N7	46.2	46.1	60	Yes	35.2	36.6	50	Yes
N8	47.3	47.1	60	Yes	37.5	35.4	50	Yes
N9	47.1	48	60	Yes	37.3	36.3	50	Yes
N10	47.3	48.6	60	Yes	33.2	34.6	50	Yes
N11	45.6	44.2	60	Yes	35.2	34.7	50	Yes
N12	54.5	57.6	60	Yes	**50.5**	**52.4**	50	No
N13	55.7	55.8	60	Yes	**51.3**	**53.3**	50	No
N14	43.1	42.8	60	Yes	34	34.2	50	Yes
N15	46.6	50.8	60	Yes	36.5	35.2	50	Yes
N16	48.2	47.7	60	Yes	38.9	35.6	50	Yes
N17	47.5	47.6	60	Yes	36.4	35.8	50	Yes
N18	48.6	45.7	60	Yes	36.5	36.1	50	Yes
N19	47.4	46.6	60	Yes	35.7	35.6	50	Yes

183. **Soil quality.** Soil quality in the LIP has been assigned to meet Class II standards of Environmental Quality Standard for Soils (GB 15618-1995). The sampling arrangement is the same as groundwater monitoring in 6th November 2013 as shown in **Figure IV-3**. All indicators tested were in compliance with the Class II of GB15618-1995 (**Table IV-10**).

Table IV-10: Soil quality monitoring data

Unit: mg/kg

No.	Indicator	T1 # Wujiachuan	T2 # Industrial park	T3 # Rare earth alkali plant	GB15618-1995 Class II
1	pH	8.12	8.15	8.17	＞ 7.5
2	Copper	28.3	37.2	35.3	100
3	Lead	34.2	37.1	41.2	350
4	Zinc	43.2	52.1	47.3	300
5	CD	0.033	0.041	0.038	0.6
6	As	4.11	5.27	5.31	20
7	Hg	0.0033	0.0048	0.0041	1
8	Cr	78	82	85	350

Source: Domestic EIA report

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

A. Positive Impacts and Environmental Benefits

184. **Direct project beneficiaries**. The implementation of the Project and the development of LIP is expected to generate 70,000 temporary jobs and 92,000 permanent jobs in the long term, benefiting urban and rural surplus labor in Baiyin and Jingyuan County directly. The TVET component will improve local vocational education and provide more skilled labor to LIP. In addition, the ITS component will benefit the urban population of 276,500 of Baiyin directly and a population of over 510,000 in the remainder of Baiyin.

185. **Reduced water pollution.** The project will improve the water quality of the project area and the Dasha River by providing wastewater collection and treatment to the new industries in the LIP (Phase 1). A few existing industries that have inadequate wastewater treatment will now have their wastewater collected and treated properly but there are many pollutant sources along the Dasha River beyond the influence area of the LIP project. 100% reuse of treated wastewater effluent will be achieved by 2019, avoiding discharge of treated effluent to surface water altogether. It is estimated by the EIA institute that the reduction of COD, BOD_5, ammonia, TN, TP and SS through the proper operation of the WWTP and 100% reuse of treated effluent will be 3,632 t/a, 832 t/a, 330 t/a, 31 t/a and 1809 t/a respectively.

186. **Reliable water supply.** The project water supply subcomponent will increase the capacity and security of water supply to LIP and provide vital support to the development of LIP Phase 1. Sufficient capacity is being provided for the first phase industries and residential areas within LIP, while nearby villages are being supplied with improved water supply through the Jingyuan County Rural Drinking Water Safety Project that will be completed in 2014.[29] These complementary projects improve industrial water supply and nearby villages for domestic supply.

187. **Air pollution.** In a similar fashion to the water pollution section, the LIP will work to comply with the new Ambient Air Quality Standard GB3095-2012 going into effect in January 2016 by applying best management practices toward construction and operation of LIP in the EMP as well as through ongoing compliance in the LIP EMS. The ITS will enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks thereby reducing traffic-related air pollution.

188. **Water conservation**. The proposed wastewater management scheme for the LIP calls for 100% reuse of WWTP effluent for landscape irrigation and industrial reuse. Other water conservation programs will be encouraged within the various industries through the LIP environmental management system (EMS). The EMS will promote reduction in water use through the application of industrial best management practices and pollution prevention techniques. Clear targets for water reclamation and water efficiency will be defined in the EMS.

189. **Environmental Management System (EMS)**. The EMS subcomponent under the project will ensure safe, environmentally friendly and sustainable operations in the LIP. It will enhance environmental management and emergency response capacity of the LIP to minimize environmental pollution and mitigate negative impacts of environmental incidents, and to comply with the final recommendations of the planning EIA that was prepared for the LIP. The mid-term objective (2018) of the subcomponent is to achieve ISO 14001 EMS certification for LMC. The proposed EMS for LIP is intended to contribute to LIP's accreditation as an eco-industrial park under PRC Standard for Sector-Integrated Eco-Industrial Parks (HJ 274-2009), targeted by 2025.

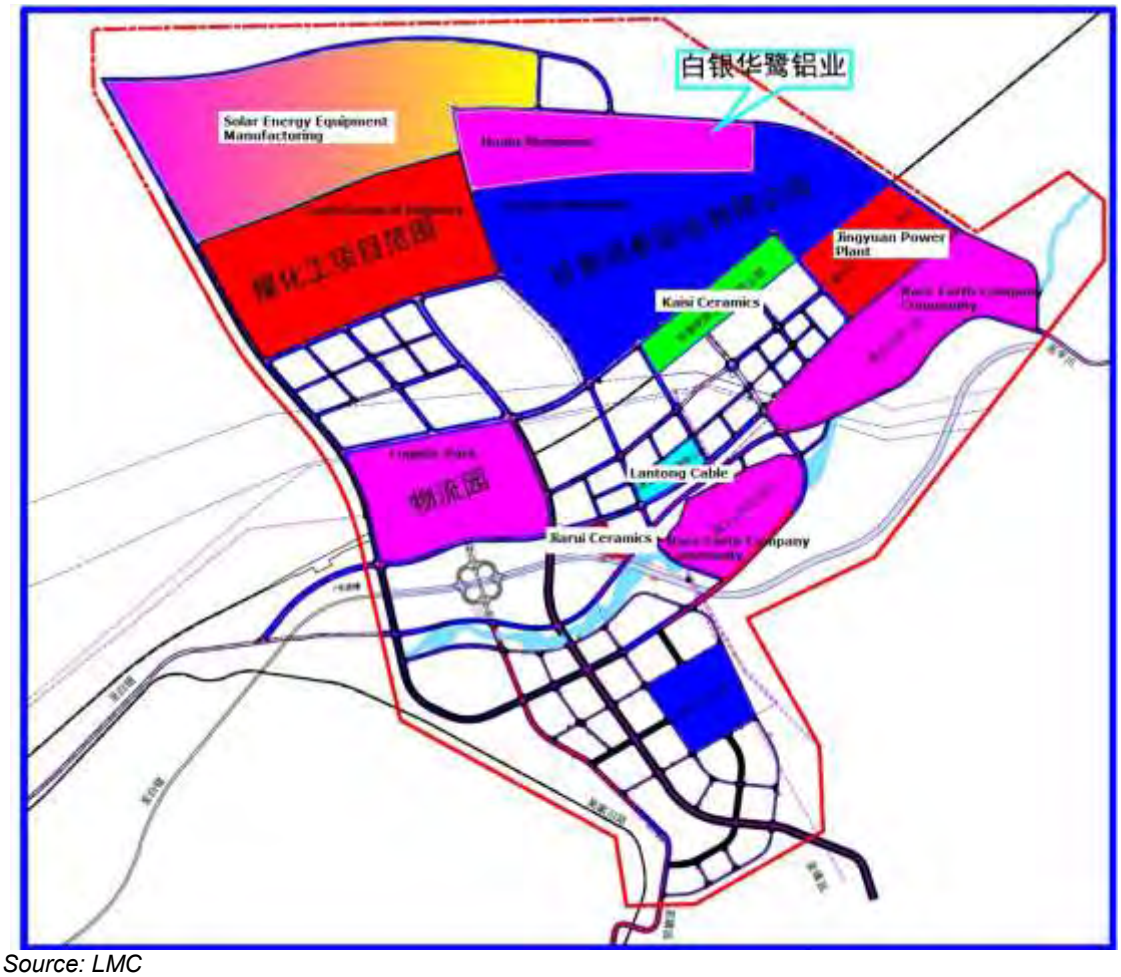
[29] There will be no competition between the two projects. The water balance covers the water allocated to, and used for, LIP Phase 1. Jingyuan Country Drinking Water Safety Project is supplied by its supply network, using a separate quota from Yellow River water allocation plan.

190. **Poverty and social benefits**. The Project, by its nature of improving environment and public services, is classified as general intervention regarding poverty reduction impact. The Project will not entail disparities and inequalities between the poor and non-poor for their access to the project outputs and the access to the resultant social and economic benefits. The water supply and wastewater treatment facilities will not only serve the industrial park, but also residents within the LIP. By 2030, LIP is expected to offer 92,000 permanent jobs and 70,000 temporary jobs. Over 50% of the local surplus labor will improve their skills and receive new jobs from LIP by receiving different types of vocational training through the TVET project component. The ITS component will generate great social benefits, such as reducing the number of urban traffic violations, and reducing casualties and property losses arising from traffic accidents. It is estimated that the total amount of direct and indirect financial losses arising from traffic accidents and violations in Baiyin City exceeds 200 million yuan per year. It is estimated after intelligent traffic management systems are provided, the number of traffic violations will be reduced greatly, thereby reducing financial losses and the probability of major traffic accidents.

191. **Gender benefits.** The project is designed to meet the criteria for effective gender mainstreaming category. Results from the household survey and focus group discussions indicated that improved public infrastructure are important benefits of the project to women as well as job creation opportunities. The project will significantly improve their access to social services, and provide new employment and income opportunities. The project will be an important way to help the BMG implement their Women's Development Plan of Baiyin (2011-2020), which proposes specific development objectives and strategies in respect of women and health, women and education, women and economy, women's participation in decision-making and management, women and social security, women and environment, and women and law to promote women's development and gender equality.

B. Screening and Scoping of Potential Impacts

192. **Environmental impacts related to the LIP.** Liuchuan Industry Park aims to develop rare earth materials, deep processing of non-ferrous metals, equipment manufacturing, logistics and agricultural product transit base and achieve demonstration on new industrialization and circular economy for other industrial clusters in Gansu Province. By April 2014, the major industries introduced include aluminum, coal chemistry, solar energy equipment manufacturing, and ceramics. The layout of the industries introduced/planned in LIP Phase 1 (23-km^2) is indicated in **Figure V-1** below. The major potential hazardous sources and pollutants of concerns in these industries are listed in **Table V-1**.



Source: LMC

Figure V-1: Layout of the industries (introduced/planned) in LIP Phase 1

Table V-1: Current industries in LIP and their pollutants of concern

Table V-2: Current industries in LIP Phase 1 and their pollutants of concern

Industries	Pollutants of Concern, Parameters			Relevant Pollutant Discharge Standards
	Industrial wastewater	Gas emissions	Solid and hazardous wastes[30]	
Non-ferrous metal smelting	pH, suspended solids, chemical oxygen demand, sulfide, volatile phenol, lead, zinc, arsenic, cadmium, mercury, hexavalent chromium and other	Particulate matter, sulfur dioxide, fluorides, asphalt smoke	Drosses and skimmings, spent linings and refractories, wastes/residues/by-products of air pollution abatement systems, wastes and residues from hydrometallurgical processes.	Emission standard of pollutants for aluminum industry (GB25465-2010)

[30] In addition to conventional domestic waste streams from packaging, food processing, and other domestic waste streams in the industrial enterprises.

Industries	Pollutants of Concern, Parameters			Relevant Pollutant Discharge Standards
	Industrial wastewater	Gas emissions	Solid and hazardous wastes[30]	
Rare earth	pH, suspended solids, fluoride, petroleum, COD, TP, TN, ammonia, zinc, thorium, uranium, cadmium, lead, arsenic, chrome, hexavalent	Sulfur dioxide, sulfuric acid mist, hydrogen chloride, chlorine, nitrogen oxide, thorium, uranium	Spent hydroxide cake, spent monazite solids, spent sodium fluoride, waste filtrate, waste solvent, spent lead filter cake, lead backwash sludge, solvent extraction crud	Emission Standards of Pollutants from Rare Earth Industry (GB26451-2011)
Coal Power generation	pH, suspended solids, sulfides, volatile phenol, lead, arsenic, cadmium, petroleum, water temperature, etc.	Smoke, NO_X, SO_2	Fly ash, bottom ash, boiler slag, flue gas desulfurization sludge, demineralizer regenerants and rinses, boiler cleaning wastes, pyrites	Emission standard of air pollutants for thermal power plants. (GB 13223-2011)
Ceramics	COD, phenol, etc.	Dust, smoke, SO_2	Process sludge resulting from glazing, plaster, and grinding activities, broken ware, solids from dust treatments, spent plaster molds.	Emission Standard for Pollutants from Ceramics Industry (GB 25464-2010)

Sources: For industrial wastewater and gas emissions: PPTA Consultant. For solid and hazardous waste: (1) Guidance Document for Management of Wastes from the Base Metals Smelting Sector, Environment Canada, Web.; (2) U.S. Congress, Office of Technology Assessment, Managing Industrial Solid Wastes From Manufacturing, Mining, Oil and Gas Production, and Utility Coal Combustion-Background Paper, OTA-BP-O-82 (Washington, DC: U.S. Government Printing Office, February 1992); (3) Rare Earth Elements: A Review of Production, Processing, Recycling, and Associated Environmental Issues, US EPA, EPA 600/R-12/572, December 2012; (4) Ceramics Manufacturing Environmental Issues, (ceramic_and_tile.pdf), unidentified author.

193. A Planning EIA was conducted for the LIP master plan (Phase 1), approved by Gansu EPB in 2012. The planning EIA determined a total emission control target for the LIP Phase 1 (23-km^2) in terms of SO2, Dust, COD, NH_3-N as indicated in **Table V-2**. The total amount control target is integrated into the overall Total Pollution Amount Control Plan of Baiyin Municipality.

Table V-3: Pollutants total amount control target of LIP, Phase 1 (t/a)

Pollutant	SO_2	Dust	COD	NH_3-N
Target limits	5,120 t/a	1,222 t/a	133 t/a	34 t/a

Source: LIP Phase 1 planning EIA (2012)

194. In addition, the planning EIA defines the following requirements for LIP management: (i) industries introduced to the LIP must comply with national industry development policy, clean production and circular economy, promoting resource use efficiency; (ii) the introduction of high water consuming industries must be strictly controlled; (iii) an EIA including water resources assessment is a pre-requirement for each enterprise planning that enter the park; (iv) each enterprise in the park as well as the LIP as a whole, must avail of emergency preparedness and response plans; and (v) the LIP should establish an environmental protection division and develop strict environmental management and supervision procedures and plans. These requirements will be complied with through the establishment of an environment management system (EMS) for the LIP (see full EMS proposal in **Appendix 2**). Industries that have already established within LIP are partly complying with these requirements (e.g. EIAs have been prepared for each industry; industrial wastewater pretreatment systems have, or will be, installed), or will also be required to comply with (e.g. setting water reuse targets, establishing emergency preparedness and response procedure, etc).

195. The proposed EMS will target the pollutants of concern from existing and future industries in the LIP, and will help LIP ensure compliance with the total pollution control target set for LIP Phase 1, defined in **Table V-2**.

196. **Environmental Impacts Related to the Project**. The potential impacts (positive and negative) and risks were screened during the EIA study process in order to (i) identify the relative significance of potential impacts from the activities of the proposed infrastructure; (ii) establish the scope of the assessment which assists in focusing on major, critical, and specific impacts; and (iii) enable flexibility in regard to consideration of new issues, such as those reflecting the requirements of both the PRC's environmental laws, regulations and standards, and ADB's Safeguard Policy Statement (2009).

197. The major anticipated impacts caused by the infrastructure subcomponents for LIP during construction phase include: noise, air pollution (mainly fugitive dust); wastewater discharge, soil erosion; solid waste disposal; interference with traffic and municipal services, permanent and temporary acquisition of land and involuntary resettlement; and occupational and community health and safety.

198. The major potential impacts of the infrastructure component for LIP during operation phase include traffic noise, vehicle emissions, noise from pump stations, odor from wastewater treatment plant, accidental failure of WWTP and risk of spills caused by traffic accidents with impacts on rivers and groundwater, occupational health and safety related to the water treatment and wastewater treatment processes.

199. The following sections describe the adverse environmental impacts in detail. Construction and operational phase impacts are considered separately. Potential impacts from the project were considered under the following categories: (i) direct impacts-directly due to the project itself; (ii) indirect impacts-resulting from activities arising from the project, but not directly attributable to it; and (iii) cumulative impacts which in combination would exert a significant additive influence.

C. Measures during project design and pre-construction phase

200. **Environmental considerations during project design.** A number of measures have been proposed during the preparation of the domestic FSR and EIA, Water and Soil Conservation Plan, Water Resources Assessment Report, and the LAR plans, to improve project and ensure its environmental sustainability. These measures are discussed below:

(i) The borrower decided to upgrade the wastewater treatment plant design from effluent standard class 1B to 1A to allow for wastewater reuse and minimize impact on the Dasha River. The mid-term plan (by 2019) is to reuse 100% of the WWTP effluent within the LIP.

(ii) The original concern that the project may induce uncontrolled industrial development within LIP has been addressed through the conduct of a planning EIA for the LIP, which was approved by the GPEPD in 2012. The planning EIA concludes that the LIP is feasible from an environment point of view, but defines clear requirements to safeguard the environment during LIP development and operation, described earlier. These requirements will be complied with through the establishment of the environment management system (EMS) for the LIP under the project. The EMS subcomponent will work to ensure that environmental management of the LIP is performed to international best practices and move the LIP into ISO14001 certification as well as "eco-industrial park" (EIP) status under the Ministry of Environment and NDRC programs.

(iii) The project scope was carefully reviewed and optimized during PPTA based on thorough demand analyzes to minimize use of natural resources and environmental impacts: (i) the capacity of the water supply component was reduced from original 85,000 m3/d to 60,000 m^3/d;

(ii) the length of the pipeline network for water supply and wastewater collection was reduced from original 144km to 66km; and (iii) the length of the project road was reduced from original 8km to 6km.

(iv) All the project sites and the pipeline routes were carefully selected to avoid or minimize potential adverse impacts on the environment and surrounding communities;

(v) Meaningful consultation with the stakeholders and potentially affected people (AP) has been undertaken on the potential environmental and social impacts. Special consultations with the residential community members, villagers, local water management authorities and experts were held with regard to the possible impacts of proposed LIP infrastructure.

201. **Measures during pre-construction.** A number of environmental management measures will be implemented in the pre-construction phase to ensure project's environment management readiness. These include:

(i) Institutional strengthening, including (a) appointment of a qualified environment specialist (EML) within the BPMO; (b) establishment of an environment management unit (EMU) within LMC; (c) hiring of loan implementation environment consultant (LIEC) within loan administration consultant services by the PMO; and (d) contracting of environmental monitoring station by the IA to conduct environment impact monitoring;

(ii) Updating EMP: Mitigation measures defined in this EMP will be updated based on final technical design. This will be the responsibility of the BPMO, using the LDIs;

(iii) Land-take confirmation: The Resettlement Plan will be updated with final inventory. This will be the responsibility of the LMC, using the LDIs.

(iv) Contract documents: Include EMP obligations in tender documents and specifications, referencing the EMP and monitoring plan. This will be the responsibility of the LDIs, with support of BPMO and the LIEC;

(v) Environmental Protection Training: LIEC provide training on implementation and supervision of environmental mitigation measures to contractors;

(vi) Grievance Redress Mechanism (GRM): The GRM will be adjusted and/or confirmed, and made operational prior to construction. This will be the responsibility of BPMO, with support of the LIEC.

(vii) Contractor Site-EMP: Following the award of contracts of construction and construction supervision companies (CSCs), the contractor and the CSC will prepare a Construction Site Environmental Management Plan (CS-EMP) and an Environmental Supervision Plan (CSC-ESP) respectively, including an emergency preparedness and response plan for construction emergencies and a site environmental health and safety plan, for clearance by LMC.

D. Environmental Impacts and Mitigation Measures during Construction

a. Impacts on Soil

202. **Impacts on soil.** During construction, the infrastructure components could affect the soil in the project areas through erosion, contamination, and differential compaction. Soil erosion may be caused by roadbed construction; excavation of pipe trenches; stockpiles and spoils from earthwork during construction of road, bridges, treatment facilities and pipelines. Soil contamination may result from inappropriate transfer, storage, and disposal of petroleum products, chemicals, hazardous materials, liquids and solid waste.

203. **Earthwork.** The earthwork and surplus spoil from the proposed infrastructure component are summarized in **Table V-3** below. The surplus earth within the LIP will be used for land leveling. The spoil

outside the industry park will be transported to the disposal site 3km away from K4+870 of the transmission line and to the sludge storage yard at the preliminary WTP. No borrow pit is needed.

Table V-4: Earth Balance for Each Subcomponent (m^3)

Subcomponent	Excavation (earth)	Filling	Excavation (Stones)	Mountain Stone	Disposed	Borrow	Destination (final deposition site)
	Natural Volume	Compressed Volume	Natural Volume	Natural Volume	Natural Volume	Natural Volume	
Transmission pipeline	676,787	658,107	49,570	74,903	124,473		Designated disposal site at K4+870; sludge storage yard in the preliminary WTP
Preliminary WTP	187,332	154,988					
Intake pump station	26,073	22,902					
Lift pump station	28,561	27,166					
Pipeline Tunnel		2,293	12,602		12,602	2,706	
Water supply pump station	34,232	32,378					
Secondary WTP	110,000	120,000	88,000		88,000	31,600	
WWTP	120,000	78,000		21,200	63,200		LIP Land leveling
West Ring Road	285,000	270,000	56,000	44,000	12,000		
Total	***1,467,985***	***1,365,834***	***206,172***	***140,103***	***300,275***	***34,306***	

Source: Domestic Water and Soil Conservation Plan, 2013

204. **Soil erosion.** According to the water and soil conservation plan, the natural soil erosion intensity in the project area is moderate (2600t/km^2·a). Higher soil erosion rates are expected during construction when surface vegetation and soil are damaged or disturbed. Soil erosion can also occur after completion of construction in areas if site restoration is inadequate. The most vulnerable soil erosion areas in the construction sites of influence include deep cuts, high fills, spoil sites, temporary construction sites, and other areas where surface soil is disturbed. The current pre-project soil erosion amount is estimated as 3,412 tons in the project area. Due to the disturbance by the construction activities of the project, the estimated total soil erosion amount will be 10,963 tons, a project-induced increase of 7,550 tons.

205. **Site Drainage and Soil Erosion Management Plan.** To mitigate soil erosion, contractors will prepare and implement a Site Drainage and Soil Erosion Management Plan as part of the CS-EMP according to the engineering and vegetation measures defined in the *Water and Soil Conservation Plan (2013)*. The Plan will include the following measures for control of soil erosion due to construction activities:

(i) Surplus earth shall be used for filling at sites defined in the *Water and Soil Conservation Plan (2013);*
(ii) Trench width and depth should be minimized to reduce spoil generation. Duration of open trenches should be minimized, and backfill should commence immediately following pipe laying;
(iii) Use settling ponds, silt fences and screens to prevent sediment transport;
(iv) Construct intercepting ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainage;
(v) Strip and stockpile topsoil, and cover or seed temporary soil stockpiles; graded soil must be separately stockpiled from other materials and be readily recoverable for reinstatement;
(vi) Limit construction and material handling during periods of rains and high winds;
(vii) Properly slope or re-vegetate disturbed surfaces, such as compacted pipeline trenches and cut banks;
(viii) Slope stability must be undertaken and drains and sediment barriers must be installed as necessary and maintained until final reinstatement is completed; and

(ix) Appropriately set up temporary construction camps and storage areas to minimize the land area required and impact on soil erosion.

206. **Strengthen inspection and monitoring of soil erosion**. Internal soil erosion inspection and monitoring will be conducted by the CSCs through there CSC-ESP, while compliance inspection and monitoring will be conducted by a certificated water and soil erosion monitoring station. The internal and compliance inspection and monitoring results will be submitted to the GPWRB and the LMC to serve as basis for project implementation progress reports and acceptance of construction.

207. Mitigation measures for **soil contamination control** include the following:

(i) Properly store petroleum products, hazardous materials and wastes on impermeable surfaces in secured and covered areas, and use the best management practice to avoid soil contamination;
(ii) Remove all construction wastes from the site to approved waste disposal sites;
(iii) Establish emergency preparedness and response plan; and
(iv) Provide spill cleanup measures and equipment at each construction site and require contractors to conduct training in emergency spill response procedures.

b. Impacts on Hydrology and Water Quality

208. The following sections assess impacts on hydrology and water quality during construction. The proposed infrastructure component is not expected to cause significant impacts on hydrology and water quality, but the measures for construction site management described below were proposed in the domestic EIA, and included in the project EMP.

209. **Surface water pollution**. Inappropriate storage and handling of petroleum products and hazardous materials, or accidental spills, disposal of domestic wastewater from construction camps, and wash-down water from construction equipment and vehicles may contaminate adjacent surface water or groundwater resources. Infrastructure and river intake works, as well as pipeline works, will disturb surface soils and could affect surface water in the project area through increased sedimentation in Dasha River and other minor streams, resulting from cutting and filling operations, excavation of pipeline trenches, and bridge construction across the Dasha River.

210. An **intake structure** will be needed to withdraw water from Yellow River. Construction of the intake structure could disturb parts of the shoreline and the bottom of the river. This disturbance will produce a temporary increase in the turbidity of the water. However, because the impacts will be restricted to a relatively limited area and be temporary, the impacts are not likely to be significant. The physical presence of the intake structure could affect the currents in the site area. Changes in these currents could affect the transport and deposition of sediments in the site area. However, the structure is not large as to produce significant impacts on currents or sediment deposition in this section of the Yellow River.

211. **Bridge.** The 60m wide bridge will cross Dasha River with span of 3x20m. No piers will be constructed in Dasha River according to the design. Bored grouting for the abutment can cause a discharge of sediment and wastewater into Dasha River.

212. **Construction wastewater**. Wastewater produced during construction will come from washing aggregates, pouring and curing concrete, wastewater from maintenance and cleaning of mechanical equipment and vehicles. The peak work force is estimated as 80, 150 and 50 for the WWTP, WTP and

road subcomponents respectively. The daily wastewater discharge from labor camps will be 1.92m^3/d, 3.6m^3/d and 1.2m^3/d correspondingly during peak construction period.

213. **Impacts on groundwater**. Groundwater in the project's area is relatively deep as the geological survey did not find groundwater at depth of 14m. No major impacts on groundwater resources are anticipated in either the construction or operation phases of the project. However, fuels and chemicals used for construction could contaminate groundwater if they are not properly stored and disposed. Spills of toxic substances resulting from traffic accidents during construction may also contaminate groundwater if no proper emergency response is undertaken.

214. **Measures to avoid surface water and groundwater pollution** include the following:

(i) During bridge construction, the contractor will be required to pump slurry to shore and properly dispose cutting materials. This will reduce the disturbance of sediments and the impact to Dasha River water quality;
(ii) Contractors will be required to develop contingency plans for control of oil and other dangerous substances (Spill Management Plan) as part of the CS-EMP;
(iii) Wastewater from construction activities will be collected in sedimentation tanks, retention ponds, and filter tanks to remove silts and oil;
(iv) All areas where construction equipment is being washed will be equipped with water collection basins and sediment traps;
(v) Fuel storage, maintenance shop and vehicle cleaning areas must be stationed at least 500 m away from the nearest water body;
(vi) Storage facilities for fuels, oil, and other hazardous materials will be within secured areas on impermeable surfaces, and provided with bunds and cleanup installations;
(vii) Contractors' fuel suppliers must be properly licensed. They shall follow proper protocol for transferring fuel and the PRC standard of JT3145-88 (Transportation, Loading and Unloading of Dangerous or Harmful Goods);
(viii) Labor camps will be located at least 500 m from surface water bodies;
(ix) Mobile toilets and on-site wastewater pre-treatment systems will be installed at construction camps along with proper maintenance protocols; and
(x) Water quality (for pollutants such as SS, CODcr, oil, and grease) in the Dasha River and the Yellow River will be monitored during construction in accordance with the EMP monitoring program to identify and confirm results of the impact assessment and effectiveness of adopted mitigation measures.

c. Impacts on Air Quality

215. Anticipated sources of air pollution from construction activities include: (i) dust through blasting, excavation, moving equipment, traffic on unsealed roadways, loading and unloading operations, stockpile stacking and land reclamation operations; (ii) vehicle emission from construction vehicles ($PM_{2.5}$, gaseous CO and NO_2) and heavy diesel machineries and equipment; and (iii) asphalt flue gas during road pavement.

216. During the asphalt heating and mixing process relative to asphalt flue gas, the fuel burning will produce smoke, and the asphalt will produce flue gas emissions. The fumes will contain small quantities of toxic and hazardous chemicals such as volatile organic compounds (VOC) and poly-aromatic hydrocarbons (PAH). There is no sensitive receptor within 200m near the proposed location of the asphalt mixing station. After diffusion, the impact from asphalt flue gas resulting from mixing is not significant. According to the monitoring conducted by Shenzhen Environmental Monitoring Station, if the asphalt is paved at 120℃, the concentration of hazardous gases is slight. There are 22 household within

35m of the Right-of-Way of the proposed road. If the pavement cannot be done properly, there will be adverse impacts on the residents nearby.

217. A series of **mitigation measures** are defined in the EMP for reducing the impact of air emission, including:

(i) Spraying water on construction site and roads to reduce dust from earthwork excavation, transport, loading and uploading and stacking;
(ii) Avoid construction activities during strong windy days as possible;
(iii) Transport the spoil and other solid waste in a timely manner. Cover the construction materials during temporary stacking and transport to avoid spillage and dust;
(iv) The asphalt pavement construction should be done when the weather condition is conducive for pollutant diffusion.

218. With the above mitigation measures implemented properly, the impact during construction on air quality is anticipated to be acceptable.

d. Noise

219. A significant increase in noise is expected during construction, due to various construction and transportation activities. Construction activities will involve excavators, bulldozers, graders, stabilizers, concrete-mixing, drills, stone-crushing, rollers and other heavy machinery. Noise during pipeline construction will be generated by the trench excavator, roller and compaction machine. However, the noise impacts will be temporary and localized. Noise prediction and necessary mitigation measures are discussed separately for the different subcomponents in the following sections.

1) Water supply and wastewater subcomponents

220. **Prediction model for noise during construction.** Construction equipment noise source is considered as a point sound source, the following predictive model is used to forecast the noise level for water and waste water sub components:

$$L_i = L_0 - 20\lg\left(\frac{R_i}{R_0}\right) - \Delta\mathrm{L}$$

Where: $L_i$and L_0 are equipment noise level at R_i and R_0 respectively, dB(A);
$\Delta\mathrm{L}$ is additional diffusion attenuation caused by barriers, vegetation, air and earth, dB(A);

221. **Prediction results.** Noise levels at different distance without considering any barriers are predicted as shown in **Table V-4**. Without mitigation measures, the maximum noise level will be 63 dB(A) at 400m.

Table V-5: Noise from construction machineries at different distance (Unit: dB (A))

Machinery	Distance to the machinery (m)									
	5	10	20	50	70	100	150	200	300	400
Hydraulic excavator	82	78	72	64	60	58	54	52	48	46
Electric excavators	80	75	69	61	57	55	51	49	45	43
Wheeled loaders	90	85	79	71	67	65	61	59	55	53
Bulldozer	83	80	74	66	62	60	56	54	50	48
Portable generator	95	90	84	76	72	70	66	64	60	58
Rollers	80	76	70	62	58	56	52	50	46	44
Heavy transport vehicle	82	78	72	64	60	58	54	52	48	46
Saws	93	90	84	76	72	70	66	64	60	58
Electric hammer	100	95	89	81	77	75	71	69	65	63
Vibratory Rammer hammer	92	86	80	72	68	66	62	60	56	54
Pile driver	100	95	89	81	77	75	71	69	65	63
Static pile-pressing machine	70	68	62	54	50	48	44	42	38	36
Pneumatic picks	88	83	77	69	65	63	59	57	53	51
Concrete pump	88	84	78	70	66	64	60	58	54	52
Concrete mixer truck	85	82	76	68	64	62	58	56	52	50
Concrete vibrators	80	75	69	61	57	55	51	49	45	43
Marble machine, angle grinder	90	84	78	70	66	64	60	58	54	52
Air compressor	88	83	77	69	65	63	59	57	53	51

Source: Domestic EIA report

222. According to PRC "Standard of Noise Limits for Construction Site" (GB12523-2011), the noise limits are 70 dB (A) during daytime and 55 dB (A) during nighttime. Activities with intensive noise levels not only will have an impact on the residents, but also may cause injury to construction workers operating the equipment.

223. The nearest noise sensitive receiver of the preliminary water treatment plant is Xintian Village (210m away). With effective noise control measures, the impact of noise will be limited. The residential area of Zhangjiatai is 1,000m away from the secondary water treatment plant so that the noise from construction of the plant will not affect residents in Zhangjiatai.

224. Some sections of the preliminary water supply transmission pipeline go through residential areas. Temporary noise barriers or curtains around noise sources will be provided if necessary. The contractor will be required to properly arrange the construction time and avoid construction activities during rest and night time, especially the usage of high noise equipment.

225. The sewage collection pipes cover large areas of the industrial park. There are several residential houses in the construction's areas of influence. Using of several high noise machineries simultaneously will be avoided. Where the pipes are close to the residential houses, construction will be avoided during nighttime and rest time after lunch. CSCs will be required to assess compliance of construction machinery with noise standards. Regular monitoring will be conducted by the Baiyin EMC to confirm compliance.

226. The nearest sensitive receiver to the wastewater treatment plant is the residential area of Baiyin Rare Earth Company, which is 700m way, so the impacts are not significant.

2) Western Ring Road subcomponent

227. **Prediction model for noise during construction.** Construction equipment noise source is considered as a point sound source and traffic noise is regarded as linear sound source. The predictive mode for point source and linear source is as follows:

a) Point source: $L_i = L_0 - 20\lg\left(\frac{R_i}{R_0}\right)$;

b) Linear source: $L_i = L_0 - 10\lg\left(\frac{R_i}{R_0}\right)$

Where: Li and L0 are equipment noise level at Ri and R0 respectively, dB (A);

228. As for the impact of multiple construction machineries at a certain position, superposition is needed:

$$\mathrm{L} = 10\lg\sum 10^{0.1\times L_i}$$

229. **Prediction results.** Based on the assumed mix of construction equipment for the road, the major construction machinery noise level is shown in **Table V-6**.

Table V-6: Various mechanical equipment noise (Unit: dB (A))

No.	Construction phase	Mechanical type	Number	Distance (m)	Single maximum noise level
1	Subgrade construction	Loader	2	5	90
2		Grader	2	5	90
3		Bulldozer	2	5	86
4		Excavator	2	5	84
5	Pavement construction	Paver	2	5	87
6		Road roller	2	5	86
7	Subgrade / Road Construction	Transport vehicle	4/4	1	65-80

Source: Domestic EIA report

230. Noise levels at different distance without considering any noise mitigation measures are predicted as shown in **Table V-7**. The noise level at 200m still cannot satisfy the requirements of "Standard of Noise Limits for Construction Site" (GB12523-2011) if not considering the sound attenuation by natural barriers during the paths. Although there is no school or hospital along the route of the proposed road, there is certain number of residents scattered nearby including 22 households within 35m of the road right-of-way.

Table V-7: Noise from construction at different distance (Unit: dB (A))

Construction Activities	Distance from sound source (m)							
	25	50	100	150	200	250	300	400
Subgrade construction	82.8	79.7	75.2	72.8	71.2	70.1	69.1	67.7
Pavement construction	80.6	77.6	73.9	71.9	70.5	69.4	68.6	67.2

Source: Domestic EIA report

231. **Mitigation of noise impact.** The following mitigation measures will be implemented to meet the PRC construction site noise limits and to protect sensitive receptors (as identified in Figure II-5):

(i) Ensure that noise levels from equipment and machinery conform to the PRC standard GB12523-2011, and properly maintain construction vehicles and machineries to minimize noise;
(ii) Apply noise reduction devices or methods where piling equipment is operating within 300 m of sensitive sites such as schools, hospitals and residential areas;
(iii) Locate sites for rock crushing, concrete-mixing, and similar activities far away from sensitive areas;
(iv) To reduce noise at night, restrict the operation of machinery generating high levels of noise, such as piling, and movement of heavy vehicles along urban and village roads between 20:00 and 06:00 the next day in accordance with the PRC regulations;

(v) Take special caution at construction sites that are close to such sensitive sites as schools, hospitals and office buildings. When construction activities are unavoidable during the school seasons, the use of heavy equipment will be restricted to weekends and non-class hours;
(vi) Place temporary hoardings or noise barriers around noise sources during construction when there are residence within 50m of the noise source;
(vii) Monitor noise at sensitive areas at regular intervals (refer to the monitoring plan in the EMP). If noise standards are exceeded by more than 3dB, equipment and construction conditions shall be checked, and mitigation measures shall be implemented to rectify the situation; and
(viii) Conduct monthly interviews with residents living adjacent to construction sites to identify community complaints about noise, and seek suggestions from community members to reduce noise annoyance. Community suggestions will be used to adjust work hours of noise-generating machinery.

