*OFFICIAL USE ONLY

AIIB-financed Project

Henan Flood Emergency Rehabilitation and Recovery Project —Jiaozuo Subproject

Environmental and Social Impact Assessment (ESIA) and Management Plan (ESMP)

Implementing agencies: Jiaozuo PMO
Jiaozuo Municipal Urban and Rural Construction Bureau (JMURCB)
Jiaozuo Municipal Water Resources Bureau (JMWRB)
Macun District Agriculture and Rural Affairs Bureau (MDARAB)
Xiuwu County Water Resources Bureau (XCWRB)
Prepared by: Environmental Technology Consulting Engineering Co., Ltd., Zhengzhou University
Date of preparation: November 5, 2022

Contents

List of Figures

List of Tables

Abbreviations

AIIB	-	Asian Infrastructure Investment Bank
AH	-	Affected Household
AP	-	Affected Person
ESF	-	Environmental and Social Framework
ESS	-	Environmental and Social Standard
ESIA		Environmental and Social Impact Assessment
ESMP		Environmental and Social Management Plan
ESMPF	-	Environmental and Social Management Plan Framework
GRM	-	Grievance Redress Mechanism
HD	-	House Demolition
JLAO	-	Land Acquisition Office under the Jiaozuo Municipal Natural Resources Bureau
JMURCB	-	Jiaozuo Municipal Urban and Rural Construction Bureau
JMWRB	-	Jiaozuo Municipal Water Resources Bureau
IA	-	Implementing Agency
LA	-	Land Acquisition
LEF	-	Land-expropriated Farmer
MDARAB	-	Macun District Agriculture and Rural Affairs Bureau
M&E	-	Monitoring and Evaluation
MLS	-	Minimum Living Security
PMO	-	Project Management Office
PPM	-	Project-affected People's Mechanism
PRC	-	People's Republic of China
RAP	-	Resettlement Action Plan
RIB	-	Resettlement Information Booklet
XCWRB	-	Xiuwu County Water Resources Bureau

Units

Currency unit	=	Yuan (CNY)
1.00 yuan	=	$0.15
1 hectare	=	15 mu

Executive Summary

The Jiaozuo Subproject (hereinafter, the “Subproject”) of the AIIB-financed Henan Flood Emergency Rehabilitation and Recovery Project (hereinafter, the “Project”) involves the restoration of rivers and urban roads, and the upgrading of urban bridges in Jiaozuo City, has an extensive beneficiary area, and is generally supported by local residents. Since the Subproject is partly located in the urban center, and involves the drinking water source reserve of the trunk canal of the central line (Henan segment) of the South-to-North Water Diversion Project, it may generate substantial environmental impacts. According to AIIB’s ESF and the ESMFP of the Project, and Opinions on E&S Impacts and Risks Identification and Screening of the Subproject, the Subproject is classified as Class A in terms of environmental impacts. An ESIA report and an ESMP should be prepared for the Subproject for review and approval by AIIB.

1. Range and coverage

The Subproject is located in Jiaozuo City, Henan Province, and covers Jiefang, Zhongzhan, Shanyang and Macun Districts, and Xiuwu County. See Figure 0.0-1.

2. Classification of components

The Subproject includes water and municipal infrastructure restoration and improvement, emergency response and institutional capacity building, etc.

3. Assessment methods

According to AIIB’s ESF and ESMPF, and the Opinions on E&S Impacts and Risks Identification and Screening of the Subproject, the Subproject is a Class A subproject in terms of E&S impacts, for which an ESIA report should be prepared, including an ESMP. The ESIA is conducted using the following methods:

1) The design documents were reviewed to identify key E&S impacts;

2) Since November 2021, the PMO has communicated with local residents to disclose subproject information, and collect their attitudes to and opinions on the Subproject.

3) Since December 2021, the Jiaozuo Municipal Government, municipal finance bureau, and affected county / district governments have disclosed subproject information and site selection criteria, conducted publicity on traffic safety, and collected residents’ needs and expectations by means of village / community congress, household head meeting, bulletin board, notice, brochure, banner, slogan, WeChat, etc.

4) In February and March 2022, the EIA agency and taskforce conducted a field survey to have a more objective understanding of construction sites, sensitive sites, impacts, and socioeconomic profile in the subproject area.

5) During June 9-16, 2022, fieldwork was conducted at 21 subproject sites in the 5 affected counties / districts:

- Organizational interview and data collection: Organizational interviews and FGDs were held with the Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), Land Acquisition Office under the Jiaozuo Municipal Natural Resources Bureau (JLAO), natural resources bureau, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women’s federation, civil affairs bureau, transport bureau, etc. 65 times, and relevant data and literatures related to the Subproject collected.
- FGD: To further collect the APs’ needs and suggestions, the taskforce held 13 FGDs with local residents, with 453 participants in total, including 134 women, accounting for

29.58%; 78 elders, accounting for 17.22%; and 241 village officials and villager representatives, accounting for 53.2%.

- Key informant interview: The taskforce interviewed 87 key informants at the county / district, sub-district and village / community levels to further collect attitudes and suggestions from stakeholders.
- Questionnaire survey: A questionnaire survey was conducted in the 5 affected counties / districts using the probability proportional to size (PPS) method, and 400 copies of the questionnaire were completed, all valid.

6) From December 2021 to date, the Jiaozuo Municipal Government, municipal finance bureau, and 5 affected county / district governments have disclosed updates of the Subproject on their websites.

4. Key E&S impacts

4.1 Environmental impacts

The Subproject will restore damaged flood control facilities to improve the flood discharge capacity of the urban center and Xiuwu County, protect people's personal safety, and improve the ecological environment.

The Subproject will generate significant environmental impacts at the construction stage, and minor environmental impacts at the operation stage.

The environmental impacts at the construction stage and the mitigation measures are as follows: ①Earthworks, additional permanent and temporary land occupation will have slight, reversible terrestrial ecosystem impacts in construction areas, which can be mitigated effectively through land reclamation and vegetation restoration, so that ecosystem biodiversity will be restored or even improved; ②River dredging, and barrage and bridge restoration will have negative impacts on the aquatic environment, and aquatic animals and plants, which can mitigated through construction timing, aquatic plant restoration and aquatic animal proliferation, so that the aquatic environment will be restored or even improved; ③Flying dust, tail gases, etc. will have adverse impacts on the local air environment, which can be mitigated through wet working, enclosure, use of environment-friendly machines and vehicles, vehicle cleaning, speed control, rational routing, etc.; ④Construction and domestic wastewater discharge will reduce the environmental quality of surface water, which can be mitigated through settling tank construction, integrated domestic wastewater treatment and integrated wastewater utilization; ⑤Construction machinery and vehicle noise will have adverse impacts on acoustic environment sensitive targets within 50m, which can be mitigated by use of low-noise machinery and vehicles, reduction of overnight construction and speed control; ⑥Spoil, construction waste and domestic waste generated during construction will be mitigated by spoil ground construction, integrated construction waste utilization and domestic waste landfilling; ⑦Traffic interruption arising from road and bridge construction or restoration can be mitigated by improving the local road network. Therefore, preparing and strictly implementing the EMP will reduce the adverse environmental impacts during construction to an acceptable range.