232. **Vibration Impact.** Vibration impacts are expected during road and bridge construction, pipeline installation, including vibrations from piling, blasting, pipeline trench compaction and roadbed compaction and rolling. During the operation of machinery, different degrees of mechanical vibration will occur. Such vibration is sudden and discontinuous. Main road construction machinery includes vibrating road rollers, land scrapers, loader and spreading machines. Mitigation measures defined in the EMP include prohibition of pilling and compaction operations at night.

e. Solid Waste

233. **Municipal solid waste** from workers' camps. During construction the workers will generate an average of 0.5 kg/d per worker of garbage in construction camps. If not promptly removed, the garbage will breed mosquitoes, producing unfavorable smell and spread disease. The contractors need to provide appropriate number of garbage bins at suitable location. The domestic garbage need to be collected regularly and delivered to the place designated by local sanitation agency for proper disposal.

234. **Construction solid waste**. The construction solid waste includes debris, sand, stones, broken brick, wood waste, scrap metal, scrap steel and other decries. If not promptly transported off-site, it will generate dust during windy weather and safety hazards. The transport vehicles need follow a specified route and time and should be covered by tarp to prevent spill. The solid waste during construction is not expected to contain toxic or harmful substances and can be reused if possible.

235. Contractors will be required develop solid waste transport and disposal plan as part of their CS-EMP, in consultation with the Jingyuan county Housing and Urban-rural Development Bureau.

f. Impact on Biological Resources

236. As established during environmental baseline assessment, no area of the project site is within a legally protected site or a site proposed for protection. The project site does not include critical habitats with recognized critically endangered or endangered species. No rare and endangered species were identified and recorded in the project area during the domestic EIA process. The Dasha River cannot sustain aquatic life of ecological significance or high biodiversity due to its polluted state. Flora to be affected in project area includes mostly shrubs, common seasonal crops, and weeds. Greening measures will also be taken for the spoil sites. Contractors will be required to implement the following measures to protect biological resources within the project area:

(i) Protect existing vegetation near construction sites;
(ii) Properly backfill, compact and re-vegetate pipeline trenches after pipeline installation;

(iii) Protect existing trees and grassland during road, bridge, treatment plant and pipeline constructions; where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area immediately after construction;
(iv) Only native plant species of local prevalence will be used for re-vegetation; and
(v) Identify, demarcate and protect sites where small animals, reptiles, and birds of common species live such as vegetated roadside areas, trees, inner areas of bridges and river riparian zones, etc.

g. Impacts on Socio-Economic Resources

237. **Land acquisition, resettlement.** The Project will affect 3 groups of 2 villages in the project area. A total of 1,019.05 mu will be occupied permanently, including 403.74 mu of collective land and 615.31 mu of state-owned land. 155 mu will be occupied temporarily. A total of 8,074.41 m² residential housing will be demolished, and the Project will affect a total of 111 households (HH) with 563 persons. Among these, LA will affect 53 HHs/entities (including one Farm) with 263 persons. House demolishing will affect 35 HHs with 156 persons including 23 HHs with 99 persons also affected by land acquisition. Temporary land use will affect 46 HHs with 243 persons, and house demolition will affect 35 households/entities with 156 residents.

238. **Impact on physical cultural resources.** No cultural heritage or archaeological sites are recorded within the project area.

239. **Risks to public utilities and community health and safety**. Traffic congestion may worsen as construction traffic in project area increases, causing temporary inconvenience to traffic, residents, commercial operations, and institutions. Some construction sites will be located close to residential communities, presenting a threat to public health and safety. The constructions may also contribute to road accidents through the use of heavy machinery on existing roads. Construction may cause unexpected interruptions in municipal services and utilities because of damage to pipelines for water supply, drainage, and gas supply, as well as to underground power cables and communication cables (including optical fiber cables).

240. **Mitigation of impacts on community health and safety.** The potential impacts on community health and safety will be mitigated through a number of activities defined in the EMP. The contractors will implement the following measures:

(i) **Temporary traffic management.** A traffic control and operation plan will be prepared before construction. The plan will include provisions for regulating traffic at road crossings, selecting transport routes to reduce disturbance to regular traffic, reinstating roads, and opening them to traffic as soon as the construction is completed;
(ii) **Underground facilities protection**. Given the undeveloped status of LIP, disruption of underground facilities is unlikely. However, where the risk cannot be totally excluded, an assessment of underground facilities shall be conducted before construction;
(iii) **Information disclosure, construction sites protection.** Residents, businesses and industries will be informed in advance of the construction activities, given the dates and duration of expected disruption. Clear signs will be placed at construction sites in view of the public, warning people against potential dangers such as moving vehicles, hazardous materials, excavations etc., and raising awareness on safety issues. Heavy machinery will not be used at night. All sites will be secured, disabling access by the public through appropriate fencing whenever appropriate.

241. **Risks to occupational health and safety.** Construction industry is considered to be one of the most hazardous industries. Intensive use of heavy construction machinery, tools, and materials present physical hazards including noise and vibration, dust, handling heavy materials and equipment,

falling objects, work on slippery surfaces, fire hazards, chemical hazards such as toxic fumes and vapors, etc.

242. **Measures to ensure adequate occupational health and safety.** Contractors will implement adequate precautions to protect the health and safety of their construction workers. The occupational health and safety risks will be managed by applying measures in the following order of preference: avoiding, controlling, minimizing hazards, and providing adequate protective equipment. The contractors will undertake the following activities:

(i) **Environmental, health and safety management plan.** Each contractor will prepare such a plan for the construction works on the basis of the EMP. The plan will include the following provisions:
   (a) **Clean water.** Provide a clean and sufficient supply of fresh water for construction sites and for all camps, offices and workshops;
   (b) **Sewage and wastewater.** Provide an adequate number of latrines and other sanitary arrangements at construction sites and work camps, and ensure that they are cleaned and maintained in a hygienic state;
   (c) **Solid waste.** Garbage receptacles at construction sites and camps will be set up, which will be periodically cleared to prevent outbreak of diseases;
   (d) **Personal protection.** Provision of personal protective equipment (PPE) that is fit for the task to prevent injury and maintain hygiene standards. Workers should be trained in the correct selection, use and maintenance of PPE.
   (e) **Emergency preparedness and response.** An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies associated with hazardous material spills and similar events. A fully equipped first-aid base in each construction camp will be organized;
   (f) **Records management**. A records management system that will store and maintain easily retrievable records against loss or damage will be established. It will include documenting and reporting of occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and audits;
   (g) **Safety communication.** Ensure that occupational health and safety matters are given a high degree of publicity to all persons regularly or occasionally on each construction site. Posters will be displayed prominently in relevant areas of the site; and
   (h) **Training, awareness and competence.** Train all construction workers in basic sanitation, general health and safety matters, and on the specific hazards of their work. Implement site HIV/AIDS and other communicable diseases awareness and prevention program to target the local community and construction workers.

243. **Other Social Issues.** No other social risks and/or vulnerability are anticipated as a result of the project. The project construction workers will be engaged locally. Prevention and control of transmissible diseases and HIV/AIDS, and community disturbance training and sensitization will be provided to the contractors, as well as drug and human trafficking education will be provided to the local communities, ensured in the loan assurances and monitored in the social action plans. Core labor standards will be implemented. Civil works contracts will stipulate priorities to (i) employ local people for works, (ii) ensure equal opportunities for women and men; (iii) pay equal wages for work of equal value, and pay women's wages directly to them; and (iv) not employ child or forced labor. Specific targets for employment have been included in the gender action plan (GAP).

E. Environmental Impacts and Mitigation Measures during Operations

a) Operation of Wastewater Treatment Subcomponent

244. **Design assumption.** The WWTP is designed to produce high quality treated effluent, since it will reused within LIP for landscaping and industrial production. The discharge quality will meet the highest standard, Class 1A, of Pollutants Discharge Standards of Town Sewage Treatment Plants (GB18918-2002). Effluent discharge to Dasha River will be permitted only in exceptional cases where 100% reuse cannot be achieved.

245. The FSR has predicted the WWTP influent quality based the type of current and future industries and based on PRC's Discharge Standard for Municipal Wastewater (CJ 3082-1999) for wastewater influent from industrial sources and industrial discharge standards for specific industries (GB26451-2011 for rare earth, GB25465-2010 for aluminum industry), applying a weighted average approach to the estimated discharge volume and wastewater strength (Table III-4). Wastewater generated in the LIP industries is subject to PRC requirements for pretreatment of the wastewater prior to discharge to the wastewater collection system. **Table V-7** provides pretreatment discharge standards for the industries to be located in the LIP. **Table V-8** shows the design inflow and discharge for the plant. Further verification of the design influent volume and quality parameters will be undertaken during the detailed design phase. Prior to commissioning of the WWTP, a series of tests will be conducted to ensure proper functioning of the WWTP. Compliance monitoring will be undertaken prior to and during WWTP operation to ensure that effluents meet class 1A of Discharge Standards of Pollutants for Municipal WWTPs (GB18918-2002).

Table V-8: Pretreatment Standards for Industries located in LIP

Industry	Basis	BOD_5 (mg/L)	COD_{Cr} (mg/L)	SS (mg/L)	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)
Aluminum Industry	Discharge Standards for the Aluminum Industry" (GB25465-2010)	---	200	70	30	25	2.0
Ceramics Industry	Ceramic Industry Discharge Standards (draft)	80	130	400	15	12	3
Coal Chemical Industry	Wastewater Drainage Discharge Standards	60	500	100	70	45	1.5
Thermal Power Plant	Wastewater Drainage Discharge Standards	40	70	30	8	5	1
Logistics Park	Domestic Wastewater Discharge Standard	230	400	410	55	25	6
Rare Earth Company	Rare Earth Industry Wastewater Discharge Standards" (GB26451-2011) – plus pH of 6 to 9	---	100	100	70	50	5

Source: DEIA (2014)

Table V-9: Design Inflow and Effluent Standards

Pollutant	CODcr	BOD_5	SS	NH_3-N	TP
Design inflow quality (mg/L)	297	68	158	32	3
Design effluent quality (mg/L)	≤50	≤10	≤10	≤5	≤0.5
Class 1A Discharge standards mg/L	≤50	≤10	≤10	≤5-8	≤0.5
Total pollution load (t/a)	3632	831	1932	391	36.7
Pollution removal at WWTP (t/a)	3020 (83%)	709 (85%)	1809 (94%)	330 (84%)	30.6 (83%)
Emission load in reclaimed water (t/a)	612	122	123	61	6.1

Source: FSR (2014)

246. **Table V-8** also quantifies total pollution reduction through wastewater treatment and reuse. The wastewater treatment plant will remove some 3,000 t/a of COD, 830 t/a of BOD, 1930 t/a of SS, 390 t/a of ammonia nitrogen, and 30 t/a of phosphorous. 100% reuse of treated wastewater effluent will be achieved by 2019, avoiding discharge of treated effluent to surface water altogether. As a result, COD, BOD_5, ammonia, TN, TP and SS through the proper operation of the WWTP and 100% reuse of treated effluent will be 3,632 t/a, 832 t/a, 330 t/a, 31 t/a and 1809 t/a respectively (compared to a worst-case scenario where 100% untreated wastewater is discharge to surface water).

247. **Air Quality (Odor).** The odor produced in the WWTP is mainly from coarse screen, lift pump room, fine screen, grit chamber and sludge treatment. The major pollutants of odor are NH_3 and H_2S, which are regulated by PRC's *Discharge Standard of Pollutants from Municipal Wastewater Treatment Plant* (GB 18918-2002). The Maximum allowable concentrations of NH_3 and H_2S at the plant boundary are 1.5 mg/m^3 and0.06 mg/m^3 respectively. The screen chamber, aerated grit chamber and distribution chamber will be covered. The gases will be delivered to the blower room using draft fan and imported to the G-BAF tanks for biological treatment. The removal rate by G-BAF tanks is estimated as 50%. The exhausted gases will be discharged through 15m high funnel with rate of 13,800 m^3/h. The emission rates of NH_3 and H_2S are estimated as 0.0757kg/h and 0.0035kg/h respectively. The maximum ground concentrations (NH_3: 3.26E-03mg/m^3; H_2S: 1.48E-04mg/m^3) are at 270m downwind from the funnel, where there is no sensitive receiver.

248. **Noise**. Noise during operation of WWP is mainly from various pumps and air compressors. The types of noise sources in the water treatment facilities and recommended mitigation measures are shown in **Table V-9**.

Table V-10: Noise sources during WWTP operation

No.	Structure	Noise source	Sets	Noise intensity (dB(A))	After mitigation (dB(A))	Mitigation measures
1	Lift pumping	Sewage lifting pump	3	90-95	75	Underwater
2	Aerated grit Chamber	Roots blower	1	90-100	80	Indoor/Shock absorption, damping
3	Preliminary sedimentation tank	Sludge pumps	3	70-75	50	Underwater
4	intermediate clarifier	Submersible sewage pump	2	75~80	55	Underwater
5	Storage tank	Backwash pumps	1	85-90	70	Indoor noise damping
6	Blower room	Centrifugal blower	2	100-105	85	Indoor/Shock absorption, damping
7	Sludge thickening and dewatering	Sludge screw pump	1	80-85	65	Indoor noise damping
		Sludge dewatering machine	1	75-85	70	Indoor noise damping
		Air compressor	2	95-105	83	Indoor/Shock absorption, damping
		Dosing pump	2	75-85	70	Indoor noise damping

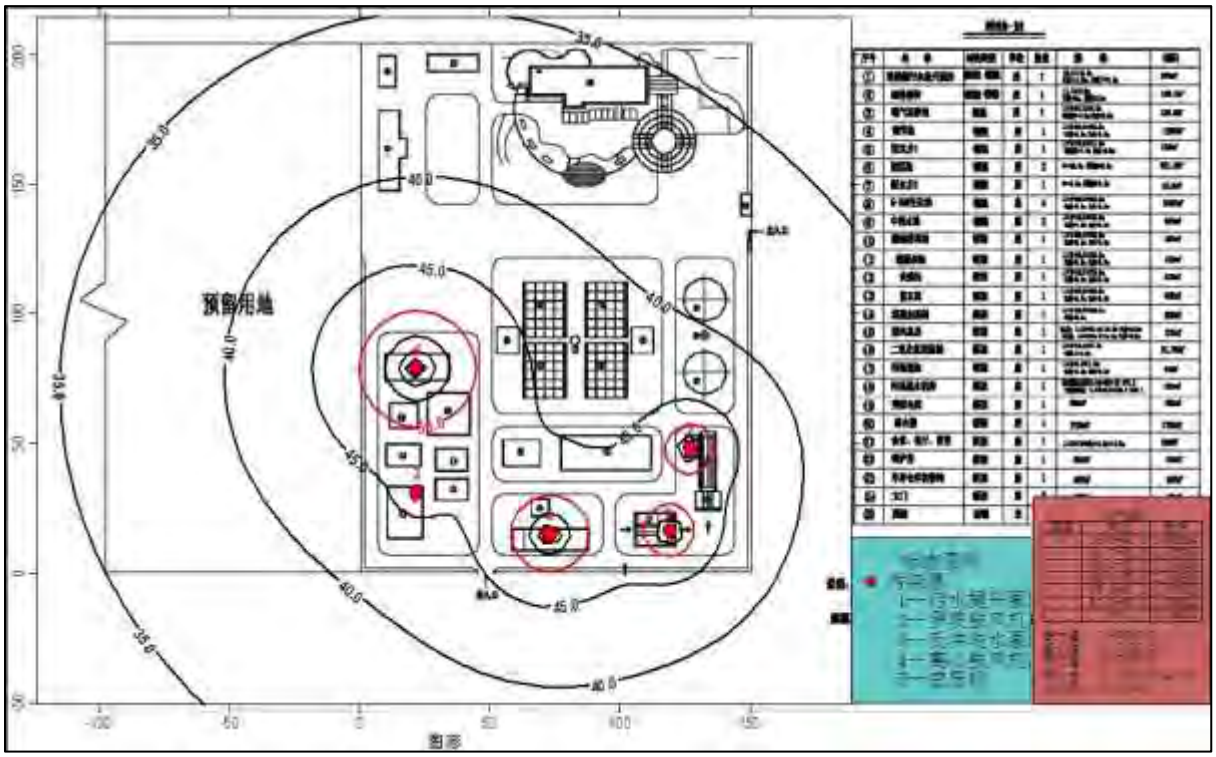
Source: Domestic EIA report

249. The following are the predicted noise levels at plant boundary and contour levels from domestic EIA report. The conclusion is that the noise standards (*Noise Standards at the Boundary of Industries and Enterprises* (GB 12348-2008)) are not exceeded outside the WWTP area and that noise protection should be used by workers inside the WWTP near high noise sources.

Table V-11: Noise Levels Predicted During Operation of WWTP

	Contribution value	Status monitor maximum value (background)		Synthesis of sound level (forecast)		GB 12348-2008
		Daytime	Night	Daytime	Night	
East boundary	44	48.6	34.6	49.9	44.5	Daytime 60 Night50
South boundary	49.7	45.6	35.2	51.2	49.9	
West plant	36.8	47.6	35.5	47.9	39.2	
Northern boundary	36.2	45.8	35.3	46.3	38.8	

Source: Domestic EIA report



Source: Domestic EIA report

Figure V-2: Predicted noise contour level of WWTP during operation

250. **Solid Waste.** The solid wastes during operation of WWTP include screenings, grits, sludge and domestic solid wastes generated by the working staff. The solid waste amounts are estimated as shown in **Table V-12**.

Table V-12: Solid waste produced during operation of WWTP and mitigation measures

Solid Wastes	From	Description	Amount (t/d)	Disposal
Screenings and grids	Screen and grit chamber	Plastic, glass, sand, etc.	5.05	Landfill
Sludge	Thickening and dewatering	Dewatered sludge	7.25 (water content 60%)	Depending on the nature of sludge.
Municipal solid waste	Daily life	Municipal solid waste	0.026	Landfill

Source: Domestic EIA report

251. The **sludge** will be tested regularly for moisture content and heavy metal content. If it meets PRC Standard GB/T 23485-2009 for moisture level as well as requirements set by Jingyuan County Landfill No. 2 for metal content, it will be transported to Jingyuan county No. 2 municipal landfill site, which is 17km away from the WWTP site. Should it qualify as hazardous waste, the sludge will be transported to Gansu Hazardous Waste Treatment Center in Lanzhou. If the LIP pre-treatment system

is successful and the LIP WWTP operates properly, the beneficial reuse of the sludge will also be considered in the future. The domestic EIA recommended landfill disposal mainly on the basis of other WWTPs in the PRC and the sludge quality problems in these facilities. The need to pursue beneficial sludge reuse will be flagged as loan assurance.

252. **Risks of Accidental Discharge, Overload and Emergency Preparedness.** Although the proposed G-BAF wastewater treatment process is reportedly simple to operate, any large complex wastewater treatment plant requires significant technical expertise and management oversight to ensure proper operations. The volume and wastewater characteristics may vary considerably. To minimize peaks, a regulation tank will be installed to adjust the flow and loads of influent. There is also a non-negligible risk of accidental release of untreated wastewater at the WWTP, due to a possible malfunctioning of the electric, mechanical or control system, or the failure of the treatment process as a result of shock loads or chronic system overload. This risk has been identified and assessed in the FSR and domestic EIA. The mitigation measures include: (i) provision of an emergency holding tank of 3,000 m^3; (ii) provision of dual power supply; (iii) spare parts for key components; (iv) regular inspection and proper maintenance of the WWTP; (v) automated on-line, real-time monitoring of influent and effluent quality; and an in-house analytical lab will be established prior to operation of the WWTP. The major analytical equipment will include the following: wastewater sampler, pH meter, flow meter, conductivity meter, UV/VIS spectrophotometer, DO meter, COD speedy tester, thermostat incubator, electric balance, and centrifuge. The EMS supported by the project will also include various training and reporting systems to help ensure that the WWTP is operated properly and meets its performance targets.

253. **Industrial wastewater pretreatment.** A key pre-condition for proper functioning of the WWTP and to avoid malfunctioning is the pre-treatment of industrial wastewater. Failure of the LIP industries to comply with the relevant pretreatment standards represents a risk for the operation of the WWTP. The Baiyin municipal EPB is monitoring and validating the proper operation of LIP industrial pretreatment systems through online monitoring systems. Incoming industries will also be equipped with on-line monitoring systems linked to the Baiyin municipal EPB. Monitoring data as well as compliance assessment of industries will be shared with the LMC for integration into the proposed environment management information system (EMIS). The need to ensure adequate pre-treatment will be flagged as loan assurance in the project agreement.

254. **Emergency Response Plan.** An emergency preparedness and response plan will be formulated and put in place by the WWTP operator before the WWTP becomes operational. The emergency preparedness and response plan will address, among other things, training, resources, responsibilities, communication, procedures, and other aspects required to respond effectively to emergencies associated with the risk of accidental discharges. The emergency response plan for the WWP will be connected to the EP&R system of LMC, which will be established under the EMS subcomponent of the project.

255. **Treated Wastewater Reuse.** The wastewater treatment plant has been designed to allow for 100% recycling of the treated wastewater effluent, meeting PRC Class 1A wastewater standards. I order to minimize the health risks related to wastewater reuse for irrigation, Chlorine dioxide will be used to disinfect the treated wastewater prior to reuse. Although considered safer than chlorine, chlorine dioxide needs to be prepared from sodium chlorate and hydrogen chloride on site. The ventilation system inside the disinfection facilities will be designed according to the PRC regulations.

256. **Treated wastewater discharge.** Despite the target of 100% reuse, there may be a need to discharge treated wastewater effluent if the wastewater reuse system is temporary non-operational. A by-pass has been proposed in the FSR (**Figure V-2**), with discharge outlet to the Dasha River and then flow into Yellow River.

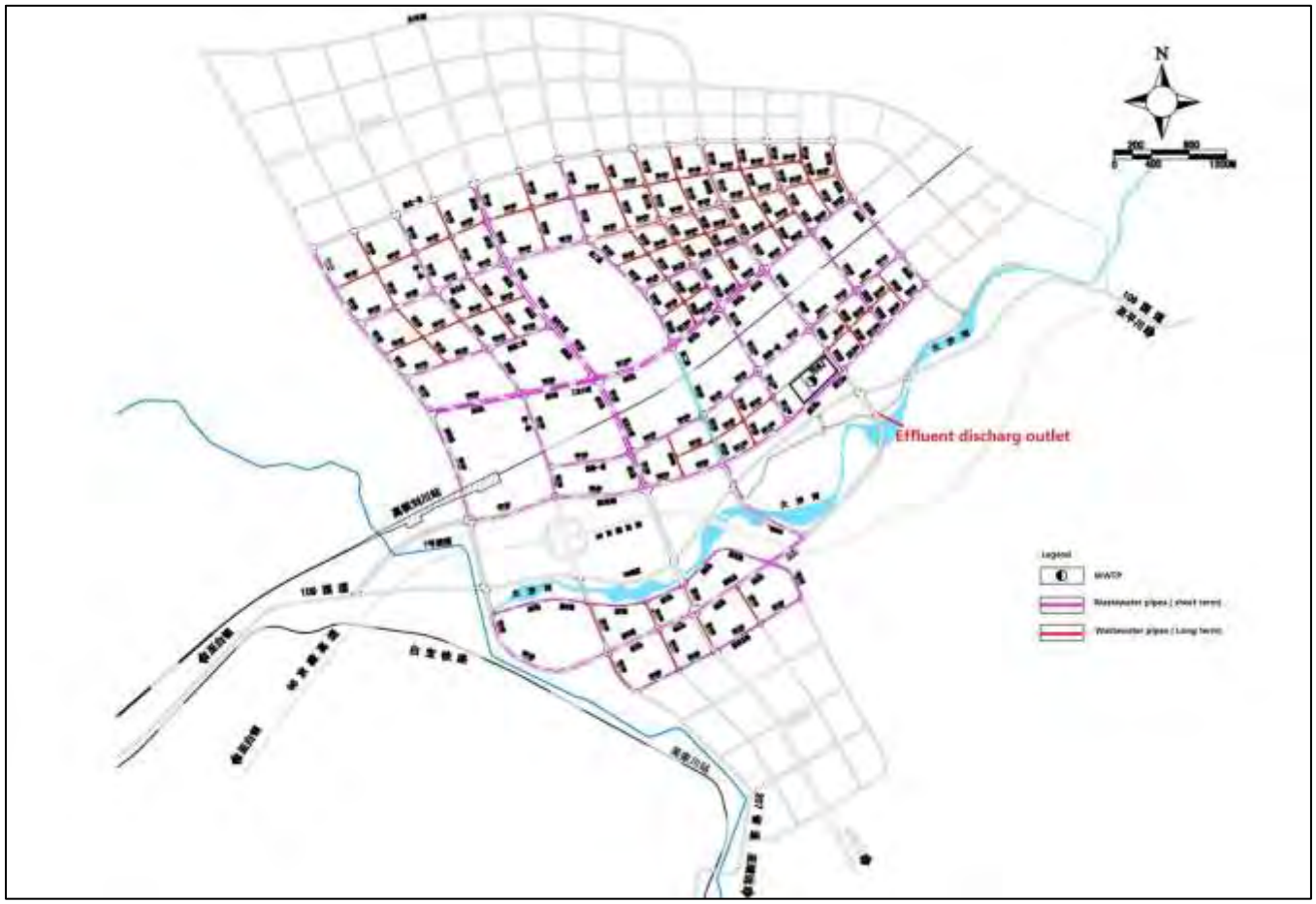


Figure V-3: WWTP bypass outlet Location, Dasha River

257. Since 100% effluent reuse within LIP Phase 1 will be achieved by 2019, and since an emergency storage tank of 3,000m^3 will be provided to contain untreated wastewater in case of malfunctioning, the assessment of impact on water quality in Dasha River assumed a realistic scenario, i.e., discharge of treated wastewater to Dasha River during dry season (minimal flow). Water quality modeling was undertaken to predict the mixing zones of COD and NH3-N upon discharge of treated wastewater into the Dasha River. “Mixing zone” is a concept commonly applied to effluent discharges into water bodies. Wastewater quality that exceeds applicable standards (in this case is Category III water quality standard) is allowed within the mixing zone, provided that there is no sensitive receptor within the mixing zone that could potentially be adversely affected by the pollutants. The size of the mixing zone in this case is the downstream distance from the effluent discharge point, at which the concentrations of COD and NH3-N would meet Category III water quality standards (or background values if these exceed Category III standard).

258. **Table V-12** shows the mixing zone distances downstream of the treated wastewater discharge point based on water quality modeling. Upon discharge, the effluent will immediately go through initial dilution by the river water at the discharge point and mixed with pollutants already present in the river. The Table also shows the concentrations of COD and NH3-N upon initial dilution and after mixing with same pollutants in the river at the discharge point, indicating that substantial reduction in concentrations would occur at the discharge point. After initial dilution, the pollutants will go through

natural decay in the river water eventually reaching Category III water quality standards at the edge of the mixing zone downstream. **Table V-12** shows that COD and NH3-N would exceed Category III water quality standards after initial dilution (this takes into account mixing with the background), but achieve Category V water quality standard for COD. Upon natural decay, COD would meet Category III water quality standard approximately 2.5km downstream of the effluent discharge point, while NH3-N would require 8.6 km downstream to reach baseline level. As described above, Dasha River does not sustain any aquatic biota. There is no drinking water source along the Dasha River until its confluence with the Yellow River. The nearest irrigation water intake is 23.2km downstream of the outlet. The impact on the Dasha river during discharge of treated effluent is considered acceptable, especially since this will only occur when effluent reuse is temporarily not possible (e.g. during maintenance of reuse facilities).

Table V-13: Mixing zones of COD and NH_3-N upon effluent discharge

Water Quality Parameter	WWTP effluent quality	Background level (Dasha River)	Category III Water Quality Standard (GB 3838-2002)	Category V Water Quality Standard (GB 3838-2002)	Concentration upon Initial Dilution	Mixing Zone Distance Downstream
COD	50 mg/l	20mg/l	20 mg/l	40 mg/l	30.6 mg/l	2,460 m
NH3-N	5 mg/l	0.8mg/l	1 mg/l	2 mg/l	3.9 mg/l	8,600 m

259. **Total emissions.** Based on the anticipated treatment performance of the WWTP and the proposed mitigation measures (including odor control, 100% wastewater reuse, noise control), residual pollutant emissions have been estimated in the domestic EIA, as presented in **Table V-14** below. The "zero-residual emissions" for treated effluent is a result of 100% wastewater reuse within LIP.

Table V-14: Predicted Emissions from WWTP during Operation

Type		Pollutants	Total emissions from WWT process	Emission reduction by mitigation measures	Residual emissions
Exhaust gases	Odor pollutants	H_2S (kg/a)	536.1	268.1	268.1
		NH_3 (kg/a)	255.4	127.7	127.7
	Dining hall cooking exhaust	Fumes (kg/a)	36.5	21.9	14.6
Waste water	Treated effluent	Volume of wastewater (m^3/a)	1277.5	1277.5	——
		COD (t/a)	4471.3	4471.3	——
		BOD_5 (t/a)	1533	1533	——
		SS (t/a)	2,555	2,555	——
		Ammonia nitrogen (t/a)	536.6	536.6	——
		Total nitrogen (t/a)	715.4	715.4	——
		TP (t/a)	39.6	39.6	——
Solid waste	Wastewater treatment	Grid sands (t/a)	1843.25	0	1843.25
		Sludge (t/a)	2646.25	0	2646.25
	Municipal solid waste	Municipal solid waste (t/a)	9.5	0	9.5
Noise	Sludge thickening and dewatering equipment, pumping stations, blower room in the plant dB(A)		75-105	5-45	Daytime≤60 At night≤50

Source: Domestic EIA report

260. **Occupational Health and Safety.** WWTP operators may be injured by slips, trips and falls on wet floors; by falls into treatment ponds, pits, clarifiers or vats and by splashes of hazardous liquids; they may suffer cuts and pricks from sharp tools, contusions, etc. They are exposed to hazards related to work in confined spaces. The following measures will be implemented to safeguard their safety and health:

(i) use safety shoes or boots with non-slip soles;
(ii) wear personal protective equipment and chemical resistant clothing to avoid exposure of skin or

eyes to corrosive and/or polluted solids, liquids, gases or vapors;
(iii) post safety instructions in each workshop regarding the storage, transport, handling or pouring of chemicals;
(iv) check electrical equipment for safety before use; verify that all electric cables are properly insulated; take faulty or suspect electrical equipment to a qualified electricity technician for testing and repair;
(v) wear safety goggles in all cases where the eyes may be exposed to dust, flying particles, or splashes of harmful liquids;
(vi) wear respiratory mask in the sludge dewatering and de-odor workshops and when moving and transporting sludge;
(vii) obey all safety instructions concerning entry into confined spaces, e.g., check atmosphere for oxygen or for poisonous gases, use respiratory protection equipment if needed, have a co-worker stand guard in case of need for help, etc;
(viii) all workers will undergo periodic examinations by occupational physician to reveal early symptoms of possible chronic effects or allergies; and
(ix) health and safety will be incorporated into the regular staff training programs.

b) Operation of Water Supply Subcomponent

261. **Source water quality.** According to "2011 State of the Environment in Gansu Province" and the “Gansu Surface Water Function Zoning (2012-2030)”, the Yellow River in Lanzhou segment is Grade II – III. This makes it suitable as a source for drinking water. As shown in baseline data section, water quality testing was performed during the domestic EIA and data was also provided from the Wujiawan water intake station located upstream of the proposed water intake. Raw source water monitoring indicates that except for total nitrogen and fecal coliform, the other indicators meet PRC Category III water standards. Nitrogen levels will be carefully monitored to avoid nitrate and nitrite problems.

262. **Water Source Protection.** The water intake will be 30m downstream of the original intake of Baiyin Rare Earth Company, which will be abadoned after the operation of the proposed new facility. Jingyuan County has delineated Grade I and Grade II water source procetion zones for centralized water supply to Jingyuan county town, which is 25km upstream of proposed project water intake. The Pingchuan District water intake is 2.5km upstream of the project water intake to abstract raw water for Pingchuan District as drinking water source. There is no industrial discharge within 3km upstream of the project water intake based on the investigations of DEIA institute. Current land use along the river near proposed water intake is farmland, barren hills and house sites of villagers. The major potential threat to water quality is non-point pollution from agriculture. Protection measures will be defined for water source protection zones in accordance with the Technical Guideline for Delineating Source Water Protection Areas (HJ/T338-2007).[31] These comprise:

(i) **Grade I protection zone -** water area: 1000m upstream and 100m downstream from the intake; land area: not less than 50m from the riverbank. The following activities are forbiddend within the Grade I protection zone: (a) tourism, swimming and any other recreation activitie that will threaten water quality; (b) any new construction which is not related to water quality protection; (c) industrial and municipal waste storage; (d) oil depots; (e) any waste discharge outlet.
(ii) **Grade II protection zone -** water area: 2000m upstream from the boundary of Grade I zone; land area: not less than 200m from the boundry of Grade I zone. The following activities are forbiddend within the Grade II water source protection zone: (a) any new project or expansion of

[31] The standard is developed for the purpose of implementing the Law of the People's Republic of China on the Prevention and Control of Water Pollution and Detailed Rules for the Implementation of the Law of the People's Republic of China on the Prevention and Control of Water Pollution, preventing and controlling the pollution at source water protection areas, and ensuring the safety of drinking water. This standard specifies the basic method for the delineation of both surface and groundwater drinking water source protection areas and the compilation requirement for technical documents on the delineation of drinking water source protection areas.

existing project that will discharge pollutants to the water body; (b) loading and unloading of oil and other hazardous substances; and (c) any pollution eimissions exceeding the national and local discharge standards.

263. Unauthorized personnel will be forbidden from entering the Grade I zone. No buffer zone is required. During operation, the WTP operator shall monitoring the quality of raw water in line with the" Water Quality Monitoring Plan for Centralized Drinking Water Source" (MEP [2012]).The need to establish water source protection zones is flagged as time bound project assurance.

264. The **impact of water extraction on regional water resources** has been assessed through regional water balance analysis in the context of the Yellow River water allocation plan. The amount proposed to be withdrawn as a percent of Yellow River Flow is shown in **Table V-14**. The assessment confirmed that the Yellow River water extraction rate for the project's water treatment plant will remain within the approved extraction quota for Jingyuan County. The proposed supply amount is 60,000 m^3/d for 2020 (LIP Phase 1) and 200,000 m^3/d for 2030 (LIP Phase 1 and 2), with a design abstraction guarantee rate of 97%. The Yellow River has an average annual flow of 920 cubic meters per second (m^3/s) and a historic minimum flow of 236 m^3/s. The amount proposed to be withdrawn will thus not exceed 0.3% and 1% of the Yellow River at maximum extraction rate and minimum flow for the short (2020) and medium term (2030). However, a review of LIP development plans beyond the approved medium term plan (2030 horizon, 50-km^2) will be required to ensure water resource use efficiency and sustainability, also accounting for mid- to long-term climate risks.

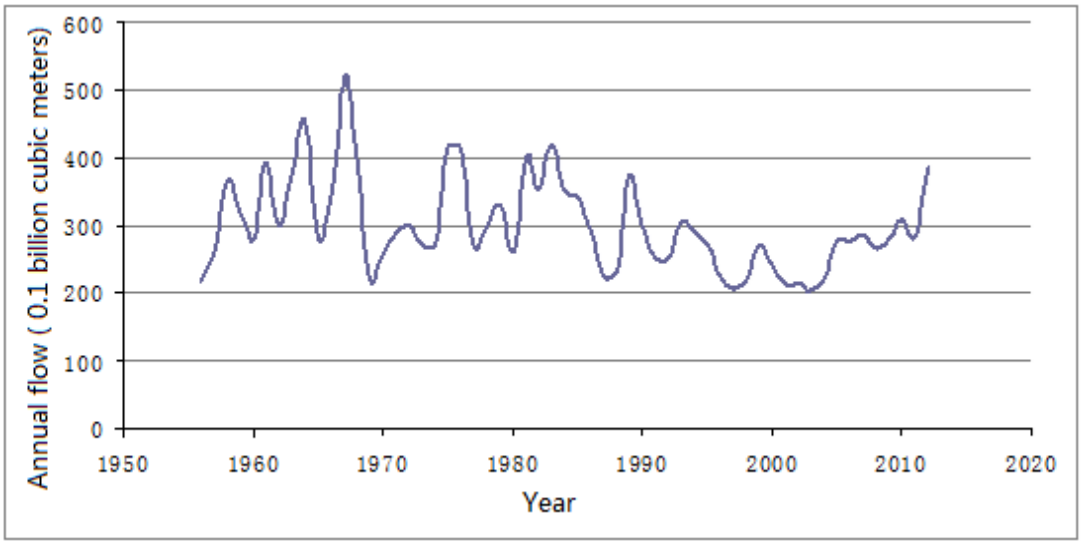
265. The proposed water extraction for the water supply component will remain within the water quota allocated to LIP. Baiyin City has an allocation of 1.4 billion m^3 per year (4.2% of the River flow passing through Baiyin) which is not fully used. Jingyuan County is allocated 0.34 billion m3 per year from the Baiyin City allocation (24.3%). LIP Phase 1 (short term, 23-km^2) will use 60,000 m^3/day, equivalent to 22 million m^3 per year, which is 6% of Jingyuan County allocation. 41.3 million m^3 per year of water will be allocated to LIP Phase 1, including: (i) 30 million m^3 per year from agriculture, resulting from water savings by high efficiency irrigation systems; (ii) 4.3 million m^3 per year from the Rare Earth Company which will become part of the LIP; (iii) 7 million m^3 per year from shutting down the Jingyuan County Power Station in accordance with national policy to close small, less efficient power production facilities. This re-allocation of water to the LIP is 1.9 times the volume of water planned for year 2020 (to support LIP Phase 1 with 19.4 million m^3 per year which is equivalent to 60,000 m^3/day). A water quota transfer and usage agreement has been signed between Liuchuan Industry Park Committee, Liuchuan Irrigation Project Management Bureau and Jingyuan County Water Affairs Bureau.[32] The proposed water supply subcomponent will not increase additional water quota of Jingyuan County in the short-term.

Table V-15: Proposed Flow to Be Extracted

			% of Yellow River	
Year	**m^3/day**	**m^3/s**	**Average flow**	**Historic minimum flow**
2020	60,000	0.69	0.08%	0.29%
2030	200,000	2.31	0.25%	0.98%

Source: Yellow River flow data from Construction Project Environmental Impact Statement, July 2013

[32] A total of 19.4 million m^3 annual water quota has been approved by Gansu Provincial Water Resources Department on 25th Feb 2014.



Source: water resources assessment report

Figure V-4: Annual flow at Anningdu station, Gansu Province

266. Based on the Water Resources Assessment Report (2014), Jingyuan County evaluated their Yellow River water quota and transferred some irrigation water to the LIP for industrial use.[33] The irrigation savings were achieved through promotion and use of drip irrigation instead of previous flood irrigation. There will be no need to apply additional quota for Jingyuan County. Water quota transfer/usage agreements have been signed between Liuchuan Industry Park Committee, Liuchuan Irrigation Project Management Bureau and Jingyuan County Water Affairs Bureau. The proposed water supply subcomponent will not increase additional water quota of Jingyuan County.

267. **Figure V-5** shows the major irrigation districts in Jingyuan County and surrounding area. Liuchuan Irrigation District is one of the national level demonstration districts for irrigation water saving techniques. As of 2013, 20,000 *mu* of water saving irrigation facilities were completed; an additional 28,000 m*u* are expected to be finished by 2020.

[33] Based on the "Water Allocation Plan" (1987) and "Breakdown of Water Abstraction from Yellow River in Gansu Province" (2007), the water quota of 536 million m^3 has been allocated to Baiyin Municipality. The allowable surface water abstraction in Jingyuan County is 340 million m^3.

Source: water resources assessment report

Figure V-5: Major irrigation districts in Jingyuan County and Surrounding Area

268. **Domestic wastewater**. Domestic wastewater produced by working staff in the preliminary WTP is estimated as 0.704 m^3/d assuming 20 staff will be hired and only 4 staff will live in the dormitory. Domestic sewage will be treated in an on-site septic tank. The secondary WTP is located in the industrial park so the domestic wastewater from the secondary WTP will be delivered to the new WWTP in the LIP.

269. **Operational wastewater.** The major process wastewater is from sludge dewatering. Leachate from the secondary WTP will be discharged to the municipal sewer and treated in the project WWTP. Leachate from primary sludge at the sludge storage yard of the preliminary WTP will be collected in a sedimentation basin. After sedimentation, it will be used to irrigate adjacent areas (dust control).

Noise. Noise during operation of the WTPs is mainly from various pumps. The types of noise sources in the water treatment facilities and recommended mitigation measures are shown in **Table V-16**, while predicted noise levels are shown in

Source: Domestic EIA report

270. **Table V-16**. Noise levels from equipment will range from 75 to 105 dB. In order to mitigate potential noise impact, low noise equipment will be selected. The walls will be built with sufficient thickness. **Figures V-8** and **Figure V-9** show the noise contours at preliminary WTP and secondary WTP, respectively, which demonstrate compliance with PRC's Noise Standards at the Boundary of Industries and Enterprises (GB 12348-2008).

Table V-16: Types of Noise Sources and Mitigation Measures at WTPs

Location	No.	Device name	Sets	Individual sound level	After mitigation	Noise reduction measures
Preliminary water treatment plant	1	Pumps	2	90~95	75	Indoor / Shock absorption
	2	Air compressor	1	95~105	83	Indoor / Shock absorption, damping
	3	Sludge feed pump	1	80~85	65	Indoor / Shock absorption
	4	Sludge dewatering machine	1	75~85	70	Indoor / Shock absorption
	5	Booster pumps	2	90~100	80	Indoor / Shock absorption
Secondary water treatment plant	6	Backwash pumps	2	85~90	70	Indoor / Shock absorption
	7	Roots blower	1	90~105	85	Indoor / Shock absorption, damping
	8	Sludge feed pump	1	80~85	65	Indoor / Shock absorption
	9	Submersible sewage pump	1	80~85	60	Underwater
	10	Air compressor	1	95~105	85	Indoor / Shock absorption, damping
	11	Centrifugal dehydrator	1	80~85	70	Indoor / Shock absorption
	12	Secondary booster pumps	2	85~95	75	Indoor / Shock absorption
	13	Dosing pump	2	75~85	65	Indoor / Shock absorption

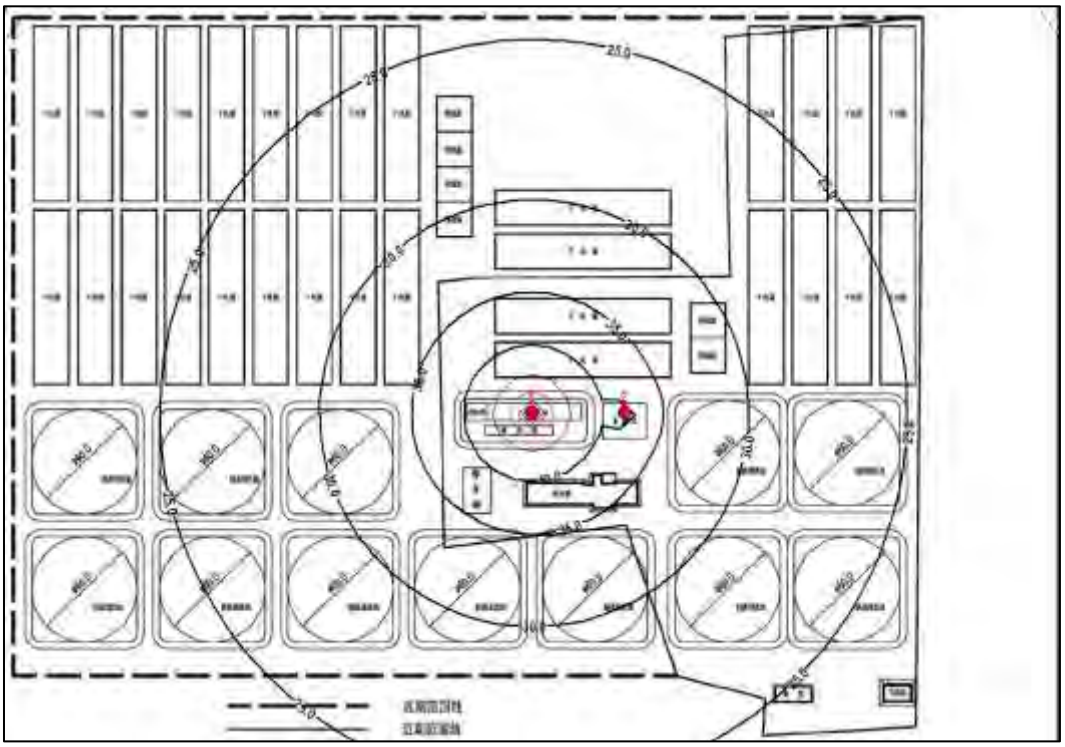
Source: Domestic EIA report

Table V-17: Predicted Operational Noise Levels at WTPs

	Contribution value	Baseline		Prediction under operation		*GB 12348-2008*
		Daylight	Night	Daylight	Night	
East boundary	30	48.2	38.9	48.3	39.4	*Day 60 Night 50*
South boundary	25	47.6	36.4	47.6	36.7	
West plant	24.1	48.6	36.5	48.6	36.7	
North boundary	39.5	47.4	35.7	48.1	41	

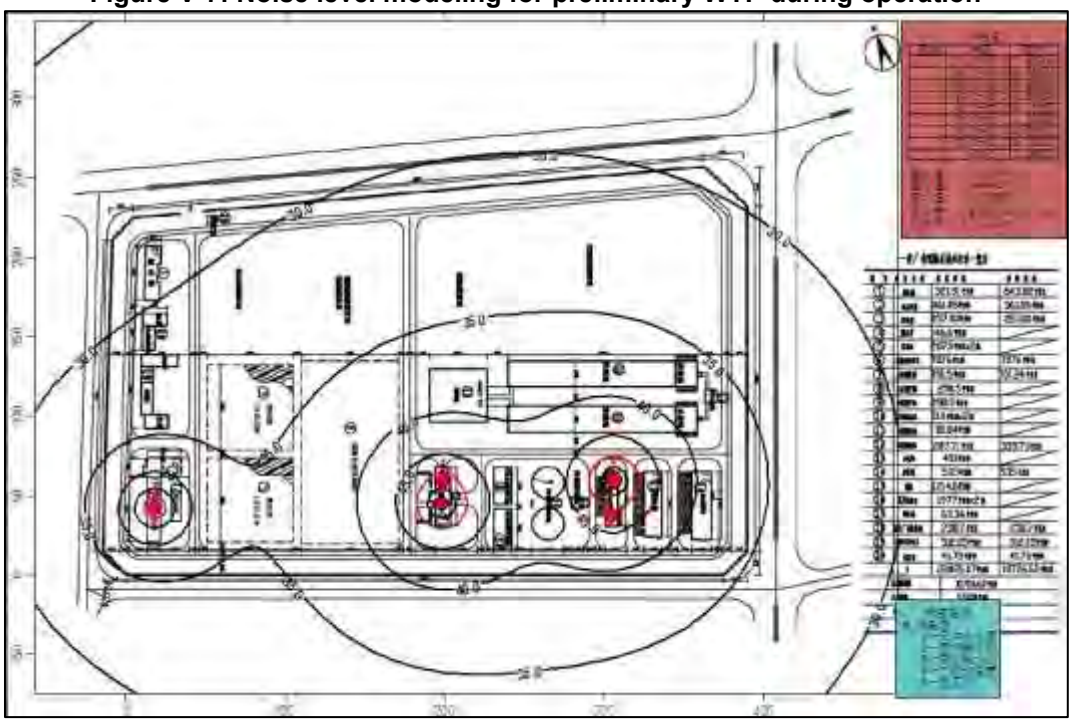
Source: Domestic EIA report

Figure V-6: Noise level modeling for secondary WTP during operation



Source: Domestic EIA report

Figure V-7: Noise level modeling for preliminary WTP during operation



Source: Domestic EIA report

271. **Table V-18** provides a summary of operational phase impacts at both of the proposed water treatment facilities.

Table V-18: Summary of Waste Discharge during Operation of WTPs

Period	Types of pollution		Pollutants	Concentration/production without treatment	Emissions intensity and emissions
Operation	Air	Dining room	Smoke exhaust	5.0mg/m^3, 9.87kg/a	2.0 mg/m^3, 3.94kg/a
		Garbage and septic tank	Odor	Minimal with proper O&M	
	Noise	Various types of pumps, compressors	Noise	75-105 dB(A)	Emissions standards
	Water	Production wastewater	Volume of wastewater	20.44 m^3/a	20.44 m^3/a, discharged into the municipal sewer network
		Domestic wastewater	Volume of wastewater	306.6m^3/a	306.6m^3/a
			COD	400mg/L,0.123t/a	300mg/L,0.092t/a
			Ammonia nitrogen	35mg/L,0.011t/a	35mg/L, 0.011t/a
	Solid waste	Preliminary treatment plant	Sediment	438000t/a	438000t/a
		Secondary treatment plant	Sludge	1825t/a	1825t/a
		Staff	Municipal solid waste	16.43t/a	16.43t/a

Source: Domestic EIA report

272. **Sediment Disposal at Primary WTP.** The annual average Yellow River source water sediment concentration is 4 kilograms per cubic meter (kg/m^3). Common practice for high sediment water is to provide preliminary treatment to settle out the sediment and the preliminary WTP is designed for sedimentation and primary sludge sand drying beds. Underdrains system will be set to return the drainage to the sludge storage tank. The dried material is fairly innocuous in nature but with alum coagulant use, it cannot be used directly for agricultural use without careful planning and potentially mixing with other material. The sediment from the preliminary WTP will be transported to the barren area 100-200 meters above the WTP, designated by the local Land Resources Bureau (**Figure V-8**). The area will be protected from public access and routine soil conservation and protection measures taken to ensure that the material does not impact surrounding land.

Figure V-8: Disposal site location for the sludge from preliminary WTP

273. **Occupational Health and Safety.** The water treatment plant will use chlorine dioxide for water disinfection. Chlorine dioxide will not produce harmful organic halogenic compounds and triholomethanes (carcinogenic substances). The main constituents of chlorine dioxide, sodium chlorite

solution and hydrochloric acid will be transported to and mixed in a reaction tank (batch reactor), in the WTP's preparation area. The product, a gas-liquid mixture which consists of chlorine dioxide and chlorine, is added to the intake water to achieve chlorine disinfection and oxidation. The annual usage is estimated at 87.6 tons. The storage is 3.6 tons, which is less than the threshold quantity of 5 tons on site. Hazards exist in preparing, transporting, storing and handling hydrochloric acid and sodium chlorite used for chlorine dioxide generation. In the chlorination room, there is an environmental risk of hydrogen chloride and chlorine dioxide leakage. Chemicals will be transported and managed in compliance with relevant state regulations on hazardous chemical substance management. The chlorination room and chemical storage area will be equipped with automatic alarms, which will be triggered by chlorine dioxide leakage. To protect personnel on duty from hazard caused by hydrogen chloride and chlorine dioxide leakage, the duty room will be equipped with gas masks, oxygen breathing apparatus and other rescue materials. An emergency response plan will be developed and implemented. The plan will inform staff about the characteristics of chlorine dioxide and hydrochloric acid, describe potential health hazards, and define accident prevention measures and an evacuation plan. The plan will be linked to the LIC-wide emergency preparedness and response plan (EP&R) developed under the EMS subcomponent of the project.

274. **Water quality monitoring, emergency response.** Monitoring data of the quality of the water sources in Chapter D "Description of the Environment" show that the raw water quality can meet Water Quality Standards for Domestic Drinking Water Sources (CJ3020-93). Water sources and extraction points have been selected to maximize water security, and routine monitoring program for water quality will be undertaken by the WTP operators.

c) Operation of Road Subcomponent

275. **Air Pollution.** The Xihuan road will result in increased traffic and related emissions. The major pollutants are NO_2, CO and $PM_{2.5}$ from exhausted gas. Emission concentrations of the indicator pollutants NO_2 and CO were calculated with the *AERMOD2.2* software developed by American Meteorological Society/United States Environmental Protection Agency Regulatory Model Improvement Committee. The main prediction parameters include traffic volume predictions from the FSR (**Table V-18**), road parameters, terrain, local climate data, etc. **Table V-19** shows the predicted hourly, 24-hour and annual maximum vehicle emission intensity of short term, medium term and long term within 200m of both sides of the road. **Table V-20** presents the predicted maximum pollutant concentrations of six (6) representative sensitive receptors, which are within/near the road redline.

Table V-19: Traffic volume projection on the project road

Year	2015	2019	2026	2034
Traffic volume (unit: pcu/h)	1152	1809	2501	3602

Table V-20: Pollutant concentration prediction

Indicators	Time	Maximum Pollutant Concentration (mg/m^3)			GB3095-2012 Class II	EHS standard
		2019	2026	2034		
NO_2	**hourly**	0.143	0.148	0.187	0.20	0.20
	24-hour	0.0497	0.0608	0.0729	0.08	n/a
	Annual	0.138	0.0230	0.0300	0.04	0.04
CO	**hourly**	1.834	1.828	1.905	10.0	n/a
	24-hour	1.391	1.412	1.440	4.0	n/a
	Annual	0.036	0.057	0.074	n/a	n/a

Source: Domestic EIA report

Table V-21: Maximum pollutant concentration projections at 6 representative sensitive receptors

(mg/m^3)

			1#	2#	3#	4#	5#	6#
Location (see Figure II-5, Table V-19)			*2*	*5*	*9*	*16*	*19*	*21*
Distance to road centerline			*37.7m*	*26.5m*	*26.6m*	*37.3m*	*27.2m*	*26.7m*
Year	**Pollutant**	**Timeframe**						
2013 *(baseline, G4, Figure IV-3)*	NO_2	Hourly	0.024	0.024	0.024	0.024	0.024	0.024
		24-hour	0.021	0.021	0.021	0.021	0.021	0.021
		Annual	-	-	-	-	-	-
	CO	Hourly	2.31	2.31	2.31	2.31	2.31	2.31
		24-hour	1.61	1.61	1.61	1.61	1.61	1.61
		Annual	-	-	-	-	-	-
2019	NO_2	Hourly	0.074	0.096	0.090	0.085	0.093	0.095
		24-hour	0.030	0.035	0.033	0.036	0.034	0.035
		Annual	0.006	0.008	0.008	0.009	0.007	0.007
	CO	Hourly	2.415	2.462	2.449	2.438	2.455	2.459
		24-hour	1.633	1.647	1.642	1.649	1.643	1.645
		Annual	0.015	0.022	0.023	0.026	0.019	0.021
2026	NO_2	Hourly	0.077	0.099	0.096	0.087	0.096	0.098
		24-hour	0.034	0.044	0.042	0.046	0.039	0.042
		Annual	0.009	0.013	0.015	0.016	0.010	0.012
	CO	Hourly	2.414	2.458	2.452	2.434	2.452	2.455
		24-hour	1.641	1.665	1.660	1.669	1.653	1.659
		Annual	0.022	0.032	0.039	0.041	0.026	0.030
2034	NO_2	Hourly	0.093	0.123	0.118	0.107	0.119	0.121
		24-hour	0.038	0.051	0.048	0.053	0.045	0.048
		Annual	0.011	0.017	0.002	0.021	0.015	0.015
	CO	Hourly	2.446	2.504	2.495	2.473	2.496	2.500
		24-hour	1.651	1.682	1.675	1.687	1.666	1.675
		Annual	0.029	0.042	0.050	0.054	0.035	0.039

Source: Domestic EIA report

276. The results indicate that the maximum CO and NO_2 ground-level concentration values can comply with the Class II standard limits of the Ambient Air Quality Standard (GB3095-2012) going into effect in January 2016 and EHS guidelines during future operation. The green belt and trees along the road will further reduce the NO2 and CO concentrations to certain extent.

277. **Noise.** Traffic noise predictions for sensitive sites along the road in short, medium and long terms are shown in **Table V-22**. The noise impact assessment criteria for Xihuan road are:

(i) For areas within 35m from the edge of road right-of-way, the Grade 4a of Acoustic Environmental Quality Standard (70dB at daytime and 55dB at nighttime) is applicable;
(j) For areas outside of 35m from the edge of road right-of-way, Grade II standard is applicable (60dB at daytime and 50dB at nighttime).

278. The assessment scope is 200m from the edge of road right-of-way, with 84 households, including 22 households within 35m of red-lines. There is no school or hospital in the assessment area. According to the master plan of the LIP, the land use types along the Xihuan Road are logistics, category II industrial land, green land and reserved land. No residential areas, hospital and school are planned. The future development should follow this master plan.

279. **Table V-21** presents the predicted noise levels at all 84 households. The predictions indicate that the noise levels will exceed the standard in the medium and long term, in particular during nighttime. The following noise attenuation and protection measures will be implemented during operation stage: (i) vehicle speed will be limited to 50km/h within LIP; and (ii) Noise insulation windows will be installed for these 84 households. Total cost for the insulation windows is estimated at 373,000 CNY, which is included in the contract package of the road (RD-C02).

Table V-22: Traffic noise level prediction along the Xihuan road (Leq [dB (A)])

No	Location	Baseline		Noise produced due to the operation of road						Prediction						Standard		Compliance? [Numbers are values over stds]					
				Period						Period								Period					
				2019		2026		2034		2019		2026		2034				2019		2026		2034	
		Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
1	K0+115	45.6	35.2	66	62.5	67.8	64.2	69.2	65.6	66.0	62.5	67.8	64.2	69.2	65.6	70	55	Yes	7.5	Yes	9.2	Yes	10.6
2	K0+161	45.6	35.2	70.4	66.9	72.2	68.6	73.6	70	70.4	66.9	72.2	68.6	73.6	70.0	70	55	0.4	11.9	2.2	13.6	3.6	15.0
3	K0+40	48.6	34.6	49.9	46.3	51.6	48	53	49.4	52.3	46.6	53.4	48.2	54.3	49.5	70	55	Yes	Yes	Yes	Yes	Yes	Yes
4	K0+245	45.6	35.2	71.1	67.6	72.9	69.3	74.2	70.7	71.1	67.6	72.9	69.3	74.2	70.7	70	55	1.1	12.6	2.9	14.3	4.2	15.7
5	K0+285	45.6	35.2	73	69.5	74.8	71.2	76.2	72.6	73.0	69.5	74.8	71.2	76.2	72.6	70	55	3.0	14.5	4.8	16.2	6.2	17.6
6	K0+640	45.6	35.2	71.1	67.5	72.8	69.2	74.2	70.6	71.1	67.5	72.8	69.2	74.2	70.6	70	55	1.1	12.5	2.8	14.2	4.2	15.6
7	K1+65	45.6	35.2	68	64.4	69.7	66.1	71.1	67.5	68.0	64.4	69.7	66.1	71.1	67.5	70	55	Yes	9.4	Yes	11.1	Yes	12.5
8	K1+100	45.6	35.2	61.2	57.7	63	59.4	64.4	60.8	61.3	57.7	63.1	59.4	64.5	60.8	70	55	Yes	2.7	Yes	4.4	Yes	5.8
9	K1+170	45.6	35.2	72.3	68.8	74.1	70.5	75.5	71.9	72.3	68.8	74.1	70.5	75.5	71.9	70	55	2.3	13.8	4.1	15.5	5.5	16.9
10	K1+206	45.6	35.2	72.7	69.1	74.4	70.8	75.8	72.2	72.7	69.1	74.4	70.8	75.8	72.2	70	55	2.7	14.1	4.4	15.8	5.8	17.2
11	K1+200	45.6	35.2	67.7	64.2	69.5	65.9	70.8	67.3	67.7	64.2	69.5	65.9	70.8	67.3	70	55	Yes	9.2	Yes	10.9	0.8	12.3
12	K1+234	45.6	35.2	71.6	68	73.3	69.7	74.7	71.1	71.6	68.0	73.3	69.7	74.7	71.1	70	55	1.6	13.0	3.3	14.7	4.7	16.1
13	K1+375	45.6	35.2	71.5	67.9	73.2	69.6	74.6	71	71.5	67.9	73.2	69.6	74.6	71.0	70	55	1.5	12.9	3.2	14.6	4.6	16.0
14	K1+400	45.6	35.2	71.4	67.8	73.1	69.5	74.5	70.9	71.4	67.8	73.1	69.5	74.5	70.9	70	55	1.4	12.8	3.1	14.5	4.5	15.9
15	K1+457	45.6	35.2	69.6	66	71.3	67.7	72.7	69.1	69.6	66.0	71.3	67.7	72.7	69.1	70	55	Yes	11.0	1.3	12.7	2.7	14.1
16	K1+520	45.6	35.2	70.8	67.3	72.6	69	74	70.4	70.8	67.3	72.6	69.0	74.0	70.4	70	55	0.8	12.3	2.6	14.0	4.0	15.4
17	K1+700	45.6	35.2	69.8	66.3	71.6	68	73	69.4	69.8	66.3	71.6	68.0	73.0	69.4	70	55	Yes	11.3	1.6	13.0	3.0	14.4
18	K1+850	57.6	52.4	71	67.5	72.8	69.2	74.2	70.6	71.2	67.6	72.9	69.3	74.3	70.7	70	55	1.2	12.6	2.9	14.3	4.3	15.7
19	K2+800	43.1	34.2	73.4	69.9	75.2	71.6	76.5	73	73.4	69.9	75.2	71.6	76.5	73.0	70	55	3.4	14.9	5.2	16.6	6.5	18.0
20	K2+840	43.1	34.2	70.8	67.3	72.6	69	74	70.4	70.8	67.3	72.6	69.0	74.0	70.4	70	55	0.8	12.3	2.6	14.0	4.0	15.4
21	K3+440	43.1	34.2	70.7	67.1	72.4	68.8	73.8	70.2	70.7	67.1	72.4	68.8	73.8	70.2	70	55	0.7	12.1	2.4	13.8	3.8	15.2
22	K3+630	43.1	34.2	66.6	63.1	68.4	64.8	69.8	66.2	66.6	63.1	68.4	64.8	69.8	66.2	70	55	Yes	8.1	Yes	9.8	Yes	11.2
23	K0+30	48.6	34.6	59.4	55.9	61.2	57.6	62.6	59	59.7	55.9	61.4	57.6	62.8	59.0	60	50	Yes	5.9	1.4	7.6	2.8	9.0
24	K0+30	48.6	34.6	39.5	36	41.3	37.7	42.7	39.1	49.1	38.4	49.3	39.4	49.6	40.4	60	50	Yes	Yes	Yes	Yes	Yes	Yes
25	K0+85	45.6	35.2	49.3	45.8	51.1	47.5	52.5	48.9	50.8	46.2	52.2	47.7	53.3	49.1	60	50	Yes	Yes	Yes	Yes	Yes	Yes
26	K0+95	45.6	35.2	54.5	50.9	56.3	52.6	57.6	54.1	55.0	51.0	56.7	52.7	57.9	54.2	60	50	Yes	1.0	Yes	2.7	Yes	4.2
27	K0+135	45.6	35.2	57.5	54	59.3	55.7	60.7	57.1	57.8	54.1	59.5	55.7	60.8	57.1	60	50	Yes	4.1	Yes	5.7	0.8	7.1
28	K0+130	45.6	35.2	47.9	44.3	49.6	46	51	47.4	49.9	44.8	51.1	46.3	52.1	47.7	60	50	Yes	Yes	Yes	Yes	Yes	Yes
29	K0+95	45.6	35.2	63	59.4	64.7	61.1	66.1	62.5	63.1	59.4	64.8	61.1	66.1	62.5	60	50	3.1	9.4	4.8	11.1	6.1	12.5
30	K0+110	45.6	35.2	48.6	45	50.3	46.7	51.7	48.1	50.4	45.4	51.6	47.0	52.7	48.3	60	50	Yes	Yes	Yes	Yes	Yes	Yes
31	K0+65	48.6	34.6	54	50.5	55.8	52.2	57.1	53.6	55.1	50.6	56.6	52.3	57.7	53.7	60	50	Yes	0.6	Yes	2.3	Yes	3.7
32	K0+40	48.6	34.6	49.9	46.3	51.6	48	53	49.4	52.3	46.6	53.4	48.2	54.3	49.5	60	50	Yes	Yes	Yes	Yes	Yes	Yes
33	K0+260	45.6	35.2	46.4	42.8	48.1	44.5	49.5	45.9	49.0	43.5	50.0	45.0	51.0	46.3	60	50	Yes	Yes	Yes	Yes	Yes	Yes
34	K0+310	45.6	35.2	50.9	47.3	52.6	49	54	50.4	52.0	47.6	53.4	49.2	54.6	50.5	60	50	Yes	Yes	Yes	Yes	Yes	0.5
35	K0+265	45.6	35.2	57.2	53.6	58.9	55.3	60.3	56.7	57.5	53.7	59.1	55.3	60.4	56.7	60	50	Yes	3.7	Yes	5.3	0.4	6.7
36	K0+290	45.6	35.2	51.8	48.2	53.5	49.9	54.9	51.3	52.7	48.4	54.2	50.0	55.4	51.4	60	50	Yes	Yes	Yes	0.0	Yes	1.4
37	K0+420	45.6	35.2	46.3	42.7	48	44.4	49.4	45.8	49.0	43.4	50.0	44.9	50.9	46.2	60	50	Yes	Yes	Yes	Yes	Yes	Yes
38	K0+460	45.6	35.2	42.4	38.9	44.2	40.6	45.6	42	47.3	40.4	48.0	41.7	48.6	42.8	60	50	Yes	Yes	Yes	Yes	Yes	Yes
39	K0+640	45.6	35.2	54.6	51.1	56.4	52.8	57.8	54.2	55.1	51.2	56.7	52.9	58.1	54.3	60	50	Yes	1.2	Yes	2.9	Yes	4.3
40	K0+935	45.6	35.2	47.7	44.1	49.4	45.8	50.8	47.2	49.8	44.6	50.9	46.2	51.9	47.5	60	50	Yes	Yes	Yes	Yes	Yes	Yes
41	K0+975	45.6	35.2	50.1	46.5	51.8	48.2	53.2	49.6	51.4	46.8	52.7	48.4	53.9	49.8	60	50	Yes	Yes	Yes	Yes	Yes	Yes
42	K1+45	45.6	35.2	50.6	47.1	52.4	48.8	53.8	50.2	51.8	47.4	53.2	49.0	54.4	50.3	60	50	Yes	Yes	Yes	Yes	Yes	0.3
43	K1+110	45.6	35.2	51.1	47.5	52.8	49.2	54.2	50.6	52.2	47.7	53.6	49.4	54.8	50.7	60	50	Yes	Yes	Yes	Yes	Yes	0.7
44	K1+100	45.6	35.2	47.7	44.1	49.5	45.9	50.8	47.3	49.8	44.6	51.0	46.3	51.9	47.6	60	50	Yes	Yes	Yes	Yes	Yes	Yes
45	K1+190	45.6	35.2	46.5	42.9	48.2	44.6	49.6	46	49.1	43.6	50.1	45.1	51.1	46.3	60	50	Yes	Yes	Yes	Yes	Yes	Yes
46	K1+310	45.6	35.2	61.8	58.2	63.5	59.9	64.9	61.3	61.9	58.2	63.6	59.9	65.0	61.3	60	50	1.9	8.2	3.6	9.9	5.0	11.3

No	Location	Baseline		Noise produced due to the operation of road						Prediction						Standard		Compliance? [Numbers are values over stds]					
				Period						Period								Period					
				2019		2026		2034		2019		2026		2034				2019		2026		2034	
		Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
47	K1+380	45.6	35.2	51.5	47.9	53.2	49.6	54.6	51	52.5	48.1	53.9	49.8	55.1	51.1	60	50	Yes	Yes	Yes	Yes	Yes	1.1
48	K1+360	45.6	35.2	46.2	42.6	47.9	44.3	49.3	45.7	48.9	43.3	49.9	44.8	50.8	46.1	60	50	Yes	Yes	Yes	Yes	Yes	Yes
49	K1+400	45.6	35.2	63.1	59.5	64.8	61.2	66.2	62.6	63.2	59.5	64.9	61.2	66.2	62.6	60	50	3.2	9.5	4.9	11.2	6.2	12.6
50	K1+430	45.6	35.2	46.7	43.1	48.4	44.8	49.8	46.2	49.2	43.8	50.2	45.3	51.2	46.5	60	50	Yes	Yes	Yes	Yes	Yes	Yes
51	K1+480	45.6	35.2	49.5	45.9	51.2	47.6	52.6	49	51.0	46.3	52.3	47.8	53.4	49.2	60	50	Yes	Yes	Yes	Yes	Yes	Yes
52	K1+500	45.6	35.2	60.5	56.9	62.2	58.6	63.6	60	60.6	56.9	62.3	58.6	63.7	60.0	60	50	0.6	6.9	2.3	8.6	3.7	10.0
53	K1+530	45.6	35.2	59.9	56.3	61.6	58	63	59.4	60.1	56.3	61.7	58.0	63.1	59.4	60	50	0.1	6.3	1.7	8.0	3.1	9.4
54	K1+550	45.6	35.2	48.9	45.4	50.7	47.1	52.1	48.5	50.6	45.8	51.9	47.4	53.0	48.7	60	50	Yes	Yes	Yes	Yes	Yes	Yes
55	K1+735	45.6	35.2	65.8	62.2	67.5	63.9	68.9	65.3	65.8	62.2	67.5	63.9	68.9	65.3	60	50	5.8	12.2	7.5	13.9	8.9	15.3
56	K1+750	45.6	35.2	63.9	60.3	65.6	62	67	63.4	64.0	60.3	65.6	62.0	67.0	63.4	60	50	4.0	10.3	5.6	12.0	7.0	13.4
57	K1+760	45.6	35.2	62.3	58.7	64	60.4	65.4	61.8	62.4	58.7	64.1	60.4	65.4	61.8	60	50	2.4	8.7	4.1	10.4	5.4	11.8
58	K1+950	57.6	52.4	49.2	45.6	50.9	47.3	52.3	48.7	58.2	53.2	58.4	53.6	58.7	53.9	60	50	Yes	3.2	Yes	3.6	Yes	3.9
59	K1+905	57.6	52.4	64.8	61.2	66.5	62.9	67.9	64.3	65.6	61.7	67.0	63.3	68.3	64.6	60	50	5.6	11.7	7.0	13.3	8.3	14.6
60	K1+900	57.6	52.4	54.6	51	56.4	52.7	57.7	54.2	59.4	54.8	60.1	55.6	60.7	56.4	60	50	Yes	4.8	0.1	5.6	0.7	6.4
61	K1+895	57.6	52.4	59.6	56	61.3	57.7	62.7	59.1	61.7	57.6	62.8	58.8	63.9	59.9	60	50	1.7	7.6	2.8	8.8	3.9	9.9
62	K1+935	57.6	52.4	61.4	57.9	63.2	59.6	64.6	61	62.9	59.0	64.3	60.4	65.4	61.6	60	50	2.9	9.0	4.3	10.4	5.4	11.6
63	K1+950	57.6	52.4	62.6	59.1	64.4	60.8	65.8	62.2	63.8	59.9	65.2	61.4	66.4	62.6	60	50	3.8	9.9	5.2	11.4	6.4	12.6
64	K2+35	45.6	35.2	54	50.4	55.7	52.1	57.1	53.5	54.6	50.5	56.1	52.2	57.4	53.6	60	50	Yes	0.5	Yes	2.2	Yes	3.6
65	K2+65	45.6	35.2	61.8	58.2	63.5	59.9	64.9	61.3	61.9	58.2	63.6	59.9	65.0	61.3	60	50	1.9	8.2	3.6	9.9	5.0	11.3
66	K2+100	45.6	35.2	68.7	65.1	70.4	66.8	71.8	68.2	68.7	65.1	70.4	66.8	71.8	68.2	60	50	8.7	15.1	10.4	16.8	11.8	18.2
67	K2+105	45.6	35.2	47.7	44.1	49.4	45.8	50.8	47.2	49.8	44.6	50.9	46.2	51.9	47.5	60	50	Yes	Yes	Yes	Yes	Yes	Yes
68	K2+160	45.6	35.2	60.5	57	62.3	58.7	63.7	60.1	60.6	57.0	62.4	58.7	63.8	60.1	60	50	0.6	7.0	2.4	8.7	3.8	10.1
69	K2+180	45.6	35.2	62.7	59.2	64.5	60.9	65.8	62.3	62.8	59.2	64.6	60.9	65.8	62.3	60	50	2.8	9.2	4.6	10.9	5.8	12.3
70	K2+190	45.6	35.2	44.8	41.2	46.5	42.9	47.9	44.3	48.2	42.2	49.1	43.6	49.9	44.8	60	50	Yes	Yes	Yes	Yes	Yes	Yes
71	K2+265	55.8	53.3	51.1	47.5	52.8	49.2	54.2	50.6	57.1	54.3	57.6	54.7	58.1	55.2	60	50	Yes	4.3	Yes	4.7	Yes	5.2
72	K2+270	55.8	53.3	59.4	55.8	61.1	57.5	62.5	58.9	61.0	57.7	62.2	58.9	63.3	60.0	60	50	1.0	7.7	2.2	8.9	3.3	10.0
73	K2+900	43.1	34.2	58.4	54.9	60.2	56.6	61.6	58	58.5	54.9	60.3	56.6	61.7	58.0	60	50	Yes	4.9	0.3	6.6	1.7	8.0
74	K3+10	43.1	34.2	55.6	52	57.3	53.7	58.7	55.1	55.8	52.1	57.5	53.7	58.8	55.1	60	50	Yes	2.1	Yes	3.7	Yes	5.1
75	K3+220	43.1	34.2	47.1	43.5	48.8	45.2	50.2	46.6	48.6	44.0	49.8	45.5	51.0	46.8	60	50	Yes	Yes	Yes	Yes	Yes	Yes
76	K3+250	43.1	34.2	43.2	39.6	44.9	41.3	46.3	42.7	46.2	40.7	47.1	42.1	48.0	43.3	60	50	Yes	Yes	Yes	Yes	Yes	Yes
77	K3+310	43.1	34.2	47.4	43.9	49.2	45.6	50.6	47	48.8	44.3	50.2	45.9	51.3	47.2	60	50	Yes	Yes	Yes	Yes	Yes	Yes
78	K3+300	43.1	34.2	47.7	44.1	49.4	45.8	50.8	47.2	49.0	44.5	50.3	46.1	51.5	47.4	60	50	Yes	Yes	Yes	Yes	Yes	Yes
79	K3+440	43.1	34.2	50.3	46.8	52.1	48.5	53.5	49.9	51.1	47.0	52.6	48.7	53.9	50.0	60	50	Yes	Yes	Yes	Yes	Yes	Yes
80	K3+410	43.1	34.2	50.9	47.3	52.6	49	54	50.4	51.6	47.5	53.1	49.1	54.3	50.5	60	50	Yes	Yes	Yes	Yes	Yes	0.5
81	K3+350	43.1	34.2	65	61.5	66.8	63.2	68.2	64.6	65.0	61.5	66.8	63.2	68.2	64.6	60	50	5.0	11.5	6.8	13.2	8.2	14.6
82	K3+530	43.1	34.2	47.4	43.9	49.2	45.6	50.6	47	48.8	44.3	50.2	45.9	51.3	47.2	60	50	Yes	Yes	Yes	Yes	Yes	Yes
83	K3+555	43.1	34.2	50.1	46.5	51.8	48.2	53.2	49.6	50.9	46.7	52.3	48.4	53.6	49.7	60	50	Yes	Yes	Yes	Yes	Yes	Yes
84	K3+570	43.1	34.2	54.7	51.1	56.5	52.8	57.8	54.3	55.0	51.2	56.7	52.9	57.9	54.3	60	50	Yes	1.2	Yes	2.9	Yes	4.3

Source: Domestic EIA report

280. **Water pollution**. Stormwater that flows over the ground can entrain debris, waste, petroleum, chemicals, sediments and other pollutants. If prevented by impervious surfaces like asphalt pavements and sidewalks from naturally permeating into the ground, it can transport these pollutants into drainage systems, tributaries, and even directly into rivers, contributing to water pollution. Stormwater runoff can discharge into a roadside drainage systems and then flow into channels and rivers. The following measures will be implemented to minimize the risk of surface water pollution from road surface drainage: (i) routinely collecting and properly disposing litter and debris from sidewalks, driveways, and parking lots; and (ii) cleaning the roadside catch basins before the rainy season to avoid surface water pollution by storm water runoff flushing debris and silt.

281. **Traffic safety.** The proposed LIP road section includes separate pedestrian sidewalks. There are separate lanes for non-motorized traffic. Pedestrian-priority traffic lights, safety islands, crosswalks (zebra lines), and boarding bays/islands will be established at all intersections. Road maintenance vehicles will be equipped with warning lights, and staff will wear safety hats and reflective garments and undergo safety training. Park safety, which covers traffic safety, will also be an important component of the EMS subproject.

282. **Accidental spills.** The haulage of hazardous goods on the proposed LIP road represents a risk to environment and public health. Industrial facilities are also prone to accidental spillage. The applicable PRC standards and regulations related to hazardous goods transportation on roads include the Standard for Hazardous Substances and Major Hazard Installations Discrimination (GBI8218-2000), Classification of Health Hazard Levels from Occupational Exposure to Toxic Substances (GB50844-85), and Rules of Transportation of Dangerous Goods by Automobile (JT3130-88). These include hazardous goods transport vehicles and equipment, packaging and logos, consignment and documentation, consignment acceptance and hand-over, transport, loading and unloading, storage and fire control, labor protection and medical emergency treatment, as well as supervision and management, etc. The national standards will be strictly complied with. An impermeable emergency tank will be provided at the bridge crossing Dasha River to temporary store the polluted runoff should a spill occur.

283. Through the LIP EMS, an emergency preparedness and response (EP&R) plan will be prepared. International and national environmental preparedness and planning consultants will be procured to work with the LIP to define the EP&R program needs as well as necessary emergency response equipment, and perform initial training. The EP&R plan will address all aspects of planning and managing emergencies including the following:

- Establishment of the EP&R planning team and budget;
- Analysis of industrial park hazards and current capabilities to manage risks;
- Conduct of vulnerability analyses to estimate probabilities of various potential emergencies and potential impacts to people, property, business and environment;
- Development of formal plan including priorities, budgets, training, etc;
- Procurement of necessary EP&R equipment based on needs identified;
- Implementation of the plan, including coordination of internal and external stakeholders.

284. The more common elements to be addressed in the LIP EP&R plan will include: (i) fire protection; (ii) hazardous materials incidents; (iii) failure of pollution control and/or spill containment equipment; (iv) natural hazards such as floods, sand storms, draughts, earthquakes; and (v) other technological failures of equipment.

F. Greenhouse Gas Emissions, Climate Variability and Change

285. **Estimated greenhouse gas emissions**. According to the ADB Environment Safeguards - a Good Practice Sourcebook (2012), an environment impact assessment for a proposed project should determine if the project has the potential to emit greenhouse gases listed in the Kyoto Protocol at the rate of 100,000 t of CO2e per year aggregate direct and indirect emissions. The LIP will have many industries locating in the park over the years. Relative to cumulative impacts, the various industries locating in the LIP over the build-out period will also be major consumers of electricity so the indirect GHG emissions from the LIP as a whole will be substantial over time.

286. This project IEE quantifies (i) direct emissions from the facilities within the physical project boundary (basic infrastructure as defined indicate few direct GHG emissions), and (ii) indirect emissions associated with the off-site production of power used by the project. Technically and financially feasible and cost-effective options to reduce or offset project-related GHG emissions during project design and operation have been included to reduce these emissions, including water conservation and wastewater reuse programs, enhancement of energy efficiency opportunities etc.

287. **GHG emissions from water supply and wastewater treatment.** The direct emissions from the water treatment and wastewater treatment facilities within the physical project boundary will be significantly lower than indirect emissions will from electricity consumption. The water supply and wastewater treatment infrastructure is estimated to consume 20.36 GW and 4.35 GW annually at full build-out and 24 hour operations according to the FSR. Electricity in the region is produced by coal-fired generation. This equates to 22,066 t CO_2 annually (assuming the world average emission factor in 2001-2003: 893g CO_2/kWh). This is far below the threshold levels under ADB Environment Safeguards - a Good Practice Sourcebook (2012).[34]

288. **GHG emissions from road component.** CO2e emissions from the road component were screened based on the guidance provided in the Good Practice Sourcebook (2012). For a 6 km long road if the traffic is below 9,000 PCU per day, the emissions will be far below 100,000 tons per year. The traffic volume is estimated to be 3,604 PCU per hour during peak hour, or 8,650 PCU per day, and approximately 3.2 million PCU per year. Assuming CO2 emissions of 130g/km (for trucks) and a traffic volume of 3.2 million PCU per year, the total annual CO_2 emissions will not exceed 2,500-5,000 tons.

289. **GHG reduction and/or offset measures.** This project will support BMG and LMC to develop a comprehensive environmental management system (EMS) for the LIP, and assist LIP moving toward eco-industrial park (EIP) accreditation under national CE and EIP promotion programs coordinated by MEP and NDRC. Qualification criteria for EIP accreditation are defined in Appendix 2, and include production-related emission targets, such as: (i) energy consumption per industrial added value; (ii) industrial water recycling rate; (iii) water reuse rate; (iv) SO_2 emissions per industrial added value, as well as total SO_2 emissions (5,120 tons per year). These measures will significantly contribute to minimize direct and indirect GHG emissions within LIP. The introduction of ITS for Baiyin District will improve traffic conditions and reduce the operation kilometers of public transportation system, thereby reduce traffic related CO_2 emissions. It is estimated in the FSR that the bus vehicle kilometers will reduce from 620,000km (2013) to 570,000km (2020) per day due to the improved bus scheduling system.

290. **Climate variability, projected climatic changes.** There is little agreement whether long term climatic changes will bring about more or less rainfall in the upper Yellow River basin. According to a recently developed ADB/EARD climate change risk screening tool, precipitation is projected to

[34] This is based on good international practice presented in IFC Performance Standard 3: Pollution Prevention and Abatement, in Performance Standards on Social and Environmental Sustainability 2006.

significantly increase in Gansu Province. [35] Potential evapotranspiration (PET) is projected to increase, while runoff and soil moisture are projected to decrease. According to a recent technical review, Yellow River flows and runoff may increase in the short-term while glaciers retreat, but will eventually decrease in the long term.[36] There was little increase of precipitation but substantial recovery of natural runoff in the recent period (2003–2011) compared with the low flow period (1991–2002). The recent precipitation was slightly greater (+2% of the mean annual precipitation in the baseline period of 1960–1990) than precipitation in the low flow period. However, the natural runoff in the recent period was much larger (+14% baseline runoff) than runoff in the low flow period.[37]

291. **Impact of climate change on Yellow River.** Modeling results generated from HadCM3 Global Model under the B2 emission scenario from intergovernmental Panel on Climate Change (IPCC) and Soil and Water Assessment Tool (SWAT) showed that even under a moderate emission scenario, climate change may affect future regional water supply in the basin. It is predicted that the stream-flow at Lanzhou will decrease by 117.05m^3/s (5.8%), 154.08m^3/s (9.0%) and 200.03 m^3/s (12.6%) in the 2020s, 2050s, and 2080s, respectively (**Figure V-11)**.[38]

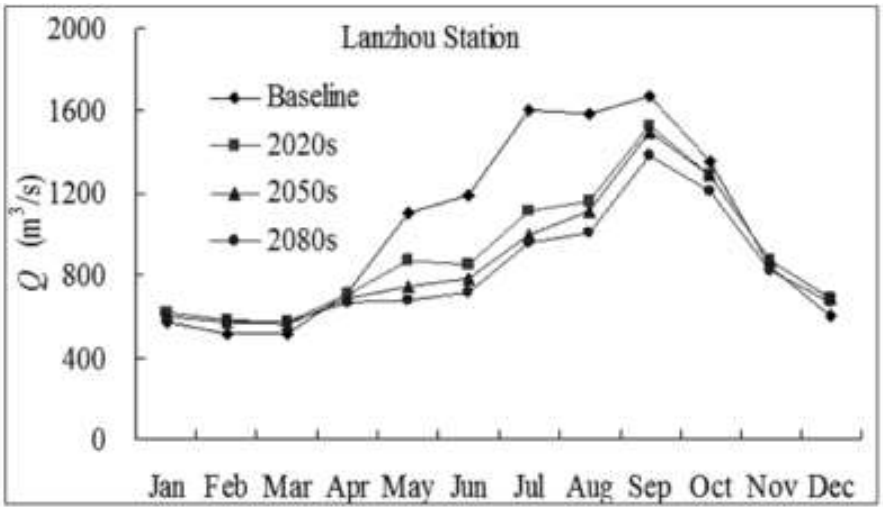


Figure V-9: Modeled changes of stream flow under B2 climate change scenario

292. As indicated in the literature, runoff may increase or decrease depending on the time scale or the model used. Reduced future runoff in the Yellow River could reduce the water availability at the LIP intake structure but the proposed water supply is an extremely small percentage of current low flow conditions in the River. Hydroelectric power production could be affected. In addition, lower flow in the Yellow River will reduce its assimilative capacity for pollutants while the amount of industrial and domestic wastewater discharges are increasing.

293. **Climate variability and change adaptation measures.** The project incorporates a series of climate variability resilience measures, mainly focusing on improving water conservation and water efficiency. The effluent from the LIP WWTP will be used for landscape irrigation and industrial reuse. This will raise resilience to climate change in the water sector by reducing demand for potable water. Qualification criteria new industries as well as for EIP accreditation (which is targeted by LIP and

[35] C. Yeager and H. Zhou. 2014. EAER Staff Guidance. Assessing Climate Change Risks in PRC and Mongolia. February 2014.
[36] The impacts of climate change on water resources and agriculture in China, Shilong Piao et al, Nature, September 2010.
[37] Responses of natural runoff to recent climatic changes in the Yellow River basin, China, Y. Tang et al, Hydrol. Earth Syst. Sci. Discuss., 10, 4489–4514, 2013
[38] Xu, Z et al. Response of stream flow to climate change in the headwater catchment of the Yellow River basin. Quaternary International 208: 62-75

supported by the project) include targets and indicators which clearly aim at increasing the LIP's resilience to future climatic changes, including but not limited to: (i) limiting fresh water consumption per industrial added value (less than 9 m3/10,000 CNY); (ii) defining minimal water reuse rate (at least 40%) and industrial water recycling rate (at least 75%). Climate change resilience will also be increased through improved irrigation practices. As described earlier, Liuchuan Irrigation District is one of the national level demonstration districts for irrigation water saving techniques. By 2020, some 48,000 *mu* of water saving irrigation facilities will be completed, significantly improving water use efficiency. A review of LIP performance and the proposed development plans beyond the approved 50-km^2 is recommended at project completion stage to ensure resource use efficiency and sustainability, also accounting for mid- to long-term climate risks.

G. Cumulative Impacts during both Construction and Operation

294. The potentially significant cumulative impacts identified in the domestic EIA are potential contamination of surface water, soil and groundwater as a combined result of construction activities and improper environmental management within LIP industries. The significance of these potential cumulative impacts will depend on whether each of the project components is designed and constructed and operated in line with environmental best practices and the EMP, as well as how well the environmental management system (EMS) is implemented by the LMC and the degree of compliance in tenant industries. This project includes environmentally friendly orientation and training to ensure that BPMO, LMC and contractors are aware of their environmental responsibilities and are provided guidance on implementation to help ensure that the project's adverse cumulative impacts on local environment and residents' daily life are minimized and acceptable. The EMS subcomponent will move the LIP toward eco-industrial park status which will indicate successful mitigation of these potential impacts.

295. The changes in land use and population density by the proposed LIP project will contribute to cumulative effects on ambient environment as a result of increased emissions, noise, GHG emissions, water and energy consumptions and increased solid waste and wastewater generation and management requirements, contributing to local, national and global pressures on resources and services. The water supply and wastewater management components of the project will provide centralized systems to the LIP which will mitigate concerns over water supply and wastewater. The EMS will help the LIP to develop sustainable waste management systems and work toward reduced emissions and improved water and energy conservation programs.

VI. ANALYSIS OF ALTERNATIVES

296. During the project preparation, various alternatives have been proposed, screened against technical, economic, energy efficiency, as well as environmental criteria. In terms of the environmental consideration for the alternatives, the primary objective was to identify and adopt options with the least adverse environmental impacts and maximum environmental benefits.

A. No-Project Alternatives

297. The without-project scenario would result in inadequate mobility and transportation infrastructure in the LIP. The without-project alternative would weaken the LIP attractiveness to outside investors and industries, impede LIP development and economic growth, as well as slow down the improvement of living standards of their residents. The provision of safe and reliable water supply is a critical component to the success of the LIP. It is a basic infrastructure for LIP's development. The LIP cannot utilize any existing water supply system. Without the proposed wastewater collection and treatment system, large volume of wastewater would be continuously discharged into adjacent surface water bodies, resulting in continued pollution of groundwater, surface water and soil, and deterioration of the river ecosystem. The no-project alternative is also discussed in detail in the section of Project Justification and Rationale in Chapter III of this project IEE, where the current situation is described. The project justification outlines the need for water supply, wastewater and road infrastructure.

B. Alternatives for road subcomponent

298. **Road Alignment.** The entire traffic network of the LIP was analyzed and the capacity of each type of roads and bridges was adjusted by factors of lane width, number of lanes, distance between intersections, and traffic mix. Much of the road network is being financed by local sources and the proposed road fills a major gap in the interconnected network. Based on the adjusted carriageway capacity and the projected flows for 2030, the proposed Xihuan Road can be justified as a dual 3-lane road.

299. **Road Cross Section.** The selection of the road cross section is based on the road classification and the volume of traffic. The proposed road is a dual 3-lane 24 m wide carriageway and with provision of non-motorized vehicle lane and sidewalk. Alternative analysis has been carried out to optimize lane configurations. For option one, the overall right of way width is 50 m which is made up of 6 m sidewalk + 5 m non-motorized vehicle lane (NMV) + 2 m divider + 24 m carriageway (two-way) + 2 m divider + 5 m NMV + 6 m sidewalk. For option two, the overall right of way width is 50 m, which is made up of 5 m sidewalk + 5 m NMV + 2 m divider + 12 m carriageway (one-way) + 2 m median divider +12 m carriageway (one-way) +2 m divider + 5 m NMV + 5 m sidewalk. Option one is recommended for the reason that it would save space and investment. Given the relatively low traffic volume, this lane configuration is considered adequate.

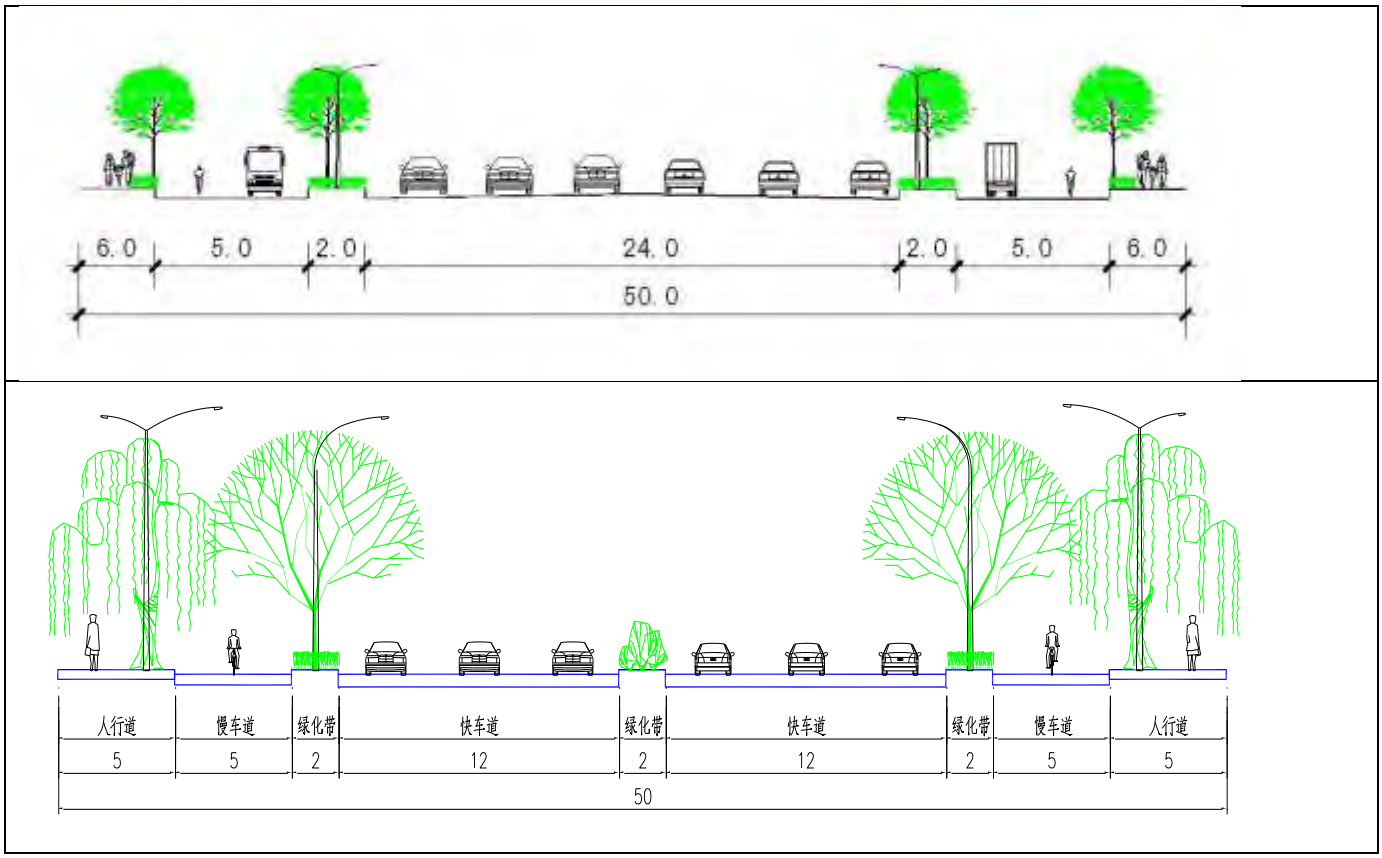


Figure VI.1: Alternative cross-section designs for the Xihuan Road

300. **Road pavement alternatives.** Due to local deep frost soil, thicker sand and gravel base courses are adopted to prevent frost heave. A comparison was made between cement concrete and asphalt concrete surface pavement. Asphalt concrete pavement was recommended because it is relatively easy to be applied and repaired. In addition, it will be more appropriate for use in the local weather condition and to a certain extent it reduces road traffic noise in comparison with rigid concrete pavement.

C. Alternatives for Water Supply Component

301. **Water Source.** The proposed water source is the Yellow River which is administered by the Yellow River Conservancy Commission (YRCC). There is no alternative surface water source within the county, and groundwater resources are insufficient to cover the LIP demand. The proposed abstraction has been approved and will remain within the county allocation quota for use of the Yellow River.

302. **Water Intake System**. The proposed intake and raw water pumping station will be located on the left bank of the Yellow River at Santan Village. The intake will take water directly from the river through a trash rack and filter to protect the pump impellers from dirt, debris, and ice. There will be 3 inlet gates for 2020 and 4 additional for 2030. The design will retain the design of the existing Santan intake. The intake pump station is located about 20 m upstream from the previous pump station because (a) the location is close to the main water flow, the river bed is stable, the flow rate is large, and the riverside is strong; (b) the water quality is good for the industrial and domestic use; and (c) coordination of staffing, operation, and management with the Pump Station located on the opposite

side of the Yellow River that serves the WTP in Pingchuan County. Based on the water intake situation over the past 40 years, this location is reasonable and reliable and no other better locations have been identified.

303. **Raw Water Pumping System**. The Preliminary WTP is about 130 m lower elevation than the main WTP in the LIP so the LDI evaluated two options for pumping water from the preliminary treatment plant to the main water treatment plant located in the LIP: (i) single-stage booster pump station with design lift of 146 m and equipped with three sets of horizontal, single-stage, double-suction centrifugal pumps with two operating and one standby; and (ii) two booster pump stations, each with a design head of 63 m and each equipped with three sets of horizontal, single-stage, double-suction centrifugal pumps 2+1 operating mode. The annual operating costs for the two options are almost the same but the capital construction is about CNY1.6 million less for one station rather than two. As a result, option (i) was selected.

304. **Preliminary Water Treatment Plant**. The LDI evaluated three types of sedimentation tanks, including: (i) radial flow sedimentation tank; (ii) advection sedimentation tank; and (iii) inclined tube sedimentation tanks. All are suitable for gravity settling or chemical coagulation. The radial flow sedimentation tank has a large volume enabling easy adaption to changing water quality and has been widely used for treating water from the Yellow River. As a result, the radial flow sedimentation tank has been selected. In terms of coagulant for water pre-treatment, poly-aluminum has been selected. Advantages of poly-aluminum compared to aluminum sulfate include (i) low levels of residual aluminum in the treated water; (ii) effective at low raw water temperatures; (iii) less sludge produced at an equivalent dose; and (iv) lower doses are required to give equivalent results.

305. **Main raw water transmission pipeline.** Steel, ductile iron, pre-stressed concrete, and fiberglass reinforced plastic pipe were considered for the water transmission pipeline (DN 1200). Steel pipe was selected because of engineering safety considerations, as well as successful experience from other projects. In terms of route selection, the straight distance from the preliminary WTP to the secondary WTP is about 10 km. However the route selected is not the shortest (straight-line) distance in order to avoid going through unfavorable terrain and take full advantage of the geological conditions. The basis for selecting the pipeline route with the lowest construction cost involved consideration of these principles: (i) select the shortest routes as much as possible; (ii) the layout should be as straight as possible, minimize pipeline turns, lower the pipeline water pressure (head), and decrease the construction and operation cost; and (iii) minimize number of river, railway, highway crossings, and try to avoid any unfavorable geological conditions.

306. **Secondary Water Treatment Facilities.** The secondary water purification plant is located inside the LIP with a total area of 10 hectares (150 *mu*). The location was selected for the following reasons: (i) close to the water distribution network inside the LIP; (ii) geological foundation and bearing capacity is good; iii) the location is convenient for construction and operation management; and (iv) convenient discharge conditions. Disinfection is by liquid chlorine due to wide application, mature technology, and low cost. Ultra-Violet (UV) was considered but rejected due to high investment, short operating life, and high maintenance costs during operations. Solids dewatering options reviewed included drying beds, vacuum filter, belt filter press, filter press and centrifuge. Based on this review, the solids from sedimentation tanks and filter backwash will go to a sludge conditioning tank for gravity settling and concentration. Then the solids will go through one of two sets of horizontal spiral centrifuge and ancillary screw conveyor for dewatering processes, i.e. one operating and one stand-by. The resulting “sludge cake” will be transported for landfilling.

D. Alternatives for Wastewater Collection and Treatment

307. **Wastewater Treatment Process.** Since WWTP effluent will be reused for landscape irrigation and industrial production, the WWTP will be designed to produce Class 1A wastewater. The LDI evaluated three secondary wastewater treatment processes: (i) A2O (anaerobic-anoxic-oxic); (ii) CASS (Cyclic Activated Sludge System), and (iii) BAF (Biological Aerated Filter). All three are biological wastewater treatment processes and their selection for consideration is based on the premise that the industries in the LIP will pre-treat their wastewater in accordance with PRC Standard CJ343 - 2010: Wastewater Discharges into Urban Sewerage Networks which sets discharge limits for 35 parameters including pH, heavy metals (10), COD, Ammonia Nitrogen, etc. all which can be toxic to the micro-organisms used in biological wastewater treatment. Based on the alternative analysis, the G-BAF system was selected. LDI identified these advantages for BAF compared to A2O and CASS: (i) no need for secondary clarifiers which reduces land requirements and capital costs; (ii) no return activated sludge making operations easier; (iii) produces less noise and less odor; and (iv) more stable at low temperatures.

308. **Sludge treatment and disposal**. For WWTP sludge treatment (dewatering), three mechanical methods were evaluated including plate and frame filter press, belt filter press and centrifuge. The plate and frame filter press was recommended. For sludge disposal, alternatives assessed included incineration (waste-to-energy), sanitary landfill, and composting with municipal solid waste. A waste to energy power plant is under construction in Baiyin. It is expected to be completed by 2016. Currently, the municipal solid waste generated in Baiyin is about 697 tons per day. The capacity of the incineration plant is only 600 tons. The facility will not have sufficient capacities to receive the sludge from the proposed WWTP and is not considered a viable option. A municipal waste composting project is under preparation for Baiyin municipality and may become a suitable alternative for sludge co-processing if successful. Meanwhile, the only viable solution is disposal in a sanitary landfill. The LIP has received an agreement from the operator of new Jingyuan County Landfill No. 2 under construction, that allows the WWTP sludge to be disposed in the new landfill. The domestic EIA recommended landfill disposal mainly on the basis of other WWTPs in the PRC and the sludge quality problems in these facilities. However the LIP will require industries to pre-treat their wastewater prior to discharge into the sanitary sewer. Industries will be monitored by the Baiyin Environmental Protection Bureau (BEPB) by in-line monitors at the point of discharge and by periodic sampling and laboratory analysis. If the LIP pretreatment system is successful in maintaining good operations of the industrial pretreatment systems and the LIP WWTP operates properly, the beneficial reuse of the sludge will also be considered in the future.

309. **Odor control.** For wastewater odor control, the LDI examined the methods for odor control including (i) water cleaning and chemical cleaning; (ii) activated carbon adsorption; (iii) ozone oxidation; (iv) soil deodorization; (v) microbiological deodorization method; and (vi) combustion. The LDI selected the microbial deodorization processes as the most cost-effective. If additional deodorization is needed, then an activated carbon absorption tower can be added.

310. Relative to **wastewater effluent reuse**, the LIP plans for 100% reuse of WWTP effluent for landscape irrigation and industrial reuse. A distribution system and tanker trucks will initially be procured to transport the treated effluent for landscape irrigation with industrial reuse systems developed by the industries located within the LIP.

VII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Legislative Framework for Public Consultation and Information Disclosure

311. Meaningful public participation and consultation in the evaluation of project planning, feasibility study, design and implementation is an important environmental safeguards' requirement; it can directly reflect the public's perceptions on environmental quality in the project's area of influence.

312. Relevant provisions in the Environmental Protection Law of PRC and the Regulations on the Administration of Construction Project Environmental Protection (Order of the State Council, No. 253) require that domestic environmental impact assessments shall solicit the opinions of units concerned and inhabitants of a proposed project construction site. The PRC National Development and Reform Commission (NDRC) issued a requirement for "Social Risk Assessment of Large Investment Projects" in August 2012, which emphasizes the importance of public consultation in an effective manner, and requires that the results of public consultation are clearly summarized in the domestic safeguards reports, including the dates of consultations, number of stakeholders, who the stakeholders are, and the comments received.

313. ADB's Safeguard Policy Statement (2009) also has detailed and strict requirements on meaningful participation, consultation and information disclosure. The consultation process for this project therefore followed both the PRC requirements and the ADB requirements.

B. Information Disclosure and Public Consultation to Date

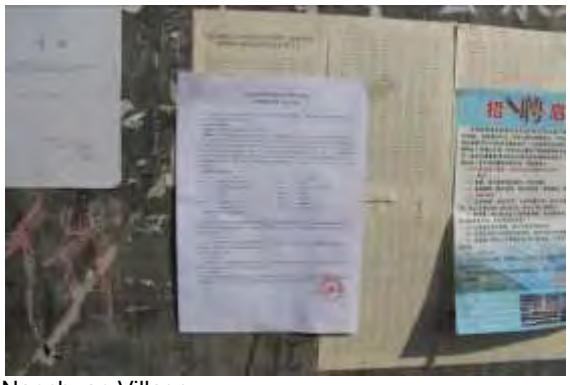
314. Two rounds of information disclosure for the proposed project were conducted by the EIA institute, which are illustrated in **Figure VII-1.**

Figure VII-1: First round of project information disclosure in Baiyin Daily (24/12/2013)

315. The first round of information disclosure was done seven days after the EIA institute was appointed. The first round disclosure was designed to solicit public comments and suggestions on the project and on the terms of reference for the EIA. The contact details of the LMC, the EIA institute and the local EPBs, major procedures and scope of the EIA, and main aspects and approaches for public

consultation were presented on posters as well as in the local newspaper (Baiyin Daily, 24 Dec 2013 edition). The second round of information disclosure was undertaken once the draft FSR and EIA report were available. The purpose was to solicit public comments on the preliminary findings of the EIA, which were disclosed on information boards at different project locations (**Figure VII-2**).

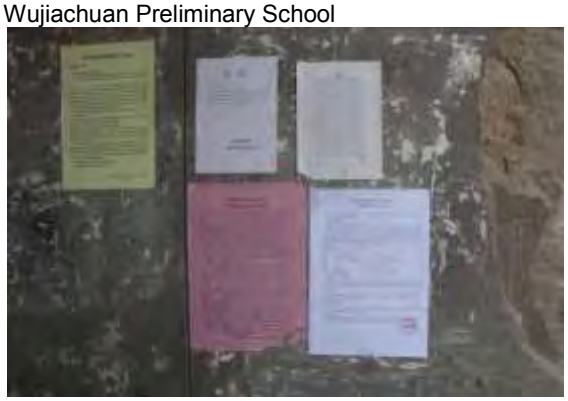
LMC


Nanchuan Village

Nanshanwei Village

Wujiachuan Preliminary School


Rare Earth Company


Xintian Village

Source: Domestic EIA report

Figure VII-2: Community Information Posters

316. In addition, a summary of the DEIA was disclosed on the website of Gansu Provincial Environmental Protection Department (GEPD) on 9th April 2014 (**Figure VII-3**). Contact information (address, fax, email address and telephone number of the GEPD) was provided on the website. The public was invited to provide feedback to GEPD within 10 working days after disclosure.

Figure VII-3: Information disclosure by Gansu Provincial Environmental Protection Department

C. Public Consultation

317. **First round of consultation**. A total of 120 questionnaires were distributed by the EIA Institute to 115 affected persons (APs) from different age groups and educational backgrounds, as well as to 5 project affected organizations (**Table VII-1**). Of these, 118 questionnaires were returned (114 APs and 4 organizations) with a return rate of 98.3%. The survey result is summarized in **Table VII-2**.

Table VII-1: Respondents of 1st Round of Questionnaire Survey

APs Consulted	Basic Information of the Consulted APs		No. of Respondents	Percentage (%)
	Age Group	＜30	7	6.1
		30 - 45	57	50
		≥46	50	43.9
	Educational Background	Secondary and below	74	64.9
		High school and College	36	31.6
		College degree or above	4	3.5
Organizations Consulted	4 organizations returned the questionnaires: Nanshanwei Village Committee, Nanchuan Village Committee; Wujiachuan Preliminary School; Xintian Village Committee			

Source: Domestic EIA report

Table VII-2: Results of 1st Round of Questionnaire Survey

No.	Question	Options	No. of Respondents	Percentage (%)
1	Did you hear about this project prior to this consultation?	Yes	105	92.1
		Don't know much about	5	4.4
		No	4	3.5
2	What do you think about the current environmental status of the project site?	Very good	78	68.4
		Good	15	13.2
		Normal	10	8.8
		Bad	2	1.8
3	What do you consider the major current environmental issues	Air pollution	29	25.4

No.	Question	Options	No. of Respondents	Percentage (%)
	in the project area?	Water pollution	12	10.5
		Noise pollution	14	12.3
		Sanitation	19	16.7
		Others	48	42.1
4	Do you think this project will be helpful to improve the local environment?	Improved	69	60.5
		Little impact	44	38.6
		Have negative impact	0	0.0
5	Which of the following will be major environmental issues during construction?	Noise	68	59.6
		Construction dust	24	21.1
		Construction solid waste	6	5.3
		Land occupation	25	21.9
		Construction wastewater	9	7.9
		Traffic management	12	10.5
		Eco-environment	7	6.1
		Other (specify)	4	3.5
6	Which of the following will be major environmental issues during operation?	Noise	29	25.4
		Air pollution	54	47.4
		Sewage	8	7
		Solid waste	13	11.4
		Other (specify)	22	19.3
7	To mitigate the negative environmental impact, the EIA report proposes measures to mitigate environmental impacts (see the disclosed outline of the EIA report). Are you satisfied with the measures described?	Satisfied	105	92.1
		Not sure	9	7.9
		Not satisfied	0	0.0
8	Do you think the project will be beneficial to local social and economic development?	Beneficial	104	91.2
		Not sure	10	8.8
		Not beneficial (specify)	0	0.0
9	If all the mitigation measures are implemented effectively, what is your attitude towards the project?	Support	110	96.5
		Don't mind	4	3.5
		Not support (specify)	0	0.0
10	Do you have any other comments towards the proposed project?	Hope the government can increase the inputs to the development of LIP.		

Source: Domestic EIA report

318. If the mitigation measures are effectively implemented, 98.5% of the consulted APs support the project, while 3.5% are not sure. 91.2% of the consulted APs believe that the proposed project will contribute to the socio-economic development of the region. 100% of the consulted organizations support the project. Major concerns raised by the public include: (i) noise during construction; (ii) air pollution during operation. 19.3% of the consulted APs were unclear or thought no significant adverse environmental impact during operation.

319. **Second Round of Consultation.** Public consultation meetings were undertaken by the EIA Institute together with the PPTA Environmental Consultant on 16th Jan 2014 under the support of LMC. Representatives from residents near the construction sites (17 participants) and Jingyuan County EPB officers attended the meeting. During the consultation meeting, LMC and the EIA institute introduced the project and environmental mitigation measures defined in DEIA and this IEE to the participants. All participants provided supportive responses to the proposed project. Questionnaires were also distributed to the participants during the consultation meeting. 100% of the APs and stakeholders supported the project. They believe the project will significantly improve the local infrastructure conditions and ensure reliable water supply, and improve Dasha river water quality. Suggestions and comments raised during the consultation meeting included the following: (i) develop sustainable and reasonable long term development plan of the LIP; (ii) introduce low pollution industries to protect the

regional environment; and (iii) make reasonable construction arrangement to minimize the negative environmental impacts.

D. Future Information Disclosure and Public Consultation Program

320. Information disclosure and public consultation relating to environment safeguards will continue throughout project implementation. The project's environmental information will be disclosed by the provincial Environmental Protection Department (EPD), local EPB and ADB as follows:

a) A summary of the domestic EIA report in Chinese will be disclosed on the local governments' websites for more than fifteen (15) days before the EIA report approved by provincial EPD;
b) Copies of the domestic EIA (in Chinese) are available on request in both the Municipal EPB and county EPB;
c) The project IEE will be disclosed on the project website at www.adb.org;
d) All environmental monitoring reports during project implementation will be available at www.adb.org;
e) In accordance with the Interim Provisions on Public Participation in EIA in Gansu Province, the EA will appoint 2-3 community representatives as environment supervisors. Three villagers from Nanshanwei Village, Nanchuan Village and Xintian Village have been selected (names not published here). The environment supervisors will perform supervision duty during construction and operation of the project facilities, and accompany the loan implementation consultant (LIC) and the LMC during periodic construction site visits and public consultations.

VIII. GRIEVANCE REDRESS MECHANISM

A. Introduction

321. A grievance redress mechanism (GRM) will be established to address community concerns and complaints related to safeguards issues. Besides issues related to land acquisition and resettlement, grievances will most likely include disturbance of traffic; dust emissions; construction noise; soil erosion; inappropriate disposal of waste materials; damage to private property; safety measures for the protection of the general public and construction workers; or water quality deterioration. The GRM will be accessible to diverse members of the community and stakeholders. Multiple points of entry, including face-to-face meetings, written complaints, telephone conversations, or e-mail, will be available.

322. The BPMO will establish a single Project Public Complaint Unit (PPCU). The PPCU will instruct contractors and construction supervision companies (CSCs) if people complain about the project. The PPCU will coordinate with the county EPB and municipal EPB and other government divisions, if necessary, and will be supported by the Loan Implementation Environmental Consultant (LIEC), hired under the Project Implementation Consultant Support (PIC). The PPCU will establish a GRM tracking and documentation system, including procedures to retrieve data for reporting purposes to the BPMO and ADB.

323. The contact persons for different GRM entry points, including contractors, CSC, LMC, county and municipal EPB, will be identified prior to construction. The contact details for the entry points (phone numbers, addresses, e-mail addresses) will be publicly disclosed on information boards at construction sites and on the website of the county and municipal EPBs. The chart of proposed GRM is shown in **Figure VIII-1**.

324. Once a complaint is received and filed, the PPCU will identify if complaints are eligible. Eligible complaints include those where (i) the complaint pertains to the project; and (ii) the issues arising in the complaint fall within the scope of environmental issues that the GRM is authorized to address. Ineligible complaints include those where: (i) the complaint is clearly not project-related; (ii) the nature of the issue is outside the mandate of the environmental GRM (such as issues related to resettlement, allegations of fraud or corruption); and (iii) other procedures are more appropriate to address the issue. Complaints illegible to the project or the environmental GRM will be recorded and passed onto relevant authorities. If an eligible complaint is rejected, the complainant will be informed of the decision and the reasons for rejection.

B. Step-by-Step GRM Procedure

325. The **procedure and timeframe** for the grievance redress mechanism are described as follows (**Figure VIII-1**):

Stage 1: If a concern arises during construction, the affected person (AP) will submit a written or oral complaint to the contractor directly. Whenever possible, the contractor will resolve the issue directly with the AP. The contractor shall give a clear reply within five (5) days. If successful, the contractor will inform the PPCU accordingly.

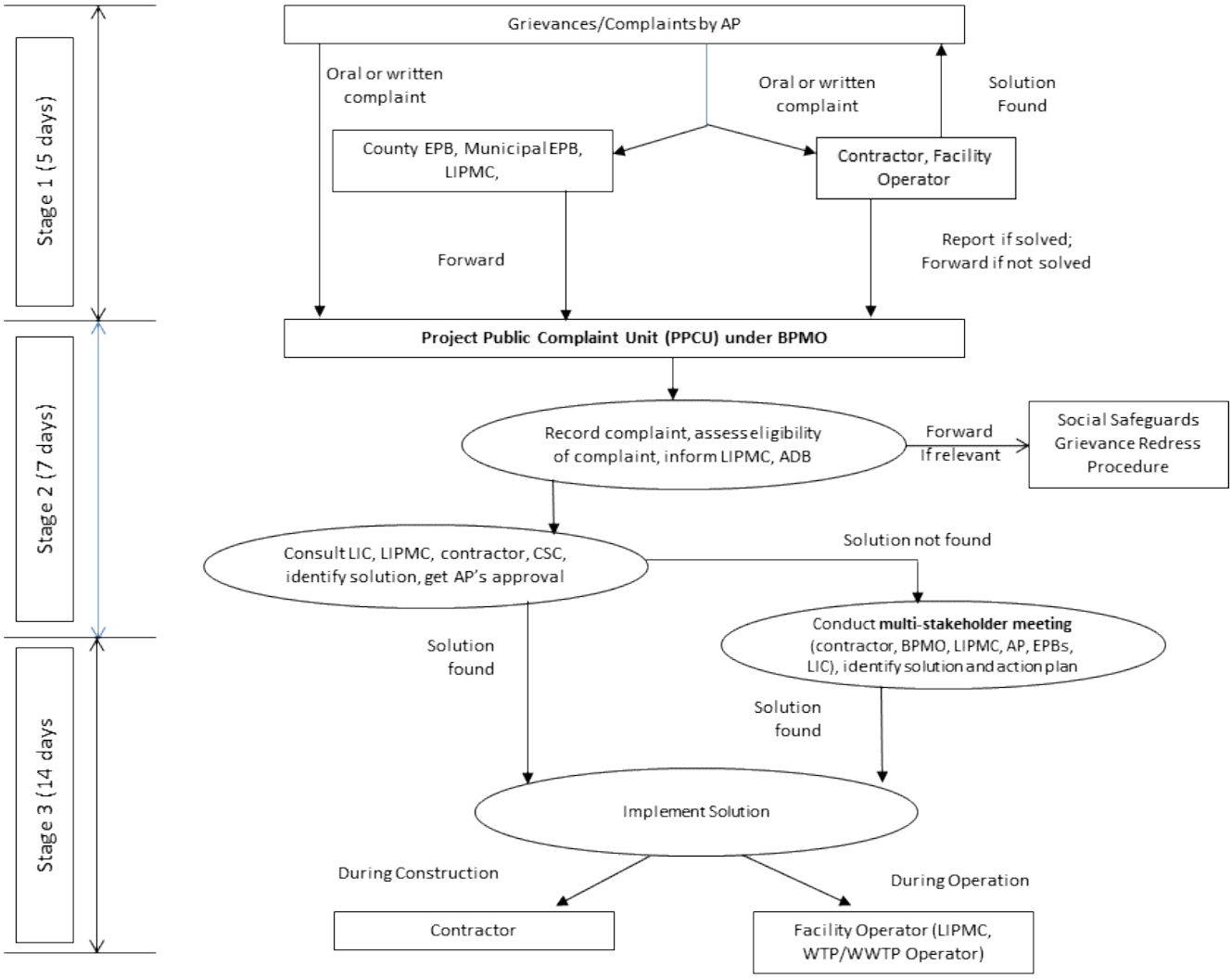
Stage 2: If no appropriate solution can be found after the Stage 1 process applied (i.e., after 5 days), the contractor has the obligation to forward the complaint to the PPCU. The AP may also decide to submit a written or oral complaint to the PPCU, either directly or via one of the GRM entry points. For an oral complaint, proper written records must be made. The PPCU will assess the eligibility of the complaint, refer complaints related to land acquisition and resettlement to the

respective mechanism, identify the solution and provide a clear reply for the complainant within five (5) working days. The LIEC will assist the PPCU in replying to the affected person, if needed. The PPCU will also inform the ADB project manager and submit all relevant documents. Meanwhile, the PPCU will timely convey the complaint/grievance and suggested solution to the contractors or LMC, and facility operator. The contractors during construction and the facility operator during operation will implement the agreed upon redress solution and report the outcome to the PPCU within seven (7) working days.

Stage 3: In case no solution can be identified by the PPCU, or the complainant is not satisfied with the proposed solution, the PPCU will organize, within two (2) weeks, a multi-stakeholder hearing (meeting) involving all relevant stakeholders (including the complainant, contractor, county and municipal EPB, LMC, BPMO). The hearing shall identify a solution acceptable to all, and formulate an action plan. The contractors during construction and the facility operator during operation will implement the agreed-upon redress solution and report the outcome to the PPCU within the agreed upon timeframe.

326. The PPCU shall accept the complaints/grievances lodged by the AP free of charge. Any cost incurred should be covered by the contingency of the project. The grievance procedures will remain valid throughout the duration of project construction and until project closure. This GRM procedure is consistent with the requirements of the RP grievance procedures but there are a few minor differences in methodology.

Figure VIII-1: Proposed Grievance Redress Mechanism (GRM)



Note: AP = affected person; EPB = environmental protection bureau; PPCU = public project complaint unit; LIEC = loan implementation environmental consultant; BPMO = Baiyin municipal project management office; CSC = construction supervision company; LMC = Liuchuan Industrial Park Management Committee.

IX. ENVIRONMENTAL MANAGEMENT PLAN

327. An environmental management plan (EMP) has been prepared for the project. It is an essential document to ensure the implementation of mitigation measures. The full EMP is presented in **Appendix 1**, and will be attached to the Project Administration Manual (PAM) of the project.

328. The EMP is based on the domestic EIA report, feasibility study report (FSR), and draws on the findings of the IEE, PPTA and ADB review mission discussions and agreements with BPMO, LMC, and consultations with municipal and county EPBs, as well as other relevant government agencies and local communities.

329. The EMP defines (i) institutional arrangement and responsibilities for EMP implementation; (ii) summary of impacts and mitigation measures (iii) environmental monitoring and inspection plan; (iv) institutional strengthening and training plan; (v) reporting requirements; (vi) public consultation plan; (vii) cost estimates, and (viii) mechanism for feedback and adjustment. The EMP will be reviewed and updated at the end of the detailed design, as needed. The EMP will also be included as separate annex in all bidding and contract documents for Component 1. Contractors will be required to develop site-EMPs that are full responsive to the EMP.

X. CONCLUSION

A. Anticipated environmental impacts and mitigation measures

330. During the preparation of the domestic FSR, the EIA and this project IEE, potential environmental impacts were carefully assessed and addressed. All components have undergone the EIA process under the PRC laws and regulations. A consolidated domestic EIA Report was prepared by Lanzhou University, reviewed by the expert panels, and approved by Gansu Provincial EPD.

331. Major safeguards issues during construction include significant earthwork and soil erosion; permanent and temporary acquisition of land and residents resettlement, noise pollution, air pollution, surface water pollution, inadequate construction waste management, and occupational and community health and safety. Overall, construction-related impacts are localized, short term, and can be effectively mitigated through the application of good construction and housekeeping practices and implementation of construction phase community and occupational health and safety plans. Appropriate mitigation measures and monitoring programs have been developed to address these issues.

332. The main potential adverse impacts during operation of the project facilities include improper operation of water and wastewater treatment facilities, traffic noise and air pollution at some sensitive areas along the constructed roads. Sludge disposal at both the WTPs and WWTP will require careful management and oversight. Noise and air quality predictions indicate that they will have minimal impact on these media, even in the long term.

333. The impact of water extraction on regional water resources has been assessed through regional water balance analysis in the context of the Yellow River water allocation plan. The assessment confirmed that the Yellow River water extraction rate for the project's water treatment plant will remain within the approved extraction quota for Jingyuan County. The amount proposed to be withdrawn will thus not exceed 1 percent of the Yellow River at maximum extraction rate and minimum flow.

334. The potential concern that the project may induce uncontrolled industrial development within LIP has been addressed through the conduct of a planning EIA for the LIP, which was approved by the Gansu Province EPD in 2012. The planning EIA concludes that the LIP is feasible from an environment point of view, but defines clear requirements to safeguard the environment during LIP development and operation, including: (i) industries introduced to the LIP must comply with national industry development policy, clean production and circular economy, promoting resource use efficiency; (ii) the introduction of high water consuming industries must be strictly controlled; (iii) an EIA including water resources assessment is a pre-requirement for each enterprise planning that enter the park; (iv) each enterprise in the park as well as the LIP as a whole, must avail of emergency preparedness and response plans; and (v) the LIP should establish an environmental protection division and develop strict environmental management and supervision procedures and plans. These requirements will be complied with through the establishment of an environment management system (EMS) for the LIP. The EMS subcomponent will work to ensure that environmental management of the LIP is performed to international best practices and move that LIP into ISO14001 certification as well as "eco-industrial park" (EIP) status under the Ministry of Environment and NDRC programs. The EMS component under the project will have a budget of CNY 2.6 million ($430,000), which will provide support for: (i) developing environmental management and early response policies and procedures for LIP and LMC, targeting ISO 14001 certification by 2018; (ii) strengthening supervision, monitoring and reporting of environmental activities in the LIP, including basic equipment, environmental management information system (EMIS), emergency preparedness and response, and training; (iii) developing a road map for national EIP accreditation by MEP or NDRC by 2025.

335. Relative to Climate variability and change, Yellow River runoff is expected to decrease

(moderate level of confidence). Reduced future runoff in the Yellow River could reduce the water availability at the LIP intake structure, but the proposed water supply is an extremely small percentage of current low flow conditions in the River. The project incorporates a series of climate variability and change adaptation measures, mainly focusing on improving water conservation and water efficiency. The effluent from the LIP WWTP will be used for landscape irrigation and industrial reuse. This will increase resilience to climate change in the water sector by reducing demand for potable water. Qualification criteria new industries as well as for EIP accreditation (which is targeted by LIP and supported by the project) include targets and indicators which clearly aim at increasing the LIP's resilience to future climatic changes, including but not limited to: (i) limiting fresh water consumption per industrial added value (less than 9 m3/10,000 CNY); (ii) defining minimal water reuse rate (at least 40%) and industrial water recycling rate (at least 75%). Resilience to climate variability and change will also be increased through improved irrigation practices. As described earlier, Liuchuan Irrigation District is one of the national level demonstration districts for irrigation water saving techniques. By 2020, some 50,000 *mu* of water saving irrigation facilities will be completed, significantly improving water use efficiency.

336. Mitigation measures and a monitoring program were defined for all identified impacts, and are included in the EMP of the project IEE. The EMP sets out the procedures and plans to carry out mitigation measures and monitoring during sequential stages of the project including pre-construction, construction and operation. It consists of two major plans, one for implementing mitigation measures and the other for conduct environmental monitoring. For each impact, appropriate mitigation measures are described. Monitoring and supervision will be undertaken to ensure that environmental impacts will be minimized to acceptable levels.

337. The BPMO will have main EMP coordination responsibility. BPMO will appoint an environmental management lead (EML) to coordinate environmental issues associated with each infrastructure component, subcomponent and contract package. The EML will take charge of (i) coordinating the implementation of the EMP and developing implementation details; (ii) supervising the implementation of mitigation measures during project construction and operation; (iii) ensuring that environmental management, monitoring, and mitigation measures are incorporated into bidding documents, construction contracts and operation management plans; (iv) submitting annual EMP monitoring and progress reports to ADB; (v) coordinating the local grievance redress mechanism (GRM); and (vi) responding to any unforeseen adverse impact beyond those mentioned in the DEIA, the project IEE and the EMP. The EML will be technically supported by the loan implementation environment consultant (LIEC) and they will jointly check the overall implementation of environmental management provisions of the EMP.

B. Risks and Assurances

338. Environmental risks, and the assurances required to address these risks, have been identified during IEE. The majority of environmental risks relate to design features and operational plans which will avoid or mitigate impacts, but which rely on the implementers' commitment and capacity to implement and consistently follow-up. The remainder relate to the likelihood of unexpected negative impacts. The major risks are listed below:

i. Failure of the LIP industries to comply with the industrial wastewater pretreatment standards;
ii. Failure to establish water source protection zone at the Yellow River water extraction point;
iii. Failure to complete the treated effluent reuse scheme allowing 100% wastewater reuse within LIP;
iv. Inadequate capacity of the executing agency and LMC in environment management, which could result in inefficient project and EMP implementation; and

v. Inadequate environment, health, and safety procedures in the LIP.

339. Commitments by the executing agency and the LMC will be incorporated into the loan documentation as loan covenants to ensure that the measures are implemented in a timely and complete fashion, including (i) a commitment to achieve 100% re-use of the treated effluent from the WWTP for landscape irrigation (including construction of a reuse pipeline network by 2019), and to explore opportunities for beneficial WWTP sludge reuse, (ii) a commitment to establish source protection zone at the water extraction works of the WTP, and (iii) a commitment to develop an environment management systems (EMS) for the LIP including ISO14001 certification.

340. The overriding assurance required is that the executing agency and the local government bodies as appropriate will ensure that the full range of effective measures set out in the project IEE and EMP are undertaken, and guarantees that the environmental management provisions and the environmental monitoring plan will be implemented effectively during project implementation, and that the implementation reports of the environmental management and monitoring plan in accordance with ADB requirements will be submitted in a timely fashion. Part of this monitoring and management commitment will be a commitment to implement and maintain an appropriate GRM. The assurance also will cover re-use of treated wastewater, appropriate treatment and disposal of wastewater sludge.

C. Conclusion

341. The project IEE concludes that as long as the environmental mitigation and management measures defined in the EMP are properly implemented, all adverse environmental impacts associated with the project will be prevented, eliminated, or minimized to an acceptable level. The project is feasible from an environment safeguards point of view. The public consultation indicated that the majority of the potential APs supported the project and project components and believed they would benefit the local economy, raise residents' living quality, improve local environmental conditions, and effectively protect the local environment. The overall findings of the DEIA and the project IEE are that some negative impacts on air, water, soil and acoustic environment are expected, in both construction and operation phases. Any adverse environmental impacts and risks associated with the project can be prevented, eliminated, or minimized to an acceptable level, if all the mitigation measures and monitoring requirements defined in the EMP are strictly implemented during detailed design, construction and operation, and the environmental management and institutional capacities of BPMO and the facility operators are strengthened through implementation of the comprehensive training and capacity building program. The development and implementation of the LIP environmental management system (EMS) will be a critical aspect to ensure environmentally friendly operations of the project infrastructure and entire industrial park. A critical review of the LIP's performance as well as proposed development plans beyond the area for LIP Phase 1 (supported by the Project) is recommended at project completion stage to ensure resource use efficiency and sustainability, also accounting for mid- to long-term climate risks.

APPENDIX 1 - Environmental Management Plan (EMP)

A. Objectives

1. This environmental management plan (EMP) was prepared for the proposed Gansu Baiyin Integrated Urban Development Project (the Project) in Baiyin Municipality of Gansu Province, the People's Republic of China (PRC). The EMP is prepared in accordance with the requirements of Asian Development Bank's (ADB's) Safeguard Policy Statement (SPS 2009) on the basis of the domestic environmental impact assessment (DEIA) prepared by Lanzhou University (the EIA Institute), a planning EIA for the Liuchuan Industry Park (LIP), and the initial environment examination (IEE) conducted for the Project.

2. The EMP defines appropriate mitigation measures for the anticipated environmental impacts, and defines the institutional responsibilities and mechanisms to monitor and ensure the compliance with PRC's environmental laws, standards and regulations, and ADB's Safeguard Policy Statement (SPS 2009). The EMP specifies (i) objectives; (ii) mitigation measures; (iii) implementing organization and responsibilities; (iv) inspection, monitoring, and reporting arrangements; (v) training and institutional strengthening; (v) a feedback and adjustment mechanism; and (vi) the grievance redress mechanism. The EMP will be reviewed and updated at the end of the detailed designs, as needed, in order to be consistent with the final technical design. The EMP (or its updated version) will be included as a separate annex in all bidding and contract documents. The contractors will be made aware of their obligations to implement the EMP, and to budget EMP implementation costs in their proposals.

3. EMP supervision and monitoring results will be used to evaluate (i) the extent and severity of actual environmental impacts against the predicted impacts, (ii) the performance of the environmental protection measures or compliance with related rules and regulations, (iii) trends of impacts, and (iv) overall effectiveness of the mitigation measures.

B. Organizations and Their Responsibilities for EMP Implementation

4. The overall EMP implementation arrangements and responsibilities of governmental organizations are summarized in **Table EMP-1**.

5. Baiyin Municipal Government (BMG) is the project **Executing Agency (EA)**. The EA is responsible for communication with ADB, loan on-lending and repayment, as well as supervision and guidance of the Baiyin Project Management Office (BPMO) and implementing agencies (IAs) during the project implementation. A **Project Leading Group (PLG)** has been established, chaired by the mayor and comprises senior officials from relevant government agencies, to facilitate inter-agency coordination, and resolve any institutional problems affecting project implementation at municipal level.

6. The **Baiyin Project Management Office (BPMO)** established under the BMG and based on Baiyin Development and Reform Commission will be in charge of project coordination. The BPMO will (i) ensure provision of counterpart funding, (ii) engage and supervise engineering design institutes, tendering company and the project management consulting service during project implementation, and (iii) report on progress. With regard to environment, BPMO will appoint an environmental management lead (EML) to coordinate environmental issues associated with each infrastructure component, subcomponent and contract package. The EML will take charge of (i) coordinating the implementation of the EMP and developing implementation details; (ii) supervising the implementation of mitigation measures during project construction and operation; (iii) ensuring that environmental management, monitoring, and mitigation measures are incorporated into bidding documents, construction contracts and operation management plans; (iv) submitting annual EMP monitoring and progress reports to ADB;

(v) coordinating the local grievance redress mechanism (GRM); and (vi) responding to any unforeseen adverse impact beyond those mentioned in the DEIA, the project IEE and the EMP. The EML will be technically supported by the loan implementation environment consultant (LIEC) and they will jointly check the overall implementation of environmental management provisions of the EMP.

7. **Liuchuan Industrial Park Management Committee (LMC)** will be the Implementing Agency (IA) of Project component 1 (basic infrastructure in LIP) and the Environmental Management System (EMS) subcomponent. LMC will (i) establish an environment management unit (EMU) to coordinate EMP implementation. The EMU will also coordinate EMS subcomponent implementation; (ii) contract the Baiyin environmental monitoring center (EMC) to conduct regular environment monitoring during project implementation in accordance with the monitoring plan defined in **Table EMP-5**; (iii) engage the construction supervision companies (CSCs) including environment supervision staff to supervise civil works contractors. Both the Baiyin Transport Police Department and the Baiyin Transport Management Company will be the IAs for the ITS component, while the Jingyuan county human resource and social security bureau will be the IA for the TVET component.

8. **Construction contractors** contracted by the LMC will be responsible for implementing the mitigation measures during construction under supervision of the CSCs, LMC and BPMO. In their bids, contractors will be required to respond to the environmental management requirements defined in the EMP. Each contractor will be required to develop site specific EMPs and will assign a person responsible for environment, construction site health and safety. After project completion, environmental management responsibilities will be handed over to operators of WWTP, WTP and roads.

9. **Construction Supervision Companies (CSCs)** will be selected through the PRC bidding procedure by the LMC. The CSCs will be responsible for supervising construction progress and quality, and EMP implementation on construction sites. Each CSC shall have at least one environmental engineer on each construction site to: (i) conduct regular site inspection; (ii) supervise the contractor's EMP implementation performance; and (iii) prepare the contractor's environmental management performance section in monthly project progress reports submitted to the LMC.

10. **Community environment supervisors (CES).** Three community representatives from Nanchuan Village, Nanshanwei Village and Xinmin Village near the project sites have been determined as community environment supervisors (CES) to perform regular site inspections. The CES will accompany the LIEC during construction site visits, and will participate in public consultation meetings.

11. **Loan Implementation Environmental Consultant (LIEC).** Under the loan implementation consultancy services (LIC), a national environmental specialist (9 man-months) will be engaged under the project management and capacity building component. The LIEC will advise the BPMO, LMC, CSCs and contractors on all aspects of environmental management and monitoring for the project. The LIEC will:

(i) assess the project components' environmental readiness prior to implementation based on the readiness indicators defined in **Table EMP-4**;
(ii) assist BPMO and LMC to update the EMP and environmental monitoring program;
(iii) review the site-specific EMPs prepared by contractors;
(iv) assist the BPMO and LMC to establish a Grievance Redress Mechanism (GRM), and provide training for the PPCU and GRM access points;
(v) Conduct regular EMP compliance assessments, undertake site visits as required (together with CES), identify any environment-related implementation issues, propose necessary corrective actions, reflect these in a corrective action plan;

(vi) assist the BPMO to prepare annual environmental monitoring and progress reports to ADB;

(vii) provide training to BPMO, LMC and contractors on environmental laws, regulations and policies, SPS 2009, EMP implementation, and GRM in accordance with the training plan defined in the EMP (**Table EMP-7**); and

(viii) assist the BPMO and LMC in conducting consultation meetings with relevant stakeholders as required, informing them of imminent construction works, updating them on the latest project development activities, GRM.

Table EMP-1: Institutional Responsibilities for EMP Implementation

Phase	Responsible Agency	Environmental Responsibility
Project preparation	Design Institutes (Dis) on behalf of BPMO	Prepare project FSRs, EIA and EMP, RPs, conduct public consultation
	Gansu Province EPD	Review and approve the domestic EIA and planning EIA for LIP
	PPTA consultant	Provide technical assistance, review domestic EIA, prepare IEE report
	ADB	Review and approve the IEE and EMP, including disclosure
Engineering detail design	Design Institutes on behalf of las	Incorporate mitigation measures defined in the EMP into engineering detail designs
	BPMO, LMC	Review the design and confirm that mitigation measures have been included in engineering detail design
	BPMO, LMC, Dis	Update EMP before the start of construction according to the detailed design if necessary
	ADB	Review and approve the updated EMP, including disclosure
Tender & contracting	BPMO, LMC and contractors	Incorporate EMP clauses in tender documents and contracts
	LMC	Engage CSCs and ensure the CSCs have dedicated and qualified staff
Construction	ADB, LIEC	Review bidding documents; confirm project's readiness
	LMC	Establish EMU and ensure the EMU has dedicated, trained, and qualified environment staff; supervise contractors and ensure compliance with the EMP; coordinate periodic environmental impact monitoring in compliance with the approved monitoring plan; coordinate construction supervision and quality control; act as local entry point for the project grievance redress mechanism (GRM).
	Contractors	Assign EMP implementation responsibilities; ensure health and safety; implement mitigation measures;
	EMC (contracted by LMC)	Undertake environmental impact monitoring; submit quarterly monitoring results to BPMO, LMC, BEPB.
	CSCs	Prepare environment supervision plan (CSC-ESP); conduct regular site inspections and regular noise and dust monitoring; supervise the contractor's EMP implementation performance; and prepare the contractor's environmental management performance section in monthly project progress reports submitted to the LMC.
	LIEC	Advise on the mitigation measures; provide comprehensive technical support to BPMO and LMC for environmental management; conduct training; conduct site visits (with involvement of CES); conduct annual EMP compliance review; support BPMO in preparing annual environmental progress reports.
	BEPB	Conduct periodic inspections of all construction projects in compliance with PRC regulations and standards.
	CES	Participate in regular construction site visits; participate in community consultation activities; provide feedback to BEPB, LMC, BPMO on observed non-compliances with the EMP.
Operation	BEPB	Undertake periodic and random environmental monitoring and inspect environmental compliance
	BPMO, LIEC	Conduct EMP compliance review, instruct LMC and O&M units on environmental management requirements; coordinate environmental impact monitoring (during first year of operation); prepare annual environmental progress report for first year of operation; draft project completion report (PCR)

Phase	Responsible Agency	Environmental Responsibility
	ADB	Review and approve environmental progress report, disclose on ADB project website

C. Summary of Potential Impacts and Mitigation Measures

12. **Tables EMP2 and EMP-3** summarize the potential impacts and environment safeguard issues of the sub-components during pre-construction, construction and operation as identified by the environmental impact assessments and set out in this IEE, as well as corresponding mitigation measures designated to minimize those impacts and address these issues.

13. Those that will permanently become part of the infrastructure such as noise reduction materials for WTPs and WWTP will need to be included in the design of the facility by the design institutes, otherwise they won't be built. The costs of building and maintaining these systems is included in the infrastructure construction and operating costs and therefore are not be double-counted as part of the EMP costs. Those that are temporary measures particularly during the construction stage, such as dust suppression, use of quiet / low noise powered mechanical equipment, etc will need to be included in the tender documents, otherwise they are not budgeted by the contractor and they won't be done. The costs for implementing these measures are included in the EMP. The budgets for implementing these measures in this project add up to the amount of $ 400,000.

14. The mitigation measures defined in the EMP will be (i) checked and where necessary re-designed by the design institutes; (ii) incorporated into tender documents (where appropriate), construction contracts, and operational management plans; and (iii) implemented by contractors and LMC under supervision of the BPMO. The effectiveness of these measures will be evaluated based on the results of the environmental impact monitoring conducted by the EMC, and through EMP compliance verification conducted by the BPMO and LIEC.

Table EMP-2: Potential Impacts and Mitigation Measures during Design, Preconstruction and Construction Phases

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
Detailed Design Stage						
Design of Water Supply Infrastructure			·			
	Treatment Efficiency	Inadequate treatment	· Technical design of the WTPs must achieve the desired PRC supply standards with dual power supply to avoid interruption to plant operation due to power failure	DI	BPMO,LMC, local EPB	Included in design contract
	Noise	Noise from WTPs	· Technical design of the WTPs must be able to contain the operational noises from pumps and other noisy equipment with proper acoustic design of these facilities	DI	BPMO,LMC	Included in design contract
	Primary WTP sludge disposal	Inadequate sludge processing and drying	· Ensure proper sludge processing facilities to meet PRC sludge quality and moisture level standards	DI	BPMO,LMC, local EPB	Included in design contract
		Land use agreement and design features of sludge disposal site	· Finalize plans and protection measures for the proposed land disposal site near the primary WTP	DI	BPMO,LMC, local EPB, local WAB	Included in design contract
	Secondary WTP sludge disposal	Inadequate sludge processing and drying	· Ensure proper sludge processing facilities to meet PRC sludge quality and moisture level standards	DI	BPMO,LMC, local EPB	Included in design contract
		Suitable disposal arrangements	· Ensure that Jingyuan County Landfill No. 2 is ready to receive secondary WTP sludge	DI	BPMO,LMC, local EPB	Included in design contract
	Climate change	GHG Emissions	· Take into account energy efficiency, energy conservation and low GHG emissions in all building and systems designs and equipment selection	DI	BPMO,LMC, local EPB	Included in design contract
Design of Wastewater Treatment System	Air quality	Odor from WWTP	· WWTP design to include odor removal equipment	DI	BPMO,LMC, local EPB	Included in design contract
	Treatment Efficiency	Inadequate treatment for reuse	· Technical design of the WWTP must achieve the desired treatment to meet Class 1A standard and safety of plant operation, with dual power supply to avoid interruption to plant operation due to power failure, and with emergency storage tank	DI	BPMO,LMC, local EPB	Included in design contract
	Noise	Noise from WWTP	· Technical design of the WWTP must be able to contain the operational noises from pumps, blowers and other noisy equipment with proper acoustic design of these facilities	DI	BPMO,LMC, local EPB	Included in design contract
	Sludge disposal	Inadequate sludge processing and quality concerns	· Ensure proper design of pretreatment facilities in tributary industries and proper sludge processing facilities to meet PRC sludge quality and moisture level standards	DI	BPMO,LMC, local EPB	Included in design contract
		Suitable disposal arrangements	· Ensure that Jingyuan County Landfill No. 2 is ready to receive WWTP sludge if reuse cannot be achieved due to quality issues.	DI	BPMO,LMC, local EPB	Included in design contract
	Climate change	GHG Emissions	· Take into account energy efficiency, energy conservation and low GHG emissions in all building and systems designs and equipment selection	DI	BPMO,LMC	Included in design contract

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
Design of Wastewater Reuse System	Water quality	Quality of treated effluent relative to various reuse systems	· Technical design of the WWTP must achieve the desired treatment to meet Class 1A standard as well as the treatment requirements of landscape irrigation and various industrial users	DI	BPMO,LMC, local EPB, local WAB	Included in design contract
	Treated effluent storage system	Sufficient storage of treated effluent to allow for balancing the needs of reuse systems	· Technical design of the WWTP must ensure sufficient storage volume of the treated effluent storage tank to balance the confirmed reuse needs and schedules	DI	BPMO,LMC, local EPB, local WAB	Included in design contract
	Irrigation Distribution System	Design of landscape distribution systems	· Confirm preliminary layout and sizing of the required distribution network as well as trucked distribution system	DI	BPMO,LMC, local EPB, local WAB	Included in design contract
	Industrial distribution system	Inadequate reserved interface for the potential industrial users of treated wastewater	· Identify the potential users of the treated wastewater and consider the usage during design	DI	BPMO,LMC, local EPB	Included in design contract
Road Design Drainage and Safety Features	Extreme weather event due to climate change	Road surface cracking due to extreme cold weather and flooding due to torrential rainfall	· Consider potential impacts from extreme weather events due to climate change in designing road surface and drainage system	DI	BPMO,LMC, local EPB	Included in design contract
	Bridge design	Inadequate bridge design could affect river hydrology, morphology and sediment transport	· No piers shall be constructed in the Dasha River; · Bored grouting for the abutment shall be conducted during low-flow season.	DI	Local EPB, local WAB	Included in design contract
	Health and Safety	Protection of vulnerable road users	· Design must ensure public health and safety and ensure barrier-free design for disabled people.	DI	BPMO,LMC	Included in design contract
Construction Preparation Phase						
EMP implementation capacities	Institutional arrangements	Lack of environmental management capacities within BPMO, LMC	· Appoint qualified environment specialist within the BPMO (environment management lead, EML); · Contract loan implementation environment consultant (LIEC) within loan administration consultant services; · Conduct environment management training · Establish EMU under LMC; · Contracting of environmental monitoring center to conduct environment impact monitoring; · Conduct environment management training · Contract CSCs	BPMO, LMC	ADB, LIEC	BMG, Loan implementation TA
	Updating EMP	EMP does not reflect final detailed design	· Updated mitigation measures defined in this EMP based on the detailed design, including disclosure on ADB website;	DI, BPMO, LMC	ADB	Included in the design contract
Contract Documents	EMP clauses in civil works contracts	EMP requirements are not reflected in civil works	· Prepare environment section in the terms of reference for bidders;	Tendering company, LMC	BPMO	Included in tendering agency

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
		contracts	· Prepare environmental contract clauses for contractors, namely special conditions (e.g., reference to EMP and monitoring table).			contract
Grievance Redress Mechanism (GRM)	Provide comprehensive and responsive complaints process	Community complaints are not adequately addressed	· Development and implementation of GRM; · Identify GRM entry points and brief them of their role.	BPMO, LMC, LIEC	BMG, ADB	Loan implementation TA

Construction site planning	Construction site EMPs (CS-EMP)	Lack of construction site environment management planning	· Develop CS-EMPs, responding to all clauses and requirements of this EMP, and including sub-plans such as:
			  · Site Drainage and Soil Erosion Management Plan
			  · Spill Management Plan;
			  · Waste Management Plan;
			  · Temporary Traffic Management Plan;
			  · Occupational Health and Safety Plan;
			· Nomination of an Environmental Health and Safety officer in contractor's team
				Head contractor for each civil work contract (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, BPMO,LMC	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)

During Construction						
Impact on physical resources	Impact on soil	Excessive earthwork, inadequate spoil management	· Manage earthwork and spoil in accordance with the water and soil conservation plan (2013); · Use surplus soil within LIP for land leveling; · Dispose excess spoil at designated spoil disposal site, at K4+870 of the water transmission line.	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	CSCs, LMC, LIEC, certified soil erosion monitoring station, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
		Soil erosion *(these measures shall be defined in the Site Drainage and Soil Erosion Management Plan as part of the CS-EMP)*	· Minimize trench width and depth to reduce spoil generation; · Minimize duration of open trenches, and backfill immediately following pipe laying; · Use settling ponds, silt fences and screens to prevent sediment transport; · Construct intercepting ditches and drains to prevent runoff entering construction sites, and divert runoff from sites to existing drainage; · Strip and stockpile topsoil, and cover or seed temporary soil stockpiles; graded soil must be separately stockpiled from other materials and be readily recoverable for reinstatement; · Limit construction and material handling during periods of rains and high winds; · Properly slope or re-vegetate disturbed surfaces, such as compacted pipeline trenches and cut banks; · Slope stability must be undertaken and drains and sediment barriers must be installed as necessary and maintained until final reinstatement is	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	CSCs, LMC, LIEC, certified soil erosion monitoring station, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
			completed; and · Appropriately set up temporary construction camps and storage areas to minimize the land area required and impact on soil erosion.			
		Soil contamination *(these measures shall be defined in the Spill Management Plan as part of the CS-EMP)*	· Properly store petroleum products, hazardous materials and wastes on impermeable surfaces in secured and covered areas, and use the best management practice to avoid soil contamination; · Remove all construction wastes from the site to approved waste disposal sites; · Establish emergency preparedness and response plan; and · Provide spill cleanup measures and equipment at each construction site and require contractors to conduct training in emergency spill response procedures.	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	CSCs, LMC, LIEC, local EPB, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
	Impact on hydrology and water quality	Surface and groundwater pollution caused by excessive siltation (soil erosion), accidental spills, construction wastewater disposal	· During bridge construction, pump slurry to shore and properly dispose cutting materials; · Develop contingency plans to control oil and other dangerous substances (Spill Management Plan) as part of the CS-EMP; · Collect wastewater from construction activities in sedimentation tanks, retention ponds, and filter tanks to remove silts and oil; · Equip all areas where construction equipment is being washed with water collection basins and sediment traps; · Fuel storage, maintenance shop and vehicle cleaning areas must be stationed at least 500 m away from the Dasha River and the Yellow River; · Storage facilities for fuels, oil, and other hazardous materials will be within secured areas on impermeable surfaces, and provided with bunds and cleanup installations; · Contractors' fuel suppliers must be properly licensed. They shall follow proper protocol for transferring fuel and the PRC standard of JT3145-88 (Transportation, Loading and Unloading of Dangerous or Harmful Goods); · Locate labor camps at least 500 m from surface water bodies; · Install mobile toilets and on-site wastewater pre-treatment systems at construction camps along with proper maintenance protocols.	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	CSCs, LMC, LIEC, local EPB, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
			· Monitor water quality (for pollutants such as SS, CODcr, oil, and grease) in the Dasha River and the Yellow River in accordance with the EMP monitoring program to identify and confirm results of the impact assessment and effectiveness of adopted mitigation measures	Local EMC	LMC, LIEC, local EPB	LMC (counterpart funds)
	Impact on air quality	Dust (TSP) during construction; fumes and PM from asphalt mixing plant, vehicles	· Spray water on construction site and roads to reduce dust from earthwork excavation, transport, loading and uploading and stacking; · Avoid construction activities during strong windy days as possible; · Transport the spoil and other solid waste in a timely manner. Cover the construction materials during temporary stacking and transport to avoid spillage and dust; · The asphalt pavement construction should be done when the weather condition is conducive for pollutant diffusion; · Maintain vehicles and construction machineries to a high standard to ensure efficient running and fuel-burning and compliance with the PRC emission standards (GB18352-2005, GB17691-2005, GB11340-2005, GB2847-2005, and GB18285-2005).	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, BPMO,LMC, BEPB, CSCs, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
			· Undertake regular site inspections and air quality monitoring in accordance with the monitoring plan;	CSC, EMC	LMC, LIEC, local EPB	LMC (counterpart funds)
	Noise	Excessive construction noise at sensitive receptors, including Nanshanwei village, Zhanghiachuan village, Xintian village residential houses within LIP,	· Sensibly schedule construction activities, avoid noisy equipment working concurrently; · Select advanced quiet equipment and construction method, and tightly control the use of self-provided generators; · Maintain equipment and machinery in good working order; · Undertake regular equipment maintenance, ensure compliance with PRC standard of GB 12523-2011; · Operate between 06:00H-20:00H only and reach an agreement with LMC and LIP management and nearby residents regarding the timing of heavy machinery work, to avoid any unnecessary disturbances; · Nighttime works should only be conducted in exceptional cases, and a permit should be obtained for that purpose; potentially affected people should be informed in advance; · Control speed of bulldozer, excavator, crusher and	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, BPMO,LMC, BEPB, CSCs, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08).

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
			other transport vehicles travelling on site, adopt noise reduction measures on equipment, strengthen equipment repair and maintenance to keep them in good working condition; · Limit the speed of vehicles travelling on site (less than 8 km/h); · Install noise-attenuation windows for 84hh along the project road where non-compliance with Category 2 in Environmental Quality Standards for Noise(GB3096-2008) is anticipated/monitored; · Monitor noise within LIP and at nearby sensitive areas at regular intervals (as defined in the monitoring plan); · (viii) Conduct monthly interviews with residents living adjacent to construction sites to identify community complaints about noise, and seek suggestions from community members to reduce noise annoyance. Community suggestions will be used to adjust work hours of noise-generating machinery.	Local EMC, CSC	LMC, LIEC, local EPB	LMC (counterpart funds)
	Vibration	Excessive vibration, especially at night	· Operate between 06:00H-20:00H only and reach an agreement with LMC and nearby residents regarding the timing of heavy machinery work, to avoid excessive vibration impacts.	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, BPMO,LMC, BEPB, CSCs, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
	Solid waste	Municipal solid waste from workers camps, construction solid waste	· Maximize reuse/recycling of construction wastes; · Transport construction waste in enclosed containers; · Establish enclosed waste collection points on site, with separation of domestic waste and construction waste and hazardous wastes; · Set up centralized domestic waste collection point and transport offsite for disposal regularly by sanitation department; · Use licensed contractors to remove wastes from the construction sites; · Dispose spoil at designated disposal site. Backfilled area if not being used must be planted with vegetation to prevent soil erosion; · Prohibit burning of waste.	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, BPMO,LMC, BEPB, CSCs, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
Impact on biological resources	Ecology	Damage to flora and fauna resources	· Protect existing vegetation near construction sites; · Properly backfill, compact and re-vegetate pipeline trenches after pipeline installation;	Contractors (RD-C01/02; WW-C01 –	LIEC, BPMO,LMC, BEPB, CSCs, CES.	Included in construction contracts

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
			· Protect existing trees and grassland during road, bridge, treatment plant and pipeline construction; where a tree has to be removed or an area of grassland disturbed, replant trees and re-vegetate the area immediately after construction; · Only native plant species of local prevalence will be used for re-vegetation; and · Identify, demarcate and protect sites where small animals, reptiles, and birds of common species live such as vegetated roadside areas, trees, inner areas of bridges and river riparian zones, etc.	C05; WS-C01 – C08)		(RD-C01/02; WW-C01 – C05; WS-C01 – C08)
Impact on socio-economic resources	Physical cultural resources	Damage to unearthed cultural relics	· Contractor must comply with PRC's Cultural Relics Protection Law and Cultural Relics Protection Law Implementation Regulations if such relics are discovered, stop work immediately and notify the relevant authorities, adopt protection measures and notify the Security Bureau to protect the site.	Contractor (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, BPMO,LMC, cultural relics bureau.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
	Occupational health and safety	Safety of workers on construction sites *(these measures shall be defined in the Occupational Health and Safety Plan as part of the CS-EMP)*	· Provide a clean and sufficient supply of fresh water for construction sites and for all camps, offices and workshops; · Provide an adequate number of latrines and other sanitary arrangements at construction sites and work camps, and ensure that they are cleaned and maintained in a hygienic state; · Garbage receptacles at construction sites and camps will be set up, which will be periodically cleared to prevent outbreak of diseases; · Provision of personal protective equipment (PPE) that is fit for the task to prevent injury and maintain hygiene standards. Workers should be trained in the correct selection, use and maintenance of PPE. · An emergency response plan to take actions on accidents and emergencies will be prepared, including environmental and public health emergencies associated with hazardous material spills and similar events; · A fully equipped first-aid base in each construction camp will be organized; · A records management system that will store and maintain easily retrievable records against loss or damage will be established. It will include documenting and reporting of occupational accidents, diseases, and incidents. The records will be reviewed during compliance monitoring and	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, LMC, BPMO, CSCs.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
			audits; · Ensure that occupational health and safety matters are given a high degree of publicity to all persons regularly or occasionally on each construction site. Posters will be displayed prominently in relevant areas of the site; and · Train all construction workers in basic sanitation, general health and safety matters, and on the specific hazards of their work. Implement site HIV/AIDS and other communicable diseases awareness and prevention program to target the local community and construction workers.			
	Community health and safety	Temporary traffic management *(as part of the CS-EMPs)*	· A Temporary Traffic Management Plan shall be developed together with the local traffic management authority prior to any construction, and included in the CS-EMP; · The plan shall include provisions for diverting or scheduling construction traffic to avoid morning and afternoon peak traffic hours, regulating traffic at road crossings with an emphasis on ensuring public safety through clear signs, controls and planning in advance.	Contractors, local traffic police, LMC	LIEC, BPMO, BEPB, CSCs, CES.	BMG (traffic police department)
		Information disclosure, construction site protection	· Residents and businesses shall be informed in advance through media of the construction activities, given the dates and duration of expected disruption; · Clear signs shall be placed at construction sites in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials, excavations etc and raising awareness on safety issues; · All sites shall be made secure, discouraging access by members of the public through appropriate fencing whenever appropriate.	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, LMC, BPMO, CSCs, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
		Utility services interruptions	· Assess construction locations in advance for potential disruption to services and identify risks before starting construction; · If temporary disruption is unavoidable, develop a plan to minimize the disruption in collaboration with relevant local authorities such as power company, water supply company and communication company, and communicate the dates and duration in advance to all affected people.	Contractors (RD-C01/02; WW-C01 – C05; WS-C01 – C08)	LIEC, LMC, BPMO, CSCs, CES.	Included in construction contracts (RD-C01/02; WW-C01 – C05; WS-C01 – C08)
Environmental	Environment	Poor environment	· Review, revise and finalize EMS proposal (defined in	LMC and EMS	BPMO, ADB	LMC, loan

Item	Impact Factor	Potential Impacts and Issues	Mitigation Measures and/or Safeguards	Implem. Agency	Superv. Agency	Source of Funds
sustainability	management system (EMS) subcomponent implementation	management of industrial park	IEE, Appendix 2); · Develop the EMS for LIP according to the design framework including policies, standards practices, budget, monitoring etc. · Submit to ADB and BPMO for review and approval.	Consultants of loan implementation consulting services		implementation TA

Notes: People's Republic of China (PRC), Asian Development Bank (ADB), Community Environment Supervisors (CES), Safeguard Policy Statement (SPS 2009), Gansu Provincial Government (GPG), Baiyin Municipal Government (BMG), Project Preparation Technical Assistance (PPTA), Environmental Management Plan (EMP), BMG is Executing Agency (EA), Baiyin Project Management Office (BPMO), Implementing Agency (IA), Liuchuan Industrial Park Management Commission (LMC), Loan Implementation Environment Consultant (LIEC), Construction Supervision Company (CSC), Environmental Monitoring Center (EMC), Grievance Redress Mechanism (GRM), Environmental Management System (EMS), Environmental Monitoring Report (EMR), Baiyin Environmental Protection Bureau (BEPB), Water Affairs Bureau (WAB), Design Institute (DI), operation and maintenance (O&M), wastewater treatment plant (WWTP), water treatment plant (WTP).

Table EMP-3: Potential Impacts and Mitigation Measures during Operation for Infrastructure Components

Item	Potential Impacts and Issues	Location	Mitigation Measures and/or Safeguards	Implementation Agency	Supervision Agency	Source of funds
Environmental Management System (EMS)	Implementation of EMS	LIP	· Ensure implementation of the EMS and achieve proposed milestones of ISO 14001 certification (by 2018) and EIP accreditation (by 2025)	LMC with EMS consulting team	BPMO, LIEC	LMC operational budget, loan implementation TA
Wastewater collection and treatment subcomponent	Failure to control influent quality of wastewater at the new WWTP	WWTP and contributing industries	· Ensure proper monitoring of pre-treatment systems in place at all wastewater contributing industries; · Integrate monitoring results into environment management information system (EMIS); · Take action to enforce pre-treatment standards on all LIP industries.	Connected companies, EMS Unit; BEPB	LMC, BEPB	Connected companies, BEPB budget (monitoring)
	Failure to operate the new WWTP to meet design and discharge standards	WWTP	· Ensure proper O&M systems are in place and equipment in good working order and also ensure backup power system available; · Provide operational training to WWTP staff.	WWTP operator	LMC, BEPB	WWTP operation budget
	Odor at WWTP	WWTP	· Ensure that the WWTP deodorization facilities are operating properly; · Strengthen management, reduce chlorine fugitive emissions.	WWTP operator	LMC, BEPB	WWTP operation budget
	Improper sludge management	WWTP, nearby areas	· WWTP sludge should be regularly tested for heavy metals and other hazardous constituents as well as moisture content; · If sludge is non-hazardous, beneficial reuse will be explored. Until reuse plan can be developed, sludge that is non-hazardous and meeting PRC standards for moisture content will be disposed at Jingyuan County landfill No. 2. · Ensure moisture content of the sludge complies with PRC's Disposal of Sludge from Municipal Wastewater Treatment Plant – Quality of Sludge for Co-landfilling (GB/T 23485-2009); · If the sludge is identified as hazardous waste sludge, it should be shipped to hazardous waste	WWTP operator	LMC, BEPB	WWTP operation budget

Item	Potential Impacts and Issues	Location	Mitigation Measures and/or Safeguards	Implementation Agency	Supervision Agency	Source of funds
			disposal center in Gansu Province for centralized disposal.			
	Risks of accidental discharge, overload, emergency preparedness and response	WWTP, Dasha River	· Provision of an emergency holding tank of 3,000 m3; · Provision of dual power supply; · Spare parts for key components; · Regular inspection and proper maintenance of the WWTP; · Automated on-line, real-time monitoring of influent and effluent quality; and an in-house analytical lab will be established prior to operation of the WWTP. · The major analytical equipment will include the following: wastewater sampler, pH meter, flow meter, conductivity meter, UV/VIS spectrophotometer, DO meter, COD speedy tester, thermostat incubator, electric balance, and centrifuge; · Install warning signs and alarms near outfall to Dasha River to notify residents of emergency discharges; · Develop and implement an emergency preparedness and response plan for the WWTP, to be linked to the EP&R plan of LIP. · *The EMS supported by the project will also include various training and reporting systems to help ensure that the WWTP is operated properly and meets its performance targets.*	WWTP operator, EMS Unit	LMC, BEPB	WWTP operation budget
	Wastewater reuse	WWTP, LIP	· Ensure 100% wastewater reuse by project completion; · Disinfect effluent prior to reuse (Chlorine dioxide);	LMC, WWTP operator, industries	LMC, BEPB	LMC and WWTP operation budget
	Occupational health and safety	Safety of WWTP staff	· Use safety shoes or boots with non-slip soles; · wear personal protective equipment and chemical resistant clothing to avoid exposure of skin or eyes to corrosive and/or polluted solids,	WWTP operator, EMS Unit	LMC, BEPB	WWTP operation budget

Item	Potential Impacts and Issues	Location	Mitigation Measures and/or Safeguards	Implementation Agency	Supervision Agency	Source of funds
			liquids, gases or vapors; · post safety instructions in each workshop regarding the storage, transport, handling or pouring of chemicals; · check electrical equipment for safety before use; verify that all electric cables are properly insulated; take faulty or suspect electrical equipment to a qualified electricity technician for testing and repair; · wear safety goggles in all cases where the eyes may be exposed to dust, flying particles, or splashes of harmful liquids; · wear respiratory mask in the sludge dewatering and de-odor workshops and when moving and transporting sludge; · obey all safety instructions concerning entry into confined spaces, e.g., check atmosphere for oxygen or for poisonous gases, use respiratory protection equipment if needed, have a co-worker stand guard in case of need for help, etc; · all workers will undergo periodic examinations by occupational physician to reveal early symptoms of possible chronic effects or allergies; and · health and safety will be incorporated into the regular staff training programs.			
Water supply component	Water Source Protection Zone	Inability to develop and ensure compliance with water source protection zone at Yellow River intake location	· Protection measures will be formally delineated for water source protection zones, including: (i) a Prohibited Zone (Grade I Zone), closest to the water source; and (ii) a Protection Zone (Grade II Zone), adjoining the Prohibited Zone. · Unauthorized personnel will be forbidden from entering the	LMC, local WAB	Local WAB	Local WAB

Item	Potential Impacts and Issues	Location	Mitigation Measures and/or Safeguards	Implementation Agency	Supervision Agency	Source of funds
			prohibited zone (to be achieved by fencing the zone (surrounding the water intake on the source water body, and providing signage notifying the public of water source protection zone). · In the Grade II zone, no new buildings or construction projects will be allowed that may drain pollutants to the water body.			
	Sediments from primary treatment	Primary treatment plant, Yellow River	· The sediment from the preliminary WTP will be transported to the barren area 100-200 meters above the primary WTP, designated by the local Land Resources Bureau; · The area shall be protected from public access and routine soil conservation and protection measures taken to ensure that the material does not impact surrounding land. · Regular monitoring of material to confirm absence of environment, health and safety risk.	WTP operator	LMC, BEPB	WTP operation budget
	Sludge from secondary WTP	Secondary WTP, LIP	· Sludge from Secondary WTP will be shipped to Jingyuan county solid waste landfill site for disposal.	WTP operator	LMC, BEPB	WTP operation budget
	Occupational health and safety	Risk of hydrochloric acid, sodium chlorite and chlorine dioxide leakage	· Chemicals will be transported and managed in compliance with relevant state regulations on hazardous chemical substance management; · The chlorination room and chemical storage area will be equipped with automatic alarms, which will be triggered by chlorine dioxide leakage; · The duty room will be equipped with gas masks, oxygen breathing apparatus and other rescue materials; · An emergency response plan will be	WTP operator, EMS Unit	LMC, BEPB	WTP operation budget

Item	Potential Impacts and Issues	Location	Mitigation Measures and/or Safeguards	Implementation Agency	Supervision Agency	Source of funds
			developed and implemented. The plan will inform staff about the characteristics of chlorine dioxide and hydrochloric acid, describe potential health hazards, and define accident prevention measures and an evacuation plan. · The plan will be linked to the LIC-wide emergency preparedness and response plan (EP&R) developed under the EMS subcomponent of the project.			
Road component	Vehicle emissions	Roads in LIP	· Strict implementation of vehicle emission inspection system to avoid vehicles that cannot satisfy exhausted gas discharge standard on the road.	Traffic police	LMC, BEPB	BMG budget for vehicle inspections
	Noise	Roads in LIP	· Enforce speed limits on Xihuan Road (50km/h); · Maintain noise-mitigation measures at sensitive receptors (84 hh).	LMC, traffic police	LMC, BEPB	LMC budget
	Water pollution	Road runoff, drainage	· Routinely collect and properly dispose litter and debris from sidewalks, driveways, and parking lots; · Clean the roadside catch basins before rains to avoid surface water pollution by storm water runoff flushing debris and silt.	Road maintenance	LMC, BEPB	LMC budget
	Road safety	Motorized and non-motorized traffic safety	· LIP road section shall include separate pedestrian sidewalks and separate lanes for non-motorized traffic; · Pedestrian-priority traffic lights, safety islands, crosswalks (zebra lines), and boarding bays/islands shall be established at all intersections; · Road maintenance vehicles shall be equipped with warning lights; · *Park safety, which covers traffic safety, will be an important*	LMC, EMS Unit, traffic police	LMC, BEPB	LMC budget

Item	Potential Impacts and Issues	Location	Mitigation Measures and/or Safeguards	Implementation Agency	Supervision Agency	Source of funds
			component of the EMS subproject.			
	Road accidents and spillage of hazardous materials	Roads in LIP	· Strict enforcement of road speed limits, trucking regulations including hauling and placarding of hazardous materials; · Implement emergency planning and response plan in LIP · *Emergency preparedness and response, which covers road accidents and spills, will be an important component of the EMS subproject.*	LMC, EMS Unit, traffic police	LMC, BEPB	LMC budget
Climate Variability and Change	Adaptation to Climate Variability and Change	LIP	· The effluent from the LIP WWTP will be used for landscape irrigation and industrial reuse. This will raise resilience to climate variability by reducing demand for potable water. · Qualification criteria for new industries as well as for EIP accreditation (which is targeted by LIP and supported by the project) include targets and indicators which clearly aim at increasing the LIP's resilience to climate variability, including but not limited to: (i) limiting fresh water consumption per industrial added value (less than 9 m3/10,000 CNY) [1] ; (ii) defining minimal water reuse rate (at least 40%) and industrial water recycling rate (at least 75%). Climate change resilience will also be increased through improved irrigation practices.	LMC	LMC, BPMO, ADB	LMC budget
	Greenhouse Gas Emission Reduction	LIP	· This project will support BMG and LMC to develop a comprehensive environmental management system (EMS) for the LIP, and assist LIP moving toward eco-industrial park (EIP) accreditation under national	LMC	LMC, BPMO, ADB	LMC budget

[1] EIP indicator as defined in the PRC standard for sector-integrated eco-industrial parks (HJ 274-2009).

Item	Potential Impacts and Issues	Location	Mitigation Measures and/or Safeguards	Implementation Agency	Supervision Agency	Source of funds
			CE and EIP promotion programs coordinated by MEP and NDRC. Qualification criteria for EIP accreditation include production-related emission targets, such as: (i) energy consumption per industrial added value; (ii) industrial water recycling rate; (iii) water reuse rate; (iv) SO2 emissions per industrial added value, as well as total SO2 emissions (5,120 tons per year).			

Notes: Asian Development Bank (ADB), Safeguard Policy Statement (SPS 2009), Baiyin Municipal Government (BMG), Project Preparation Technical Assistance (PPTA), Environmental Management Plan (EMP), BMG is Executing Agency (EA), Baiyin Project Management Office (BPMO), Implementing Agency (IA), Liuchuan Industrial Park Management Commission (LMC), Loan Implementation Environment Consultant (LIEC), Construction Supervision Company (CSC), Environmental Monitoring Center (EMC), Grievance Redress Mechanism (GRM), Environmental Management System (EMS), Baiyin Environmental Protection Bureau (BEPB), Water Affairs Bureau (WAB), Design Institute (DI), operation and maintenance (O&M), wastewater treatment plant (WWTP), water treatment plant (WTP).

D. Environmental Inspection, Monitoring and Reporting

15. Monitoring will include project readiness monitoring (to be conducted by the LIEC), environmental impact monitoring (to be conducted by a licensed entity), as well as EMP compliance verification during project implementation and the first year of project operation (to be conducted by BPMO and LIEC). Monitoring and reporting arrangements defined for this project are described below.

16. **Assessment of project readiness.** Before construction, the LIEC will assess the project's readiness in terms of environmental management based on a set of indicators (***Table EMP-4***) and report it to ADB and the BPMO. This assessment will demonstrate that environmental commitments are being carried out and environmental management systems are in place before construction starts, or suggest corrective actions to ensure that all requirements are met.

Table EMP-4: Project Readiness Assessment Indicators

Indicator	Criteria	Assessment
EMP update	• The EMP was updated after technical detail design, and approved by ADB	Yes No
Compliance with loan covenants	• The borrower complies with loan covenants related to project design and environmental management planning	Yes No
Public involvement effectiveness	• Meaningful consultation completed • GRM established with entry points	Yes No Yes No
Environmental Supervision in place	• LIEC is in place • Environmental Management Unit established by LMC • Environment specialist appointed by BPMO • Environment monitoring center (EMC) and CSCs contracted by LMC • Community environment supervisors (CES) confirmed and informed	Yes No Yes No Yes No Yes No Yes No
Bidding documents and contracts with environmental safeguards	• Bidding documents and contracts incorporating the environmental activities and safeguards listed as loan assurances • Bidding documents and contracts incorporating the impact mitigation and environmental management provisions of the EMP • Environmental requirements of EMP included in contract documents for construction contracts	Yes No Yes No Yes No
EMP financial support	• The required funds have been set aside by contractors, LMC and BPMO to support the EMP implementation	Yes No

17. **Environmental impact monitoring**. **Table EMP-5** shows the environmental impact monitoring program specifically designed for this project, defining the requirements on the scope, location, parameter, duration and frequency of monitoring during the construction and operational stages.

18. During construction, regular environmental impact monitoring will be conducted by the environment monitoring center of Baiyin (EMC), contracted by LMC. In addition, CSCs will be required to conduct frequent internal noise and air quality monitoring around construction sites and to report monitoring results in the framework of their monthly progress reports to BPMO and LMC. During operation, daily monitoring of water treatment and wastewater treatment performance will be conducted by the operator of the facilities in compliance with PRC regulation.[2] In addition, to comply with ADB

[2] For water supply, this includes weekly monitoring of 42 regular parameters defined in the standard of GB5749-2006 (Total coliform, Thermotolerant coliform, Escherichia coliform, Total plate count, As, Cd, Cr^{+6}, Pb, Hg, Se, Cyanide, NO3-N, Chloroform, Tetrachloromethane (CCl4), Fluoride, Bromate, Formaldehyde, NH3-N, Chlorite, Chlorate, Chromaticity, Turbidity, odor & taste, Lookable (appearance), pH, Al, Fe, Mn, Cu, Zn, Chloride, Sulfate, TDS, Total hardness, CODmn, Volatile phenol,

requirements, the LMC will contract the EMC to conduct environmental impact monitoring during the first year of operation. The budget for environmental impact monitoring by the EMC has been estimated at $25,000. The cost for monitoring conducted by the CSCs will be included in CSCs' contracts.

19. Monitoring will also be periodically conducted by the local environmental authorities in the framework of their legal mandate to check compliance with applicable environmental regulations. They will be responsible for undertaking regular and random environmental monitoring and inspection activities before, during, and after construction as well as in the event of emergencies. The wastewater treatment plant will install an on-line monitoring system and the data will be transmitted to Baiyin Municipal EPB automatically. In addition, Baiyin Municipal EPB will conduct quarterly inspection.

20. Three community representatives from Nanchuan Village, Nanshanwei Village and Xinmin Village near the project sites are determined as independent supervisors to perform regular site inspections. The cost will be beard by the LMC.

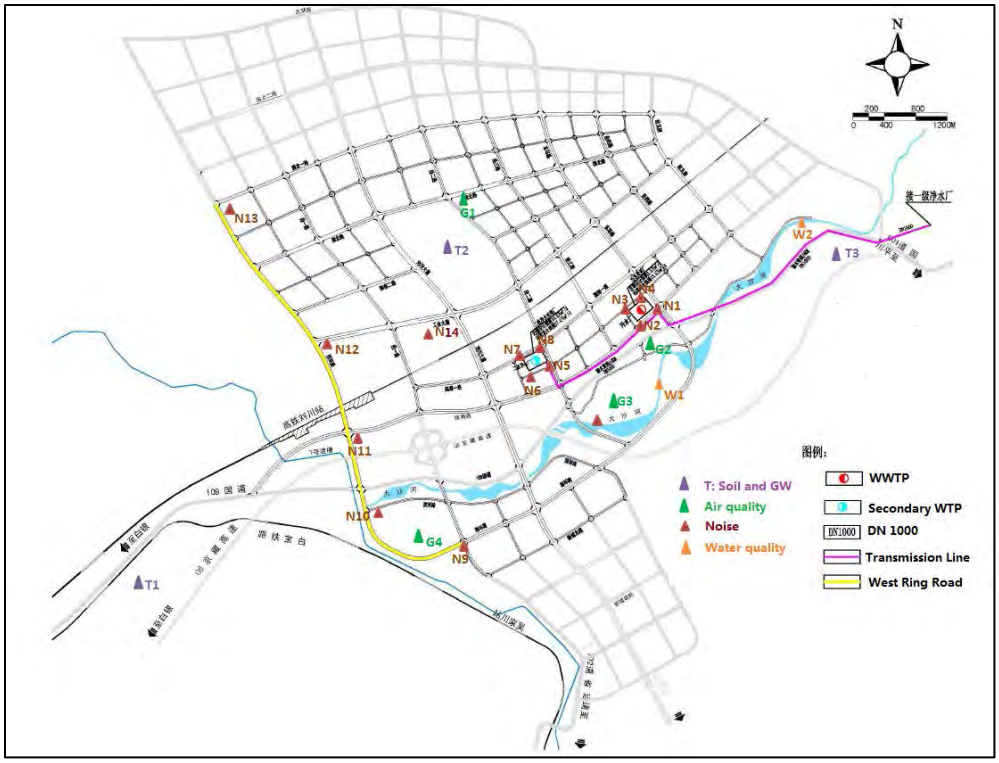
Table EMP-5: Environment monitoring plan

Item	Monitoring Parameter	Monitoring Location	Monitoring Frequency & Duration, Standard	Implem. Entity	Superv. Entity	Cost
Construction Stage						
Dust and noise	TSP, L_{Aeq}	At boundaries of all construction sites and at baseline monitoring points N1-N19, G1-G5 (Figure EMP-1 and EMP-2).	Once per month during construction period *GB3095-2012 (TSP) GB12523-2011, GB3096-2008 (Noise)*	CSCs	LMC, BPMO, LIEC	$4,000
Ambient air quality	TSP, SO2, NO2, PM10	At boundaries of all construction sites and at baseline monitoring points G1-G5 (Figure EMP-1 and EMP-2).	1 day (24-hr continuous sampling), quarterly during construction period. *GB3095-2012*	EMC	LMC, BPMO; BEPB	$5,000
Noise	L_{Aeq}	At boundaries of all construction sites and at baseline noise monitoring points N1-N19 (Figure EMP-1 and EMP-2).	2 times per day (day time and night time); quarterly during construction period *GB12523-2011, GB3096-2008*	EMC	LMC, BPMO; BEPB	$2,000
Surface water quality	pH, COD, BOD5, TP, TN, SS, TPH	At baseline water monitoring points W1 and W2 (Dasha River), W3 and W4 (Yellow River) (Figure EMP-1 and EMP-2).	1 time per day; quarterly during construction period *GB3838-2002 (class III)*	EMC	LMC, BPMO; BEPB	$5,000
Soil quality	TPH, selected heavy metals	At baseline soil monitoring points T1-T3 (LIP, Figure EMP-1).	Quarterly during construction period *GB15618-1995 (class II)*	EMC	LMC, BPMO; BEPB	$5,000
Soil erosion	Soil erosion protection measures, soil erosion intensity	12 locations as defined in the water and soil erosion control plan, including: raw water intake pump, preliminarily WTP, secondary WTP, WWTP, Xihuan road (2), spoil disposal sites (2), work camp, undisturbed sites with original topographical features (3).	Quarterly during construction period	licensed soil erosion monitoring unit	LMC, BPMO; BWAB	$5,000

LAS, Total α-radioactivity, Total β-radioactivity, ClO_2, Residual Cl_2).

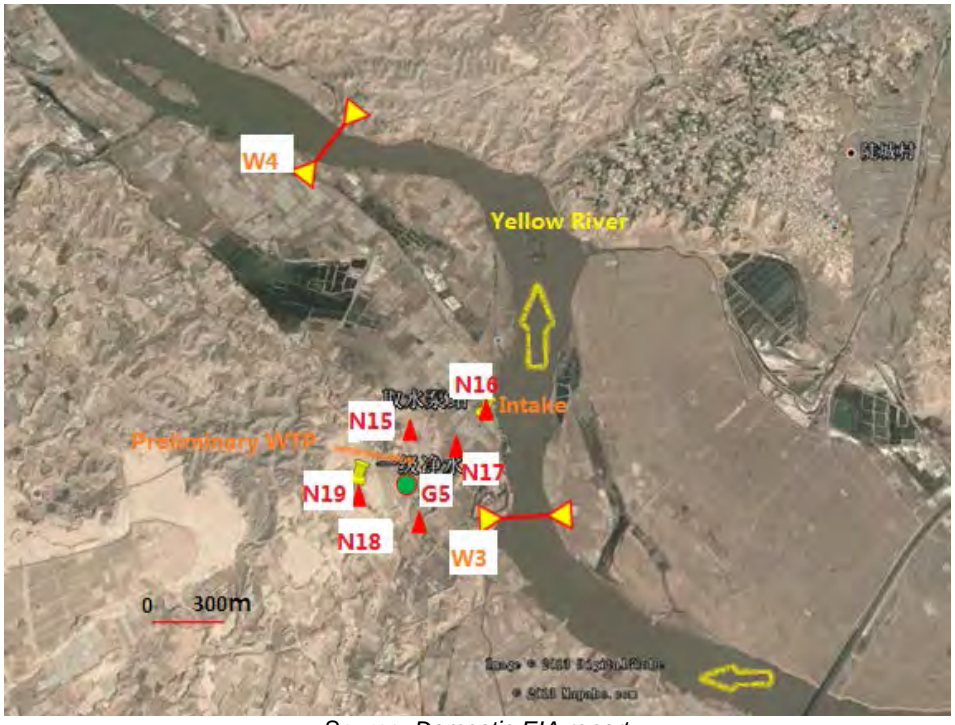
Item	Monitoring Parameter	Monitoring Location	Monitoring Frequency & Duration, Standard	Implem. Entity	Superv. Entity	Cost
Operational Stage (the first year)						
Ambient air quality	TSP, NO_2, CO, PM_{10}	4 locations within LIP (G1-G4, Figure EMP-1), 1 location at primary WTP (G5, Figure EMP-2). Points #1 to #6 (sensitive receptors along project road, IEE Table V-28).	1 day (24-hr continuous sampling), quarterly. *GB3095-2012*	EMC	LMC, BPMO; BEPB	$2,000
	Odor (SO_2, NH_3, H_2S)	At each of the 4 boundaries of the WWTP (N1-N4, Figure EMP-1)	1 time per day, quarterly	EMC	LMC, BPMO; BEPB	
	Cl^-	At chlorination rooms of WTP and WWTP (indoor and outdoor)	1 time per day, quarterly	EMC	LMC, BPMO; BEPB	
Noise	L_{Aeq}	At baseline monitoring points N1-N4 (WWTP); N5-N8 (secondary WTP); N9-N14 (road); and N15-N19 (primary WTP), (Figure EMP-1 and EMP-2) Points 1-84 (sensitive receptors along project road, IEE V-19)	2 times per day (day time and night time); quarterly *GB12348-2008, GB12523-2011, (boundary noise);* *GB3096-2008 (Grade 4a, Grade II, ambient noise)*	EMC	LMC, BPMO; BEPB	$5,000
Surface water quality	Temp, pH, COD, BOD5, TP, TN, SS, TPH, surfactants, fecal coliforms	At baseline water monitoring points W1 and W2, plus at KM1, KM2, KM3, KM4 downstream of discharge point (Dasha River), W3 and W4 (Yellow River) (Figure EMP-1 and EMP-2).	1 time per day; quarterly *GB3838-2002 (class III)*	EMC	LMC, BPMO; BEPB	$2,000
WWTP influent and effluent	Volume, Temp, pH, COD, BOD5, TP, TN, NH3-N, SS, TPH, surfactants, fecal coliforms	At WWTP inlet and outlet.	Volume, Temp, pH, COD and NH3-N: continuous (online monitoring) BOD5, TP, TN, SS, TPH, surfactants, fecal coliforms: once per month *CJ3082-1999 (influent)* *GB18918-2002 (effluent, Class 1A)*	EMC	LMC, BPMO; BEPB	$6,000
WWTP sludge quality	Moisture content (%), N, P, K, Cd, Pb, As, Cr	At WWTP sludge dewatering facility	Quarterly *GB/T 23485-2009* *CJ/T 309-2009*	EMC	LMC, BPMO; BEPB	$2,000
WTP sludge quality	Moisture content (%)	Primary and secondary WTP, primary sludge storage facility (N15/N19, Figure EMP-2)	Quarterly *GB/T 23485-2009* *CJ/T 309-2009*	EMC	LMC, BPMO; BEPB	$500
WTP water quality	106 parameters of GB5749-2006	Clear water tank, WTP	Semi-annual *GB5749-2006*	Baiyin EMC	LMC, BPMO; BEPB	$4000
Soil quality	TPH, selected heavy metals	At baseline soil monitoring points T1-T3 (LIP, Figure EMP-1).	Semi-annual *GB15618-1995 (class II)*	EMC	LMC, BPMO; BEPB	$2,000
Total estimated monitoring costs:						***$49,500***

Notes: Asian Development Bank (ADB), Gansu Provincial Government (GPG), Baiyin Project Management Office (BPMO), Liuchuan Industrial Park Management Commission (LMC), Environmental Monitoring Center of BEPB (EMC), Baiyin Environmental Protection Bureau (BEPB), OWWTP = wastewater treatment plant, WTP = water treatment plant.



Source: Domestic EIA report, PPTA consultant

Figure EMP-1: Monitoring locations within LIP



Source: *Domestic EIA report*

Figure EMP-2: Monitoring locations at water intake and preliminary WTP

17. **EMP compliance verification and reporting**. EMP compliance monitoring will be undertaken by the BPMO, with support of the loan implementation environment consultant (LIEC). The BPMO will report to ADB the project's adherence to the EMP, information on project implementation, environmental performance of the contactors, and environmental compliance through the quarterly project progress reports and annual EMP progress and monitoring reports (**Table EMP-6**). Quarterly progress reports by the BPMO to ADB will include a summary of EMP implementation progress. The LIEC will support the BPMO in developing the annual EMP progress and monitoring reports. The reports should confirm the project's compliance with the EMP, local legislation such as PRC EIA requirements, and identify any environment related implementation issues and necessary corrective actions, and reflect these in a corrective action plan. The performance of the contractors will also be reported on with respect to environmental protection and impact mitigation. The operation and performance of the project GRM, environmental institutional strengthening and training, and compliance with all covenants under the project will also be included in the report.

18. **Environmental acceptance monitoring and reporting**. Within three months after each component completion, or no later than 1 year with permission of the BEPB, environmental acceptance monitoring and audit reports of completion of each subcomponent under project component 1 shall be: (i) prepared by a licensed environmental monitoring institute in accordance with the PRC Regulation on Project Completion Environmental Audit (MEP, 2001), (ii) reviewed for approval of the official commence of individual component operation by environmental authorities, and (iii) finally reported to ADB (**Table EMP-6**). The environmental acceptance reports of the component completions will indicate the timing, extent, effectiveness of completed mitigation and of maintenance, and the needs for additional mitigation measures and monitoring during operations.

19. **Project Design and Monitoring Framework**. At the outset of project implementation, the BPMO and LMC will develop (i) comprehensive project design and monitoring framework (DMF) procedures to systematically generate data on inputs and outputs of the project components, and (ii) detailed environmental and related social economic indicators to measure project impacts. The DMF indicators for the project may include (i) public satisfaction with the living environment; (ii) increased employment; (iii) water supply delivery and wastewater collection and treatment rates; (iv) increased or decreased traffic accidents; and (v) increased local GDP. Under the DMF, baseline and progress data will be reported at the requisite time intervals by LMC. LMC will be responsible for analyzing and consolidating the data through its management information system, as part of the project EMS. The DMF will be designed to permit adequate flexibility to adopt remedial action regarding project design, schedules, activities, and development impacts. The BPMO and LMC will refine the DMF, confirm achievable goals, firm up monitoring and recording arrangements, and establish systems and procedures no later than 6 months after loan effectiveness.

Table EMP-6: Reporting plan

Reports		From	To	Reporting Frequency
Construction Phase				
Internal progress reports by contractors	Internal project progress report by construction contractors, including monitoring results by CSCs	Contractors, CSCs	LMC	Monthly (during construction season)
Environmental impact monitoring	Environmental impact monitoring report	EMC	BEPB, BPMO, LMC, LIEC	Quarterly (during construction season)
Reports to ADB	Project progress report (including section on EMP implementation and monitoring)	BPMO	ADB	Quarterly
	Environment progress and monitoring reports	BPMO	ADB	Annually
Acceptance report	Environmental acceptance monitoring and audit report	Licensed institute	BEPB	Once, not later than one year after completion of physical works
Operational Phase				
Environmental impact monitoring	Environmental impact monitoring report (during first year of operation)	EMC	BEPB, BPMO, LMC	Quarterly
Reports to ADB	Project progress report (including section on EMP implementation and monitoring)	BPMO	ADB	Quarterly
	Environment progress and monitoring report	BPMO	ADB	Once (after first year of operation)
Notes: Baiyin Project Management Office (BPMO), Implementing Agency (IA), Liuchuan Industrial Park Management Commission (LMC), Loan Implementation Environment Consultant (LIEC), Construction Supervision Company (CSC), Environmental Monitoring Center (EMC), Baiyin Environmental Protection Bureau (BEPB)				

E. Institutional Strengthening and Training

20. The capacity of the BPMO, LMC and contractors' staff responsible for EMP implementation and supervision will be strengthened. All parties involved in implementing and supervising the EMP must have an understanding of the goals, methods, and practices of project environmental management. The project will address the lack of capacities and expertise in environmental management through (i) institutional capacity building, and (ii) training.

21. **Institutional strengthening.** The capacities of the BPMO and LMC to coordinate environmental management will be strengthened through a set of measures:

(i) The assignment of a BPMO staff in charge of EMP coordination, including GRM;
(ii) The appointment of a national environmental specialist under the loan implementation consultant services to guide BPMO and LMC in implementing the EMP and ensure compliance with ADB's Safeguard Policy Statement (SPS 2009); and
(iii) The creation of an environmental management unit (EMU) by the LMC to conduct regular site inspections and coordinate environmental impact monitoring.

22. **Training.** The BPMO, LMC, contractors and facility operator (WWTP, WTP) will receive training in EMP implementation, supervision, and reporting, and on the Grievance Redress Mechanism (**Table EMP-7**). Training will be facilitated by the LIEC with support of other experts under the loan implementation consultant services.

Table EMP-7: Training Program

Training	Attendees	Contents	Times	Period (days)	No. of persons	Cost ($/person /day)	Total Cost
EMP adjustment and implementation	BPMO, LMC, contractors, CSCs, BEPB	Development and adjustment of the EMP, roles and responsibilities, monitoring, supervision and reporting procedures, review of experience (after 12 months)	Twice - Once prior to, and once after one year of project implementation	2x0.5	15	60	$ 900
Grievance Redress Mechanism	BPMO, LMC, contractors, CSCs, BEPB	Roles and responsibilities, Procedures, review of experience (after 12 months)	Twice - Once prior to, and once after one year of project implementation	2x0.5	10	60	$ 900
Environmental aspects of facilities operation	LMC, O&M unit	Environmental housekeeping; Sludge treatment and disposal process; Safety operation regulations Emergency preparedness and breakdown response procedures	Once during project operation	1	15	60	$ 900
Total estimated cost:							**$ 2,700**
Notes: Baiyin Project Management Office (BPMO), Liuchuan Industrial Park Management Commission (LMC), Loan Implementation Environment Consultant (LIEC), Construction Supervision Company (CSC), Environmental Monitoring Stations (EMC), Environmental Management System (EMS), Baiyin Environmental Protection Bureau (BEPB),							

F. Consultation, Participation and Information Disclosure

23. Section VII of the project IEE report has described the meaningful public participation and consultation implemented during project preparation. Plans for public involvement during construction and operation stages have been developed during project preparation. The BPMO and LMC are responsible for public participation during project implementation.

24. These plans include public participation in (i) monitoring impacts and mitigation measures during the construction and operation stages; (ii) evaluating environmental and economic benefits and social impacts; and (iii) interviewing the public after the project is completed. These plans will include several types of public involvement, including site visits, workshops, investigation of specific issues, interviews, and public hearings, as indicated in **Table EMP-8**. Three community representatives from Nanchuan Village, Nanshanwei Village and Xinmin Village near the project sites are determined as community environment supervisors (CES) to perform regular site inspections. The cost for public consultation and participation during project implementation will be beard by the LMC. The budget for public consultation is estimated at approximately $4,400.

Table EMP-8: Public consultation plan

Organizer	Format	No. of Times	Subject	Attendees	Budget
Construction Stage					
BPMO	Public consultation & site visits	4 times: 1 time before construction commences and 1 time each year during construction	Adjusting of mitigation measures, if necessary; construction impact; comments and suggestions	Residents adjacent to components; CES	$2,400
BPMO,LMC	Expert workshop	As needed based on public consultation	Comments and suggestions on mitigation measures, public opinions	Experts of various sectors, CES	$ 800
Operational Stage					
LMC	Public consultation and site visits	Once in the first year	Effectiveness of mitigation measures, impacts of operation, comments and suggestions	Residents adjacent to component sites; CES.	$ 400
LMC	Public workshop	As needed based on public consultation	Effects of mitigation measures, impacts of operation, comments and suggestions	Representatives of residents and social sectors	$ 400
	Public satisfaction survey	At least once	Comments and suggestions	Project beneficiaries	$ 400
Total budget:					**$4,400**
Notes: Baiyin Project Management Office (BPMO), Community Environment Supervisors (CES), Liuchuan Industrial Park Management Commission (LMC), Loan Implementation Environment Consultant (LIEC), Construction Supervision Company (CSC), Environmental Monitoring Stations (EMC), Baiyin Environmental Protection Bureau (BEPB)					

F. Grievance Redress Mechanism

25. A grievance redress mechanism (GRM) will be established to address community concerns and complaints related to safeguards issues. Besides issues related to land acquisition and resettlement, grievances will most likely include disturbance of traffic; dust emissions; construction noise; soil erosion; inappropriate disposal of waste materials; damage to private property; safety measures for the protection of the general public and construction workers; or water quality deterioration. The GRM will be accessible to diverse members of the community and stakeholders. Multiple points of entry, including face-to-face meetings, written complaints, telephone conversations, or e-mail, will be available.

26. The BPMO will establish a single Project Public Complaint Unit (PPCU). The PPCU will instruct contractors and construction supervision companies (CSCs) if people complain about the project. The PPCU will coordinate with the county EPB and municipal EPB and other government divisions, if necessary, and will be supported by the Loan Implementation Environmental Consultant (LIEC), hired under the Project Implementation Consultant Support (PIC). The PPCU will establish a GRM tracking and documentation system, including procedures to retrieve data for reporting purposes to the BPMO and ADB.

27. The contact persons for different GRM entry points, including contractors, CSC, LMC, county and municipal EPB, will be identified prior to construction. The contact details for the entry points (phone numbers, addresses, e-mail addresses) will be publicly disclosed on information boards at construction sites and on the website of the county and municipal EPBs. The chart of proposed GRM is shown in **Figure EMP-3.**

28. Once a complaint is received and filed, the PPCU will identify if complaints are eligible. Eligible complaints include those where (i) the complaint pertains to the project; and (ii) the issues arising in the complaint fall within the scope of environmental issues that the GRM is authorized to address. Ineligible complaints include those where: (i) the complaint is clearly not project-related; (ii) the nature of the issue is outside the mandate of the environmental GRM (such as issues related to resettlement, allegations of fraud or corruption); and (iii) other procedures are more appropriate to address the issue. Complaints illegible to the project or the environmental GRM will be recorded and passed onto relevant authorities. If an eligible complaint is rejected, the complainant will be informed of the decision and the reasons for rejection.

29. The **procedure and timeframe** for the grievance redress mechanism are described as follows (**Figure EMP-3**):

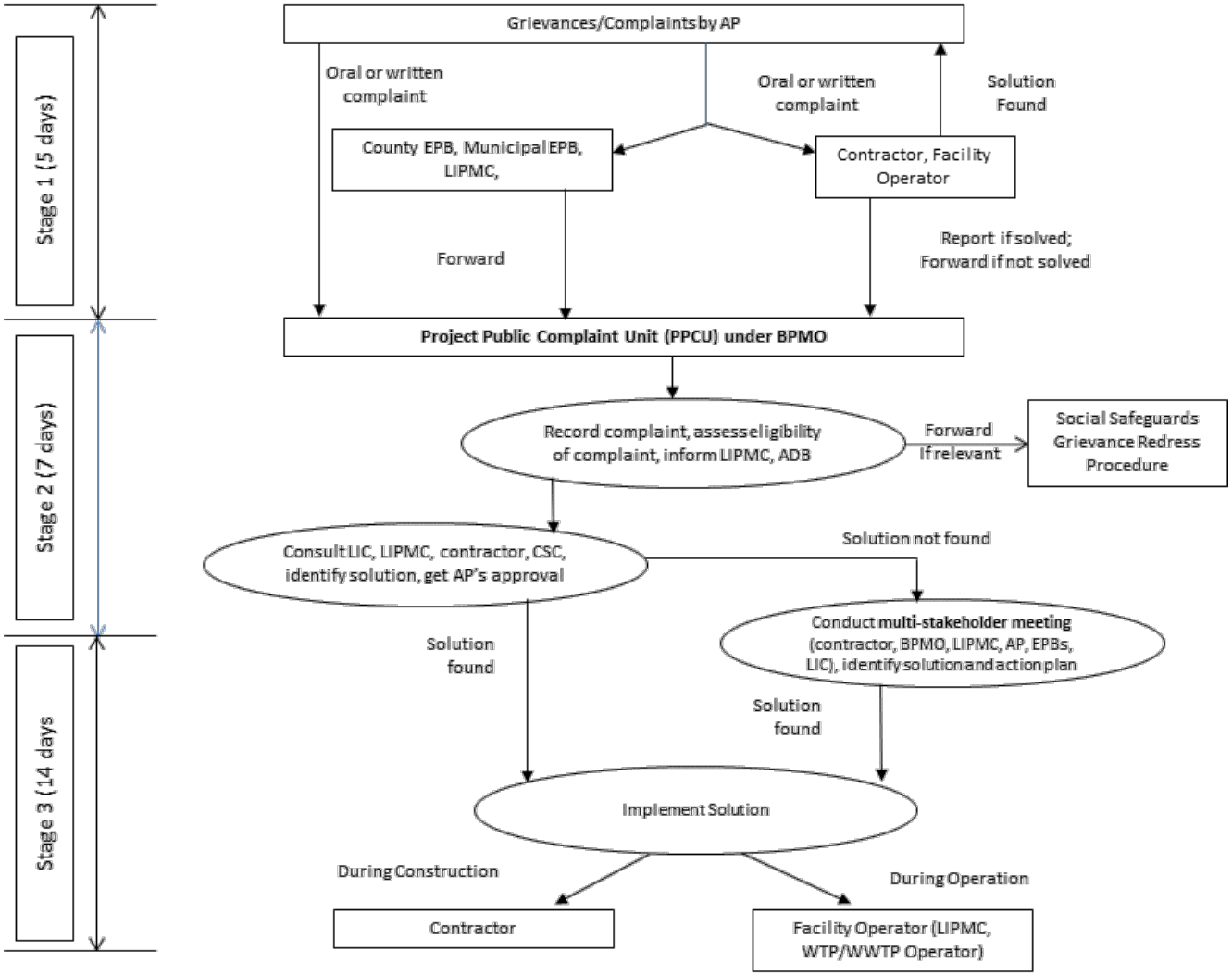
Stage 1: If a concern arises during construction, the affected person (AP) will submit a written or oral complaint to the contractor directly. Whenever possible, the contractor will resolve the issue directly with the AP. The contractor shall give a clear reply within five (5) days. If successful, the contractor will inform the PPCU accordingly.

Stage 2: If no appropriate solution can be found after the Stage 1 process applied (i.e., after 5 days), the contractor has the obligation to forward the complaint to the PPCU. The AP may also decide to submit a written or oral complaint to the PPCU, either directly or via one of the GRM entry points. For an oral complaint, proper written records must be made. The PPCU will assess the eligibility of the complaint, refer complaints related to land acquisition and resettlement to the respective mechanism, identify the solution and provide a clear reply for the complainant within five (5) working days. The LIEC will assist the PPCU in replying to the affected person, if needed. The PPCU will also inform the ADB project manager and submit all relevant documents. Meanwhile, the PPCU will timely convey the complaint/grievance and suggested solution to the contractors or LMC, and facility operator. The contractors during construction and the facility operator during operation will implement the agreed upon redress solution and report the outcome to the PPCU within seven (7) working days.

Stage 3: In case no solution can be identified by the PPCU, or the complainant is not satisfied with the proposed solution, the PPCU will organize, within two (2) weeks, a multi-stakeholder hearing (meeting) involving all relevant stakeholders (including the complainant, contractor, county and municipal EPB, LMC, BPMO). The hearing shall identify a solution acceptable to all, and formulate an action plan. The contractors during construction and the facility operator during operation will implement the agreed-upon redress solution and report the outcome to the PPCU within the agreed upon timeframe.

30. The PPCU shall accept the complaints/grievances lodged by the AP free of charge. Any cost incurred should be covered by the contingency of the project. The grievance procedures will remain valid throughout the duration of project construction and until project closure. This GRM procedure is consistent with the requirements of the RP grievance procedures but there are a few minor differences in methodology.

Figure EMP-3: Proposed Grievance Redress Mechanism (GRM)



Note: AP = affected person; EPB = environmental protection bureau; PPCU = public project complaint unit; LIEC = loan implementation environmental consultant; BPMO = Baiyin municipal project management office; CSC = construction supervision company; LMC = Liuchuan Industrial Park Management Committee.

H. Mechanisms for Feedback and Adjustment

31. The EMP is a live document. The need to update and adjust the EMP will be reviewed when there are design changes, changes in construction methods, unfavorable environmental monitoring results or inappropriate monitoring locations, and ineffective or inadequate mitigation measures. Based on environmental monitoring and reporting systems in place, the BPMO and LMC (with the support of the LIEC) shall assess whether further mitigation measures are required as corrective action, or improvement in environmental management practices are required. BPMO will inform ADB promptly on any changes to the project and needed adjustments to the EMP. The updated EMP will be submitted to ADB for review and approval, and will be disclosed on the project website.

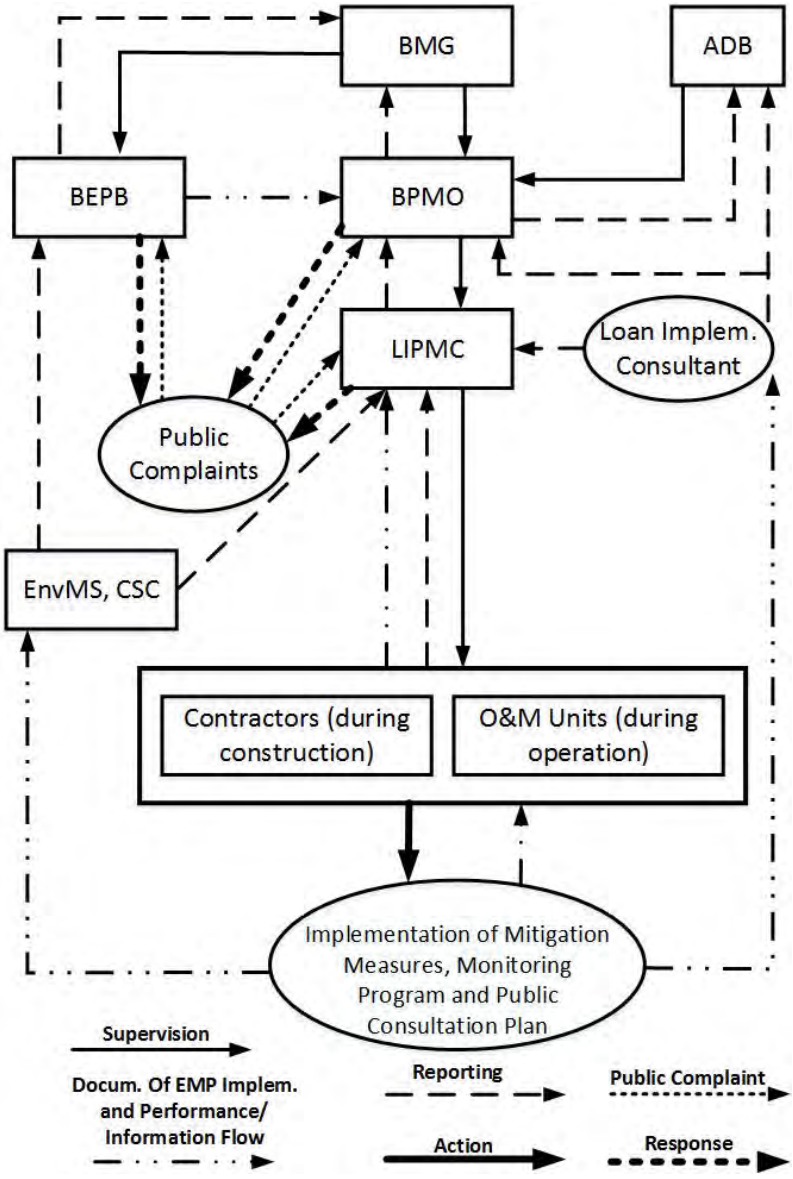


Figure EMP-4: Mechanism for Feedback and Adjustment

June 2014

PRC: Gansu Baiyin Integrated Urban Development Project

Liuchuan Industrial Park - Environmental Management System (EMS) Project Subcomponent

Asian Development Bank

Liuchuan Industrial Park
EMS Component Project – June 2014

CONTENTS

ABBREVIATIONS

ADB	–	Asian Development Bank
BPMO	–	Baiyin Project Management Office
EMIS		Environmental Management Information System
EMS		Environmental Management System
EPR		Emergency Preparedness and Response
LIP		Liuchuan Industrial Park
LMC		Liuchuan Industrial Park Management Committee
MSW	–	municipal solid waste
PRC	–	People's Republic of China
WWTP		Wastewater treatment plant

CURRENCY EQUIVALENTS

(9 May 2014)

Currency Unit	–	Yuan (CNY)
CNY1	=	$.1639
$1	=	CNY6.1

Figure EMS-1: Location of the Liuchuan Industrial Park (LIP) in Baiyin Municipality

Figure EMS-2: Liuchuan Industrial Park (LIP) Phase 1 (blue) and Phase 2-3 (red)

I. THE GANSU BAIYIN INTEGRATED URBAN DEVELOPMENT PROJECT

1. Baiyin is a medium-sized city in Gansu province (Gansu), one of the 12 less-developed provinces and autonomous regions targeted under the Western Development Strategy of the People's Republic of China (PRC). The city was originally established as a national copper mining base in the 1950s but its socioeconomic development suffered major setbacks after continuous copper exploitation and depletion, and environmental degradation.

2. Since the Eleventh Five-Year Plan 2006–2010, Baiyin received special support from the national and provincial governments to jumpstart its industrial transformation. The goal was to transform Baiyin from a resource-exhausted mining city into a new industrial center through technology upgrading and diversification of existing production chains, while achieving efficient use of resources and reducing adverse impacts on the environment.

3. In 2008, the Gansu Baiyin Urban Development Project (Phase I project) was approved by ADB, providing assistance on urban road construction and district heating supply to support the initial stage of economic diversification in Baiyin district and Pingchuan district. Although Baiyin's industrial output continued to grow by 18.9% annually in 2008–2012, urban infrastructures are still inadequate to support its economic diversification through industrial transformation. Baiyin's economy still lags behind as its per capita gross domestic product in 2012 remained at $4,136 (CNY25,231), only 66% of the national average of $6,288 (CNY38,354).

4. Baiyin's industrial transformation aims to facilitate inclusive and environmentally sustainable urban development. Although the Phase I project supported Baiyin to kick start its economic diversification, the city faces emerging urban development challenges. The water supply and wastewater treatment facilities are inadequate and land development cannot keep pace with the industrial transformation. Uneven urban–rural development broadens income disparities between two urban districts and three rural counties, thereby undermining inclusive socioeconomic growth. Limited opportunities for vocational capacity development also hinder the surplus labor force and laid-off workers from developing skills in support of the transition. Frequent traffic congestion and road hazards in the urban district adversely affect logistics and people's quality of life.

5. The Gansu Baiyin Integrated Urban Development Project will contribute to the circular economy (CE) goal of the Baiyin municipal government (BMG). The project will support: (i) development of Liuchuan industrial park (LIP); (ii) efficient water service for drinking and industrial processing; (iii) wastewater treatment for residential and industrial areas in LIP; (iv) strengthen vocational education and training capacity in Baiyin and Jingyuan County; (v) enhance environmental management for industrial transformation; and (vi) enhance road safety and traffic management in Baiyin district.

II. SUBCOMPONENT ON ENVIRONMENT MANAGEMENT SYSTEM (EMS)

A. Overview

6. Under subcomponent (v) of the Gansu Baiyin Integrated Urban Development Project, the project will support BMG and the Liuchuan Industrial Park Management Committee (LMC) to develop a comprehensive environmental management system (EMS) for the LIP, and assist LIP moving toward eco-industrial park (EIP) accreditation under national CE and EIP promotion programs coordinated by the PRC Ministry of Environment Protection (MEP) and the National Development and Reform Commission (NDRC).

7. **The project area.** The main project area is located in a 23-km^2 planned area of Liuchuan Industrial Park (LIP) of the poverty-stricken Jingyuan County, one park of the "one zone and six parks" comprising Baiyin Industrial Concentrated Zone, which is a strategic industrial base of the Lanbai (Lanzhou – Baiyin) Core Economic Zone. It aims at attracting large and medium industrial enterprises from the Eastern Region, focusing on rare earth materials, non-ferrous metal processing, coal chemical, equipment manufacturing, warehousing, logistics, and construction material industries. The area possesses advantages in terms of land, coal, water and labor resources. It is comprised mainly of wasteland and low hills, with little farmland and few inhabitants. There are provincial level road and railway links. The LIP will be supplied with centralized water supply and wastewater collection and treatment systems (under components ii and iii of the project). Water supply will come from the Yellow River some 15 kilometers away. The long-term plan is for 100% recycling of wastewater effluent for on-site landscaping or industrial reuse, but until this has been designed and constructed there are plans to discharge treated wastewater effluent to the nearby Dasha River. Solid waste can be disposed of at the nearby Jingyuan county landfill site (currently being extended), while hazardous waste can be hauled to the hazardous waste treatment facility located in Lanzhou.

8. **Current pollution sources and environment management capacities within LIP.** A number of industrial complexes have already been established in the LIP. The major potential hazardous sources and pollutants of concerns identified include the following:

Industries	Pollutants of Concern, Parameters			Relevant Pollutant Discharge Standards
	Industrial wastewater	Gas emissions	Solid and hazardous wastes[1]	
Non-ferrous metal smelting	pH, suspended solids, chemical oxygen demand, sulfide, volatile phenol, lead, zinc, arsenic, cadmium, mercury, hexavalent chromium and other	Particulate matter, sulfur dioxide, fluorides, asphalt smoke	Drosses and skimmings, spent linings and refractories, wastes/residues/by-products of air pollution abatement systems, wastes and residues from hydrometallurgical processes.	Emission standard of pollutants for aluminum industry (GB25465-2010)
Rare earth	pH, suspended solids, fluoride, petroleum, COD, TP, TN, ammonia, zinc, thorium, uranium, cadmium, lead, arsenic, chrome, hexavalent	Sulfur dioxide, sulfuric acid mist, hydrogen chloride, chlorine, nitrogen oxide, thorium, uranium	Spent hydroxide cake, spent monazite solids, spent sodium fluoride, waste filtrate, waste solvent, spent lead filter cake, lead backwash sludge, solvent extraction crud	Emission Standards of Pollutants from Rare Earth Industry (GB26451-2011)
Coal Power generation	pH, suspended solids, sulfides, volatile phenol, lead, arsenic, cadmium, petroleum, water temperature, etc.	Smoke, NO_X, SO_2	Fly ash, bottom ash, boiler slag, flue gas desulfurization sludge, demineralizer regenerants and rinses, boiler cleaning wastes, pyrites	Emission standard of air pollutants for thermal power plants. (GB 13223-2011)

[1] In addition to conventional domestic waste streams from packaging, food processing, and other domestic waste streams in the industrial enterprises.

Industries	Pollutants of Concern, Parameters			Relevant Pollutant Discharge Standards
	Industrial wastewater	Gas emissions	Solid and hazardous wastes[1]	
Ceramics	COD, phenol, etc.	Dust, smoke, SO_2	Process sludge resulting from glazing, plaster, and grinding activities, broken ware, solids from dust treatments, spent plaster molds.	Emission Standard for Pollutants from Ceramics Industry (GB 25464-2010)

Sources: For industrial wastewater and gas emissions: LIP Phase 1 planning EIA (2012). For solid and hazardous waste: (1) Guidance Document for Management of Wastes from the Base Metals Smelting Sector, Environment Canada, Web.; (2) U.S. Congress, Office of Technology Assessment, Managing Industrial Solid Wastes From Manufacturing, Mining, Oil and Gas Production, and Utility Coal Combustion-Background Paper, OTA-BP-O-82 (Washington, DC: U.S. Government Printing Office, February 1992); (3) Rare Earth Elements: A Review of Production, Processing, Recycling, and Associated Environmental Issues, US EPA, EPA 600/R-12/572, December 2012; (4) Ceramics Manufacturing Environmental Issues, (ceramic_and_tile.pdf), unidentified author.

9. Any accidents or wrong-doing will cause environmental pollution in the LIP. LMC does not have any EPR system that can provide monitoring and response facilities for LIP's needs. The PPTA review strongly recommended establishing an EMS including emergency preparedness and response (EPR) mechanism for the LIP due to the nature of current and future industries within the LIP, the vulnerability of the Dasha River (tributary to Yellow River), the proximity to residential areas, and the need to abide by regulatory compliance.

10. **PRC programs for circular economy (CE) and eco-industrial parks (EIP).** The PRC National Demonstration EIP Program under MEP divides the development process of an EIP into three stages: (1) EIP planning, (2) EIP implementation, and (3) accreditation of a National Demonstration EIP. According to current practices, the first planning stage tends to last for two to three years for those parks that have already conducted some eco-industrial development practice and obtained an ISO 14001-certified EMS for the entire industrial park. The second stage - EIP implementation - tends to last for three to six years. The NDRC implements the National Pilot Circular Economy Zone Program (NPCEZP) by stimulating cleaner production and eco-design at the firm level, promoting industrial symbiosis and EIPs at the industrial cluster level, and establishing regional eco-industrial networks at the regional level. The MEP and NDRC follow similar and complementary pathways. The PRC Standard for Sector-Integrated Eco-Industrial Parks (HJ 274-2009) issued by MEP (see **EMS-Appendix 4** for full copy of standard) defines the following requirements to quality for EIP accreditation:

(i) The industrial park (IP) has effectively implemented all relevant national and local legislation, regulations and policies;
(ii) No significant pollution accident occurred in the last three years;
(iii) The environmental quality satisfies the environmental function zone standards; all pollutant emitters in the park satisfy the discharge standards; the total pollutant discharge amount is within the total amount control targets;
(iv) An "eco-industry park construction plan" has been prepared and was approved by MEP/State EIP Demonstration Leading Group Office and local government;
(v) The IP has a dedicated environment unit and staff with clear responsibilities for environment management. An independent environmental protection agency dedicated to the IP is encouraged; environmental protection is one performance indicator to assess the performance of IP leaders;
(vi) The IP is ISO 14001 certified;
(vii) New buildings in the IP satisfy energy saving standards for buildings;

(viii) The IP has formed major industry clusters and significant eco-industry chains.

11. **Short-, mid- and long-term objective of EMS subcomponent.** The EMS subcomponent aims at ensuring safe, environmentally friendly and sustainable operations in the LIP. The primary and short-term objective of the EMS subcomponent is to enhance environmental management and emergency response capacity of the LIP to minimize environmental pollution and mitigate negative impacts of environmental incidents (to comply with requirements (i)-(v) and (vii) of HJ274-2009 defined above). The mid-term objective (2018) of the subcomponent is to achieve ISO 14001 EMS certification for the LIP (to comply with requirement (vi) of HJ274-2009 defined above, Outcome Statement). The proposed EMS for LIP is designed to achieve the EIP accreditation requirements (HJ 274-2009) by 2025 (Impact Statement).

B. Main EMS components

12. The proposed EMS will target pollutants of concern from existing and future industries in the LIP, and will include an environmental management information system (EMIS), an emergency warning system, and rescue and mitigation strategies and measures. The proposed scope of the subcomponent includes:

(i) establishment of an EMS including EMS Center within the LIP under LMC including development of clear EMS management procedures, procurement and installation of office equipment, mobile environmental monitoring equipment;
(ii) development of an emergency preparedness and response (EPR) plan, including EPR management procedures, procurement of emergency responses equipment;
(iii) establishment of an environmental management information system (EMIS) targeting pollutants of concern including EMIS software; and
(iv) training program including study tours on all EMS aspects.

13. Drawing on the elements of the established business management process of "plan, do, check, and act," the EMS must include a methodological approach to managing environmental and social risks and impacts in a structured way on an ongoing basis. A good EMS appropriate to the nature and scale of the project promotes sound and sustainable environmental and social performance, and can lead to improved financial, social, and environmental outcomes.

C. Environmental management system for LIP

14. The **EMS for LIP** will comply with international best practices including IFC Performance Standards[2] (Standard 1 covers Assessment and Management of Environmental and Social Risks and Impacts), and incorporate the following elements: (i) policy; (ii) identification of risks and impacts; (iii) management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review. **EMS-Appendix 5** provides a programmatic outline of the strategies that will be incorporated into the development of the EMS, while **EMS-Appendix 6** provides detailed roles and responsibility matrices of the LMC and county EPB. All of these EMS aspects will be further explored and refined by the EMS component project international and national consultants who will assist the LMC in the establishment of the EMS as well as moving the LMC and the entire LIP toward ISO14001 certification.

15. The EMS component project has been structured in recognition of the respective roles of the LIP management and staff responsibilities versus the responsibilities and normal operating practices of

[2] International Finance Corporation, Performance Standards on Environmental and Social Sustainability, January 1, 2012

the county and municipal EPBs. The EMS establishment, planning and strategic oversight roles are largely with the LMC and these activities include:

- Setting environmental policy, objectives and targets for LIP;
- Developing a program to meet objectives and targets, including resources;
- Communication plan, document control, and emergency preparedness;
- Approval of LIP enterprise operational plans relative to environmental aspects;
- Introduction of LIP enterprise environmental measures to minimize environmental impacts and wastes such as industrial symbiosis, resource conservation, etc; and
- Monitoring and measuring performance of EMS.

16. The Jingyuan County EPB role will be to ensure that the water supply, wastewater, and waste management systems are properly managed for minimal environmental problems and to foster environmental sustainability of operations. Their role will be regulatory to ensure compliance with PRC laws and regulations as well as technical oversight to help LIP and its tenants stay abreast of advanced environmental techniques.

D. Emergency preparedness and response (EPR) system

17. An emergency preparedness and response (EPR) plan will be prepared through the EMS component project consultancies and training program. A national environmental preparedness and planning consultant will be engaged to work with the LMC to define the EPR program needs as well as necessary emergency response equipment, and perform initial training. The EPR plan will address all aspects of planning and managing emergencies including the following:

- Analysis of LIP hazards and current capabilities to manage risks;
- Vulnerability analyses to estimate probabilities of various potential emergencies and potential impacts to people, property, business and environment;
- Development of formal plan including priorities, budget, training, etc.;
- Procurement and installation of necessary EPR equipment based on needs identified; and
- Implementation of the plan, including coordination of internal and external stakeholders.

18. The more common elements to be addressed in the LIP EPR plan will include the following: (i) fire protection; (ii) hazardous materials spills; (iii) failure of pollution control and/or spill containment equipment; (iv) natural disasters such as floods, hurricanes, tornadoes, winter storms, earthquakes; (v) technological failures of equipment; (vi) security breaches. Industries that have already been established in the LIP will be required to participate in the EPR system.

E. Environmental management information system (EMIS)

19. An environmental management information system (EMIS) will be developed and implemented to help LMC track the LIP and its industries compliance with relevance with, and progress towards, achieving eco-industrial park accreditation. The web-based EMIS will provide an automatic, state-of-the art ICT solution and include an administrative and technical database of enterprises, emission sources, waste streams, monitoring data analysis, embedded GIS for the industrial estates and surrounding environment and population. It will also be a tool to assist performance monitoring and technological risk assessment and real-time emergency management in case of accidental release of hazardous materials, atmospheric or aquatic dispersion, fires etc;

20. The EMIS will focus on the recommended **performance indicators** defined in the government's key standards on eco-industrial parks, including 'Standard for Eco-Industry Park' (HJ/T274-2006), 'Revised Standard for Eco-Industry Park' (MEP, 2012) and 'Management of National Demonstration Eco-industrial Park' (trial) (MEP. [2007] 188):

- Resource efficiency: energy consumption per added value, solid waste generation per added value, water reuse ratio etc;
- Pollutant prevention and abatement: COD emission per added value, SO_2 emission per added value, hazardous waste disposal, wastewater treatment compliance, solid waste collection and disposal system, environmental accidents, pollutant emission compliance ratio, etc;
- Industrial park management: EIA completion, emergency preparedness and response, public complaints redress, etc. [3]

F. Training

21. The training program will focus on ISO 14001 certification, emergency preparedness and response, and EMIS. The training program will include study tours to other PRC industrial parks which have achieved ISO 14001 certification and/or EIP accreditation. A national training consultant will work with the EMS, EPR and EMIS consultants to develop and implement the training program.

G. Implementation schedule

22. The EMS project component will be implemented in three stages. **Stage 1 (3 months)** will be reconnaissance-based and will review international and PRC best practices for industrial park environmental management, emergency response and environmental management information systems. Data will simultaneously be collected on current management systems and practices proposed for implementation in LIP and other Baiyin industrial parks, as well as EMS and/or EPR systems established at industrial estate level (for those industries already located within LIP).

23. **Stage 2 (6 months)** will develop detailed plans to establish the LIP EMS, the LIP EPR, and the LIP EMIS, including staffing and budget requirements, equipment, policies and management systems for all of these outputs.

24. **Stage 3 (9 months)** will provide assistance to LMC in implementing the plans developed under Stage 2. LMC ISO 14001 certification is targeted by month 18.

25. Major risks to the successful implementation of the EMS project component are the (i) inadequate or delayed establishment of EMS Center within the LIP under LMC, (ii) delayed submission of required LIP staffing, (iii) inadequate performance of consultants, and (iv) inefficient implementation of EMS component project findings and outputs in the LIP. To mitigate risks, the recruitment and performance of consultants will be monitored closely. The government has agreed to establish the EMS Center within the LIP under LMC in a timely manner and adequate counterpart support. Close coordination among the consultants, LMC, BPMO, and ADB will further mitigate risks.

[3] Industries that have already established within LIP are partly complying with EIP accreditation indicators (e.g. EIAs have been prepared for each industry; industrial wastewater pretreatment systems have, or will be, installed), or will be required to comply with (e.g. setting water reuse targets, establishing emergency preparedness and response procedure, etc).

H. Budget

26. The EMS project component is estimated to cost $430,000 financed under the loan. The government will provide counterpart support in the form of office space, remuneration and per diem for counterpart staff, city transport, miscellaneous administration and support costs, and other in-kind contributions. The design and monitoring framework is in **EMS-Appendix 1** and cost estimates and the financing plan are in **EMS-Appendix 2**.

I. Implementation Arrangements

27. The EMS project component will be implemented over 1.5 years from August 2015 through January 2017 coinciding with the initial steps of the project implementation period. LMC will have overall subcomponent implementation responsibility, under the supervision of the BPMO. LMC will establish an EMS oversight board which will include the LMC, Jingyuan County EPB, and Baiyin EPB.

28. The EMS project component will finance equipment, consulting services, training, and domestic study tours. Consulting services totaling 19 person-months (3 person-months international and 16 person-months national) will be required. Consultants will provide expertise in EMS development and implementation, emergency preparedness and response (EPR) planning, environmental management information system (EMIS) development; and training on all of these aspects.

29. Consultants will be engaged (under Component D of the project) through a firm according to ADB Guidelines on the Use of Consultants (2010, as amended from time to time) using quality- and cost-based selection criteria and simplified technical proposal procedures. A quality - cost weighting of 90:10 is considered appropriate because the EMS component project is a multidisciplinary assignment that requires innovation and creativity, and the quality of the consulting services will strongly determine the performance of the LIP EMS. Equipment will be procured in line with ADB Procurement Guidelines (2010, as amended from time to time).

30. Outline terms of reference for the consultants are in **EMS-Appendix 3**.

EMS-APPENDIX 1 – DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
Impact LIP promotes sound environmental practices through its EMS program including comprehensive planning for industrial symbiosis	Eco-Industrial Park (EIP) accreditation under MEP or NDRC by 2025.	EIP accreditation certificate. Annual reports and statistics during project implementation from BPMO. Annual environment management reports of LIP (by LMC) to MEP or NDRC.	**Assumptions** The government and LMC remain committed to development of an environmentally friendly and sustainable industrial park. LMC implements EMS component project recommendations and guidelines effectively.
Outcome Accredited environmental management system (EMS) for LIP is operational.	ISO 14001 certification of LMC by 2018. Indicators of Standard for Sector-Integrated Eco-Industrial Parks HJ 274-2009)	ISO certificate. Annual environment management report of LIP (by LMC) to MEP or NDRC.	**Assumption** The LIP embraces the EMS component project recommendations and supplies sufficient budget and staff to fully implement programs.
Outputs 1. An EMS including EMS Center (within the LIP under LMC).	Clear EMS management procedures defined by month 9, and implemented by month 16. Office equipment, mobile environmental monitoring equipment procured and installed by month 14.	Interim report and draft final report of EMS consultant to BPMO	**Assumptions** Senior authorities in LIP prioritize implementing the EMS component project. Municipal and local authorities fully cooperate with proposed EPR program for LIP
2. An emergency preparedness and response (EPR) plan for LIP.	EPR management procedures defined by month 9, and implemented by month 16. Emergency response equipment procured and operational by month 16.	Interim report and draft final report of EMS consultant to BPMO	**Risks** The provision of necessary LIP staff and budget is insufficient. The performance of the consultants is inadequate.
3. An environmental management information system (EMIS) targeting pollutants of concern	EMIS including procedures and required equipment defined by month 9, and implemented by month 16.	Interim report and draft final report of EMS consultant to BPMO	.

Design Summary	Performance Targets and Indicators with Baselines	Data Sources and Reporting Mechanisms	Assumptions and Risks
for LIP. 4. Training including study tours on all EMS aspects conducted.	Training Needs Assessment (TNA) conducted by month 3. Training plan defined by month 8 and implemented by month 16. One national study tour conducted to review industrial park EMS operations by month 9.	Interim report and draft final report of EMS consultant to BPMO	

Activities with Milestones (18 month project)	Inputs
1. Phase 1 (3 months) 1.1 EMS consultant mobilization (August 2015) 1.2 Submission of draft inception report (by end of month 2) 1.3 Reconnaissance including review international and PRC best practices for industrial park environmental management, emergency response and environmental management information systems. 1.4 Data collection on current management systems and practices proposed for implementation in LIP and other Baiyin industrial parks. 1.5 Establishment of LIP environmental protection division (to host EMS Center). 1.6 Conduct Training Needs Assessment (TNA) for LIP EMS. **2. Phase 2** (6 months) 2.1 Drafting of EMS including policy, structure, institutional responsibilities, equipment needs. 2.2 Drafting of EPR plan including equipment needs. 2.3 Drafting of EMIS proposal including equipment needs. 2.4 Conduct national study tour. 2.5 Submission of interim report (by month 8). **3. Phase 3** (9 months) 3.1 Implement recommended EMS program, including equipment procurement and installation. 3.2 Implement recommended EPR program including equipment procurement and installation. 3.3 Implement recommended EMIS program including equipment procurement and installation. 3.4 Implement training program. 3.5 Finalize application for ISO14001 certification by 16th month. 3.6 Submission of draft final report (by 17th month). 3.7 Drafting of one policy note on the EMS subcomponent as a knowledge product (by 17th month). 3.8 EMS component project closing (by January 2017)	**ADB: $430,000** Note: The LMC will provide counterpart support in the form of office space for EMS Center, remuneration and per diem for counterpart staff, local transport, miscellaneous administration and support costs, and other in-kind contributions.

ADB = Asian Development Bank, BPMO = Baiyin Project Management Office, PRC = People's Republic of China.
Source: Asian Development Bank.

EMS-APPENDIX 2 - EMS COST AND FINANCING PLAN

Item	Total Cost
Asian Development Bank[a]	
1. Consultants	
a. Remuneration and per diem (inc. fees, international/local travel)	
i. International consultants (3 person-months)	60
ii. National consultants (16 person-months)	96
2. Reports and communications	10
3. Equipment[b]	160
4. Training, seminars, and conferences[d]	84
5. Contingencies	20
Total	**430**

[a] Financed through Component D of the proposed Gansu Baiyin Integrated Urban Development Project.
[b] Equipment to be procured may include portable environment monitoring equipment, emergency preparedness and response equipment, park security and safety monitoring equipment, and EMIS computer and database equipment.
[c] Seminars may include transportation and allowance costs for various staff and meeting participants. Training may include expenses to attend domestic conferences and seminars. This includes expenditures for study tours to be conducted in PRC only.

EMS-APPENDIX 3 – OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Objectives

1. The EMS component project will have the following four outputs: (i) establishment and support for EMS development and implementation for the EMS Center (within the LIP under LMC) including equipment procurement, and clear EMS management procedures; (ii) development of an emergency preparedness and response (EPR) plan, including EPR management procedures, procurement and installation of emergency response equipment; (iii) establishment of an environmental management information system (EMIS) targeting pollutants of concern; (iv) training program including domestic study tour on all EMS aspects. The EMS component project will be implemented over 18 months, from August 2015 to January 2017.

B. Tasks

2. The EMS subcomponent will be carried out by a consulting firm and require an estimated 19 person-months of consulting services, 3 person-months international and 16 person-months national. The final input of consultants will be detailed in the simplified technical proposals to be submitted by the short-listed firms.

3. The consultants will have expertise in EMS development and implementation for industrial parks, emergency preparedness and response (EPR) planning, and environmental management information systems. The indicative terms of reference for the experts are as follows.

4. **Environmental management specialist and team leader (international, 3 person-months).** The consultant will assist the Lichuan Industrial Park Management Commission (LMC) with the development and initial implementation of the LIP Environmental Management System complying with ISO 14001 requirements. The specialist will have a post-graduate degree in environmental engineering or environmental management and at least 10 years of experience with developing ISO 14001 environmental management systems, with experience in the PRC. Specific tasks will include the following:

(i) Coordinate the development and implementation of an EMS for LMC, in cooperation with the LMC and the LIP EMS Center, with input from the Jingquan County EPB. The EMS shall clearly define: (a) environmental policy, objectives and targets for LIP; (b) institutional responsibilities for EMS implementation and supervision; (c) a program to meet objectives and targets, including resources; (d) an overall environmental monitoring plan for LIP; (e) an emergency response plan, (f) a training plan; (g) a communication plan including reporting procedures;
(ii) Overview the training program on EMS for all important stakeholders;
(iii) Define a detailed workplan including schedule for LMC to obtain ISO14001 certification by 2018;
(iv) Outline a program including workplan and schedule to achieve Eco-Industrial Park (EIP) accreditation under NDRC or MEP systems by 2025;
(v) ensure that the team's work progresses according to schedule and that inception, interim, draft final, and final reports and other outputs are submitted on time and are of a quality acceptable to the BPMO and ADB; and
(vi) prepare a policy note on environment management system establishment and ISO 14001 certification, for dissemination in the PRC and other ADB DMCs.

5. **Environmental management specialist and deputy team leader (national, 9 person-months).** In coordination with, and under the guidance of, the ISO 14001 international specialist, the

environmental management specialist will support LMC to establish an environmental management system (EMS) including environment management information system (EMIS) for LIP and achieve ISP 14001 certification for its EMS. The specialist will have a post graduate degree in environmental engineering or environmental sciences and at least 5 years of experience with developing ISO 14001 environmental management systems for industrial parks in the PRC. Specific tasks will include the following tasks:

(i) Conduct a review of the current EMSs and working procedures in nearby other industrial parks in Baiyin, including the EMS developed and implemented under Phase I of the Gansu Baiyin Urban Development Project; (ii) Develop a detailed work plan to achieve ISO 14001 certification;
(ii) Support the development and implementation of an EMS for LMC, in cooperation with the LMC and the LIP EMS Center. The EMS shall clearly define: (a) environmental policy, objectives and targets for LIP; (b) institutional responsibilities for EMS implementation and supervision; (c) key components (including, but not limited to: environment management information system (EMIS), monitoring plan, emergency preparedness and response system, communication plan including reporting procedures);
(iii) Provide support to team leader in defining a detailed workplan including schedule for LMC to obtain ISO14001 certification by 2018, and in outlining a program including workplan and schedule to achieve Eco-Industrial Park (EIP) accreditation under NDRC or MEP systems by 2025;
(i) Take the lead in developing a detailed proposal for establishing an effective EMIS for LMC, including requirements for (a) hardware, (b) software, (c) monitoring, data acquisition, processing, storage and use (information for decision making); (d) procedures (design, development and documentation);
(ii) Support LMC to develop the tender documents for EMIS facilities (including monitoring equipment, hardware and software); supervise the procurement, installation, and debugging process; and verify the system‘s compliance with the contractual requirements;
(iii) Conduct relevant training, in close cooperation with the training specialist;
(iv) Carry out other related tasks, as reasonably requested by the team leader.

6. Emergency Preparedness and Response Specialist (national, 5 person-months). The specialist will assist the Lichuan Industrial Park Management Commission (LMC) and its EMS Center with the development and initial implementation of the LIP Emergency Preparedness and Response (EPR) System. The Consultant will have a post-graduate degree in industrial production or environmental engineering, and at least 10 years of experience with developing EPR systems for major industrial facilities in the PRC. Specific tasks will include the following:

(i) Conduct a thorough investigation and an overall qualitative risk assessment of the major environment, health, and safety (EHS) risks in the LIP area;
(ii) Analyze and determine the EHS risk management capacity of the LMC and its EMS Center, and identify main vulnerabilities and risk management requirements;
(iii) Help LMC in developing a proposal for a EPR system as a key component of the LIP-EMS in accordance with national and/or international best practice; including (a) definition of potential hazards; (b) development of systems for preventing accidents; (c) provision of appropriate mechanisms for minimizing risk, loss and damage resulting from such incidents (i.e. reduce exposures to communities); (d) definition of an incident management structure and procedure to guide response activities; (e) identification of emergency response equipment needs; (g) communication strategy; and (h) budget.
(iv) In cooperation with the training specialist, conduct training needs assessment (TNA) for EPR system implementation and operation, and participate as expert in trainings;

(v) Supervise the EPR equipment procurement and installation process;
(vi) Carry out other related tasks, as reasonably requested by the team leader.

7. **Training Specialist (national, 2 person-months).** The specialist will assist the Lichuan Industrial Park Management Commission (LMC) and its EMS Center in developing and implementing a training program to fit the EMS subcomponent specificities and staff needs. The specialist will have a post graduate degree, or equivalent qualification, and at least 7 years of work experience in capacity development for environmental management. The specialist will do the following:

(i) Conduct a trainings needs assessment (TNA) together with LMC, BPMO, and the technical specialists on environment management systems, ISO 14001, and other issues of relevance for implementing the EMS subcomponent;
(ii) Compile and finalize a detailed training plan, in close cooperation with the technical specialists and the LMC and the county EPB, to be endorsed by BPMO and ADB before training is conducted;
(iii) Support the technical specialists in strengthening on-the-job training activities;
(iv) Identify and organize at least one domestic study tour to share and study lessons on environment management systems for industrial parks, ISO 14001 certification and eco-industrial park (EIP) accreditation;
(v) Undertake any other work assigned by the team leader.

8. The consultants will submit the following reports: (i) an inception report within 2 months of mobilization; (ii) an interim report submitted 8 months after mobilization; (iii) a draft final report 16 months after the mobilization; and (iv) a final report submitted 1 month after receiving comments on the draft final report from BPMO, LMC and ADB. The consultants will submit all reports in English and Chinese. The reports will be published in Chinese and English and made available online.

EMS-APPENDIX 4 –STANDARD FOR SECTOR-INTEGRATED ECO-INDUSTRIAL PARKS (HJ 274-2009, MINISTRY OF ENVIRONMENT PROTECTION, PRC)

Basic for requirements for EIP

1. The IP has effectively implemented the relevant national and local legislation, regulation and policies. No significant pollution accident in the recent three years;
2. The environmental quality satisfied the environmental function zone standards; all pollutant emitters in the park satisfied the discharge standards; the total discharge amounts are within the total amount control targets;
3. The' Eco-industry park Construction Plan' has been approved by MEP/State EIP Demonstration Leading Group Office and local government;
4. The IP has dedicated environment unit and staff, and clear responsibilities. Separate environmental protection agency dedicated for the IP is encouraged; environmental protection is one performance indicator to assess the performance of IP leaders;
5. The IP has ISO 14001 certification;
6. The new buildings in the industry park can satisfy energy saving standards for building;
7. The IP has formed major industry cluster and significant eco-industry chain.

Indicators

Item	No	Indicators	Unit	Requirements
Economic growth	1	Per capita industry added value	10,000 CNY/person	>=15
	2	Annual growth of industry added values	%	>=15
Resources reduction and recycle	3	Industry added value /km2 industry land	0.1 billion CNY//km2	>=9
	4	Energy consumption per industrial added value	t/10,000 CNY	<=0.5
	5	Comprehensive energy consumption elastic coefficient		<0.6
	6	Fresh water consumed per industrial added value	m3/10,000 CNY	<=9
	7	Fresh water consumption elastic coefficient		<0.55
	8	Wastewater production per industrial added value	t/10,000 CNY	<=8
	9	Solid waste production per industrial added value	t/10,000 CNY	<=0.1
	10	Industrial water recycle	%	>=75
	11	Solid waste reuse rate	%	>=85
	12	Water reuse	%	(≥12-40) depending on the region the IP located
Pollution control	13	COD emission per industrial added value	Kg/10,000 CNY	≤1
	14	COD emission elastic coefficient		<0.3
	15	SO2 emissions per industrial added value	Kg/10,000 CNY	≤1
	16	SO2 emission elastic coefficient		<0.2
	17	Hazardous waste treatment rate	%	100
	18	Domestic wastewater treatment rate	%	≥85
	19	Domestic garbage treatment rate	%	100
	20	Solid waste collection and centralized treatment capacity		yes

Item	No	Indicators	Unit	Requirements
IP management	21	Environmental management system and capability		complete
	22	Eco-industry information system	%	100
	23	Environmental Management report for the IP	annual	1
	24	Clean production auditing for key enterprises	%	100
	25	Public satisfaction on environment	%	≥90
	26	Public awareness on eco industry	%	≥90

EMS-APPENDIX 5 – LIP PROGRAMMATIC OUTLINE

There are a variety of environmental concerns for the management of the Liuchuan Industrial Park (LIP) which will be under the purview of the LIP EMS:

- Protection of the atmosphere – in addition to more traditional problems of air pollution, the energy use pattern within the LIP is directly related to emissions of carbon dioxide, while industrial activities within the LIP can result in the release of other greenhouse gases or ozone-depleting substances.
- Sustainable management of land – this is associated with the choice of the location of the various tenant industries within the LIP and integration of raw materials and wastes using industrial symbiosis.
- Sustainable agriculture and rural development – ensuring that the development of the LIP does not have a large impact on the local socio-economic framework.
- Conservation of biological diversity – the damage to ecosystems when an LIP is built may result in loss of habitat and affect biodiversity in the region (e.g. the use of reclaimed wetlands or other sensitive areas). Releases into the environment around the LIP of chemicals that are toxic, persistent and bio-accumulative can also have a negative effect on wildlife.
- Protecting and managing fresh water – the release of WWTP effluent to Dasha River could lead to contamination rendering the water unusable for human consumption and leading to loss of aquatic species. In addition, an unsustainable use of freshwater for industrial purposes can lead to water scarcity for the surrounding areas.
- Safer use of toxic chemicals – accidental releases of chemicals can result in exposure in the workplace as well as putting the surrounding communities and environment at risk.
- Managing hazardous wastes – inappropriate treatment and/or storage of waste from an LIP may lead to the accumulation of hazardous substances in the soil and in groundwater, resulting eventually in the transport of toxic substances into the food-chain. For the LIP management, the potential liability to the LIP represents a serious problem to the LIP's long-term economic viability.
- Managing solid wastes and sewage – improperly managed disposal of solid waste by landfill can result in leaching into the soil and groundwater. Landfill sites also have significant impacts on land-use and landscape since they require large amounts of land. Improperly treated wastewater and sewage from LIP could lead to water contamination and eutrophication and result in a scarcity of drinking water.

The LIP will be home to a large number of different companies that value, if not their independence, certainly their interdependence. This could result in there being a **cumulative effect of the environmental aspects** of the individual companies within the LIP, but with each company tending to address its problems on an individual basis.

However, this does not necessarily need to be the case - the proximity of the companies in the LIP could also be used profitably if a way can be found to co-ordinate their activities. A co-operative effort to address some of their, and hence the LIP's, environmental problems by exploiting synergies between the companies can prove to be more effective and less costly than an individual approach.

The role of the manager of the LIP will be very different to that of a company CEO in terms of how to introduce and implement environmental management, and the EMS should assist the LIP management in finding ways to balance the interests of the individual companies with those of the LIP as a whole. This requires a new approach to environmental management that is specifically tailored to the needs of the LIP using the LIP EMS.

The Liuchuan EMS will help the LMC to provide leadership in the area of environmental performance to the industrial sectors and tenants which locate in the LIP:

- The LIP EMS will provide a fertile ground for the introduction of better environmental practices because of their provision of common infrastructure, their close links with government, and the location of a broad spectrum of companies.
- The position of the LIP in the global supply chain will give companies within the LIP an opportunity to influence their local suppliers with respect to environmental performance, such as by requesting that they have ISO 14001 certification.
- The LIP EMS will bring together stakeholders from all parts of society, including manufacturing companies, local and national government, and local communities.

The LIP EMS will function through an administration that assumes the following roles:

- A **managerial role** for enforcing restrictive covenants in leasing agreements, deciding on the entry of new companies into the LIP, collecting rents and ensuring that taxes and charges are paid, and being responsible for maintenance and order on the LIP.
- A **technical role** that covers responsibility for common facilities as well as training or other technical services.
- A **financial role** including overseeing loans to tenant companies on the LIP or arranging bulk purchasing agreements for materials.

The Liuchuan Industrial Park will require the participation of a number of stakeholders to be successful on all fronts - economic, social and environmental. These stakeholders come from four sectors of society:

(a) Government:
Local and central governments may intervene at various stages of the development and operation of the LIP. Firstly government may be the sponsor of the LIP, initiating the project and providing the initial financing. As the sponsor, government's goal is to attract business to locate in the LIP so as to bring investment and employment to the region. However, government has a second role that may prove to be in contradiction with its desire to attract business and investment. This is its responsibility to the community to protect the environment by monitoring and enforcing environmental regulations. It must therefore ensure that its policies, planning and legislation are well-adapted to achieve a balance between the socio-economic role of the LIP and environmental protection.

(b) The Management of the LIP (LMC):
The management of the LIP has three main roles, as previously described. These are - managing the operation of the LIP, maintaining the technical services and arranging financing. The LIP management will also retain a close relationship to government agencies.

(c) Companies:

The tenant companies are present in the LIP because they believe that this is where they can maximize their profits. In addition to their economic goals, they are obliged to comply with the laws of the country in areas such as health, working conditions, worker safety, and environmental impact. In this respect, companies are constrained to find the optimal solution to satisfy both sets of criteria.

d) Communities:
Local communities are important stakeholders in the LIP since they benefit economically through employment and increased economic activity for the region, but may well suffer from the environmental impacts arising from the development and activities of the LIP. Communities are increasingly demanding to be informed about the activities of nearby industrial complexes.

For the EMS to be relevant the LIP manager must, as a minimum requirement:

1. Be responsible for activities that have a significant environmental impact, such as solid waste treatment and wastewater treatment.
2. Be able to control and influence the outputs of the tenant companies.
3. Be in a position to provide training for tenant companies on EMS.

The LIP Management will initially provide many environmental services to their tenants as an integral part of the overall offer of services and activities:

- Supply of water
- Collection and treatment of wastewater
- Training on environmental issues
- Environmental monitoring
- Environmental auditing
- Provision of services and advice for emergency situations, such as accidents from the emergency response plan.

The LIP Management under the EMS can consider offering other environmental services to their tenants as an integral part of the overall offer of services and activities such as:

- Centralized supply of heating and/or energy
- Waste recovery and valorization (by-product synergies)
- Collection, treatment and disposal of hazardous waste
- Collection and disposal of solid waste
- An information service on environmental issues (environmental regulations
- new technologies, new waste minimization concepts etc)
- Environmental auditing

The LIP EMS should manage the monitoring of the environmental parameters of the LIP as part of the LIP's EMS, such as:

- ambient environmental quality
- emissions to water and air
- solid waste generation (including hazardous waste)
- storage of hazardous goods on site
- accidents and spillages, and
- procedures for the control of safety and pollution

Perhaps the most important feature of being able to introduce an EMS within the LIP is that it allows everybody, both tenant companies and the LIP management, to speak the same environmental language and to work towards similar goals for the LIP. Each company will achieve its goals in its own way – its workers are undoubtedly the most knowledgeable about its processes and how to address the environmental aspects of them. However, this will hopefully open up the possibility of collaboration to solve environmental problems. Such a collaborative approach can lead to the implementation of strategies such as these in the LIP:

1. Maximize energy efficiency in design of LIP through
    a. co-generation and energy cascading within and between firms, and
    b. extensive use of renewable sources.

2. Master material flows and waste management for the LIP site by
    a. emphasizing Pollution Prevention, in particular with respect to toxic materials,
    b. maximizing re-use and recycling of materials between firms in the LIP,
    c. reducing risk from toxic waste materials by integrated waste management within the LIP, and
    d. creating links between firms in the LIP and the surrounding region for exchanges of resources and recycling networks.

3. Conserve water resources and reduce possibilities of water pollution.

4. Entrust the management of the LIP with the following tasks in addition to the traditional functions (maintenance, recruitment)
    a. maintaining the range of companies required to allow the by-product synergies to function efficiently
    b. supporting improvements in environmental performance within companies as well as for the LIP as a whole
    c. supporting efficient communication between companies, informing members of local environmental conditions and providing feedback on the LIP performance.

5. Follow best environmental practices in the selection of materials and building technology when carrying out new construction or rehabilitation of existing buildings.

6. Integrate the LIP into natural ecosystems by
    a. incorporating the LIP into the local landscape and ecosystems, for example the hydrological cycle, so as to minimize local environmental impacts
    b. considering the global environmental impact of the activities of the LIP, such as the production of greenhouse gases.

EMS-APPENDIX 6 – EMS ROLES AND RESPONSIBILITIES

The following is an initial outline of expected roles and responsibilities for the LIP EMS based on international best practices. Some of the monitoring aspects will be revised to account for issues of institutional responsibilities for monitoring in the PRC and problems with data sharing. The technical specialists will refine these initial roles during their work on the EMS.

The EMS for the Liuchuan Industrial Park requires a set of interrelated responsibilities including:

- Liuchuan IP Management and Management Committee (LMC) for EMS Establishment, Planning, and Strategic Oversight
- Individual Enterprises working cooperatively within the framework, policies and procedures of the IP EMS.

Jingyuan County EPB will not be directly involved in the EMS but will provide a technical support and regulatory function on various aspects as shown on the attached table. During operations, other agencies are also involved.

Table 1 – EMS Establishment, Planning and Strategic Oversight

EMS Establishment, Planning and Strategic Oversight Activity	Liuchuan IP Management and Management Committee	Jingyuan County EPB – technical support and regulatory)
Environmental policy, by top management is the first requirement of ISO 14001 and PRC certification. The policy directs goals, responsibilities and the establishment of performance against which the management must be judged. Top management is responsible for the initiation of the policy and for providing leadership.	Establish Environmental Policy • Reflect an ethical basis for the IP's actions • Account for regulatory requirements • Show commitment to continual improvement • Be in line with other policies used within the IP (quality management) • Be clear and concise and known by all levels within the IP • Be publicly available • Strive towards sustainable development • Set for publication of environmental objectives • Satisfy the requirements of concerned third parties such as Insurance companies, banks, and shareholders • Be updated when needed	Provide technical ideas and suggestions for incorporation into policy.
Environmental objectives and targets, the organization shall establish and maintain documented, at each relevant function and level within the organization.	Establish environmental objectives and targets for IP environmental performance. These objectives and targets must be consistent with and contain the commitments required in the policy. The business plan must be in line with the objectives and targets. Examples could include e a total load control target for wastes or water and energy conservation goals.	Provide technical ideas and suggestions for incorporation into environmental objectives and targets.
Availability of resources, essential to establish, implement, maintain and improve the EMS. Resources include human resources and specialized skills, organizational infrastructure,	The responsibilities for the environmental management must be defined and its roles must be communicated to everybody involved. The standard is clear about the appointment and authority of the management representative. This is seen as top management's commitment. Although operational resources are mainly needed by EPB for operational management, the IP should also	Most of the operational issues outlined in Table 2 will require human resources, skills, equipment and other resources

EMS Establishment, Planning and Strategic Oversight Activity	Liuchuan IP Management and Management Committee	Jingyuan County EPB – technical support and regulatory)
technology and financial resources.	allocate resources and potentially a senior staff member to EMS activities.	
Program for achieving objectives and targets, established and maintained	IP should develop program to include: • Designation of responsibility for achieving objectives and targets at each relevant function and level of the IP. • The means and time frame by which they are to be achieved.	Develop operational management program to work within the goals and timeframes of the strategic program of the IP.
Communication Plan	The organization shall establish and maintain procedures for: • Internal communication between the various levels and functions of the organization,, including individual enterprises in LIP • Receiving, documenting and responding to relevant communication from external interested parties • Interested parties outside the IP may comprise neighbors, community groups, local government, and municipalities, regulatory agencies and emergency responders	Environmental monitoring and other operational activities developed and reported according to EMS communication plan, while being cognizant of EPB policies on release of data and information.
Maintenance of Documents	The IP shall establish and maintain documents describing their programs for achieving its objectives and targets. It shall include: • The environmental policy, objectives and targets • Description of the scope of the EMS • Description of the main elements of the EMS and their interaction, and reference to related documents • Documents, including records, required by ISO 14001 or PRC certification processes • Documents, including records, determined by the IP to be necessary to ensure the effective planning, operation and control of processes that relate to its significant environmental aspects.	Technical support to all aspects of the program including documentation of their operational activities
Operational Control	The IP management will identify those operations and activities associated with the identified significant environmental aspects in line with its policy, objectives and targets in order to ensure that they are carried out under specified conditions.	EPB will also ensure their activities are carried out under specified conditions.
Emergency preparedness and response	IP shall establish and maintain procedures to identify potential emergency situations and potential accidents that can have an impact on the environment and how it will respond to them. Periodically review and test procedures.	Respond to actual emergencies and accidents and prevent or mitigate associated adverse environmental aspects
Industrial enterprise approvals	Ensure that strategic goals for IP enterprises and environmental goals are consistent with proposed operations of enterprise. Ensue that proper approval procedures are followed especially preparation of the required EIA for the enterprise.	Review enterprise EIA and determine appropriate requirements and monitoring regimes required.
Industrial symbiosis, promotion of between existing and proposed enterprises of IP to share resources and waste management planning	Promote and engage traditionally separate industries in a collective approach to competitive advantage involving physical exchanges of materials, energy, water and/or by products together with collaboration on the shared use of assets, logistics, experts and knowledge transfer.	Technical consultation on the wastes and other issues including approval of the proposed systems.

EMS Establishment, Planning and Strategic Oversight Activity	Liuchuan IP Management and Management Committee	Jingyuan County EPB – technical support and regulatory)
Introduction of advanced water and energy conservation and demand management techniques	Provide platforms for training, capacity building, demonstration projects, study tours and other means.	Support programs with technical aspects as possible.
Creating linkages between IP and surrounding region for exchanges of resources and recycling networks.	IP outreach program to achieve win-win approaches between the IP and surrounding region	Technical consultation on the wastes and other issues including approval of the proposed systems.
Enterprise certification, **encourage enterprises to achieve ISO 14001 or comparable PRC certification.**	Incentives for firms achieving ISO14001 certification in rents, utility charges or other means.	Support programs with technical aspects as possible.
Monitoring and Measurement	Regularly work with EPB and operational monitoring program to track environmental performance and status on meeting IP objectives and targets. Consider audits of reporting data to validate results periodically.	Assure that operational monitoring program (Table 2) supplies necessary information at needed intervals for IP reporting system. Also, refer to note on data sharing under the Communication Plan
Evaluate performance	Consistent with its commitment to compliance, the IP shall establish, implement and maintain a procedure for periodically evaluating compliance with applicable legal requirements. Records kept of the results of these periodic evaluations.	Operational monitoring program (Table 2) mainly focused on enterprise performance and compliance but also relates to IP EMS performance.
Management Review	IP management shall review the IP's EMS at planned intervals, to ensure its continuing suitability, adequacy and effectiveness. Reviews shall include assessing opportunities for the improvement and the need for changes to the EMS, including the environmental policy and environmental objectives and targets. Records of the management reviews shall be retained. Management review is an essential portion of the continual improvement of the IP's EMS. Management review is the essential element for systems improvement, along with preventative and corrective action.	Supply summary environmental statistics and other technical data to support the periodic reviews.

Table 2 – Operational Aspects of EMS

Environmentally-related activities	Liuchuan IP Management and Management Committee	Primary Monitoring and Data Storage Systems (Various PRC Govt Institutions)	EMS Center (in LMC)	Individual Enterprises
Water Supply Systems	- Development and operation of centralized raw water collection, transmission, and treatment systems, phased to meet growth of the IP. - Develop training and manuals on water conservation and demand management techniques - Hire and train operational staff	- Monitor treated water quality in final distribution system. - Health and safety of WTP especially chlorination equipment. - Environmental best practices at WTPs including treatment and disposal of solids. - Monitor raw water abstraction quantity and report to Water Affairs Bureau for abstraction permitting and Yellow River quota. - Monitor the distributed quantity per Health Department requirements.	- Track and review treated water quality in final distribution system in conjunction with Health. - Track and review Health and safety of WTP especially chlorination equipment. - Track and review Environmental best practices at WTPs including treatment and disposal of solids. - Track and review raw water abstraction quantity and reports. - Track and review the distributed quantity per Health Department requirements.	- Water use assessments and use of demand management and waste minimization techniques. - Implement staff training on water management and water conservation. - Install additional water treatment facilities where higher quality water supply required - Evaluate potential uses of WWTP effluent as alternative supply for some internal uses
Wastewater Systems	- Development and operation of centralized WWTP receiving pre-treated wastewater from industries and domestic wastewater from residential areas, phased to meet growth of the IP. - Hire and train operational staff - Ensure the security manual for the emergency accident by establishing manual and the training	- Real-time monitoring of performance of enterprise pretreatment systems. - Evaluate monitoring data of enterprise pretreatment facilities - Monitors performance of IP central WWTP relative to standards and effluent quality - Develop training manuals on pollution prevention and waste minimization appropriate to IP enterprises.	- Track and review performance of enterprise pretreatment systems. - Track and review monitoring data of enterprise pretreatment facilities - Take regulatory action as necessary based on performance of IP central WWTP relative to standards and effluent quality - Implement use of training manuals on pollution prevention and waste minimization appropriate to IP enterprises.	- Implement pollution prevention and waste minimization techniques to reduce wastewater volume and concentration - Design and operate appropriate wastewater pretreatment systems - Ensure proper operations of the pretreatment systems -
Wastewater Effluent Reuse	- Development and operation of the wastewater reuse storage and distribution system. - Regular testing of effluent from WWTP operations.	- Develop training manuals on use of WWTP effluent relative to various potential uses. - Utilize reuse water for greening and landscaping within IP as appropriate. - Monitors WWTP effluent for suitability for reuse systems. This includes regular testing.	- Develop training manuals on use of WWTP effluent relative to various potential uses. - Utilize reuse water for greening and landscaping within IP as appropriate. - Monitors WWTP effluent for suitability for reuse systems. This includes regular testing.	- Evaluations of potential for use of treated wastewater effluent.

Environmentally-related activities	Liuchuan IP Management and Management Committee	Primary Monitoring and Data Storage Systems (Various PRC Govt Institutions)	EMS Center (in LMC)	Individual Enterprises
WWTP Sludge	- Development and operation of sludge management system - In conjunction with municipal and county officials, ensure development of adequate disposal site for the sludge. - Develop appropriate sludge vehicles for transport of sludge from WWTP to disposal site.	- Monitors WWTP sludge for suitability for reuse systems. This includes regular validation of the WWTP testing results. - Monitor sludge reuse or disposal sites for proper operations.	- Track and review data on WWTP sludge for suitability for reuse systems. This includes regular validation of the WWTP testing results. - Review data on sludge reuse or disposal sites for proper operations.	- Not applicable for central WWTP sludge. - Manage pretreatment facility sludge in accordance with local regulations.
Solid waste	- Organize proper collection systems from municipal areas and/or industrial zones - In conjunction with municipal and county officials, ensure development of adequate capacity and operations of disposal site for the solid waste.	- Develop appropriate solid waste vehicles for transport of solid waste from enterprises to disposal site. - Municipal and county officials ensure proper operations of disposal site for the solid waste.	- Ensure appropriate solid waste vehicles for transport of solid waste from enterprises to disposal site. - Track and review proper operations of disposal site for the solid waste.	- Implement waste minimization and recycle systems to reduce quantity of conventional waste - Organize proper waste collection systems
Hazardous waste	- Regulate types of industries and processes to minimize hazardous waste generation in the IP. - Develop appropriate hazardous waste vehicles for transport of hazardous waste from enterprises to reclamation/recycle or treatment facilities. - With municipal/county officials, ensure development of adequate capacity and operations of hazardous waste treatment and disposal facilities.	- Municipal and county officials ensure operations of adequate capacity and operations of hazardous waste treatment and disposal facilities. - Develop training manuals on pollution prevention and waste minimization appropriate to IP enterprises.	- Track and review operations of adequate capacity and operations of hazardous waste treatment and disposal facilities. - Implement use of training manuals on pollution prevention and waste minimization appropriate to IP enterprises.	- Implement waste minimization and recycle systems to reduce quantity of hazardous waste - Organize proper hazardous waste storage and collection systems
Air pollution	- Regulate types of industries and processes to minimize air pollution generation in the IP. - Develop training manuals on air pollution control appropriate to IP enterprises.	- Real-time monitoring of enterprise air pollution equipment for operating status and simple parameters. - Evaluate monitoring data of enterprise facilities	- Track and review data results of enterprise air pollution equipment for operating status and simple parameters. - Take necessary regulatory action based on monitoring data of enterprise facilities	- Implement air pollution control techniques to reduce air quality emissions to meet standards - Design and operate appropriate air pollution control systems - Ensure proper operations of the air pollution control systems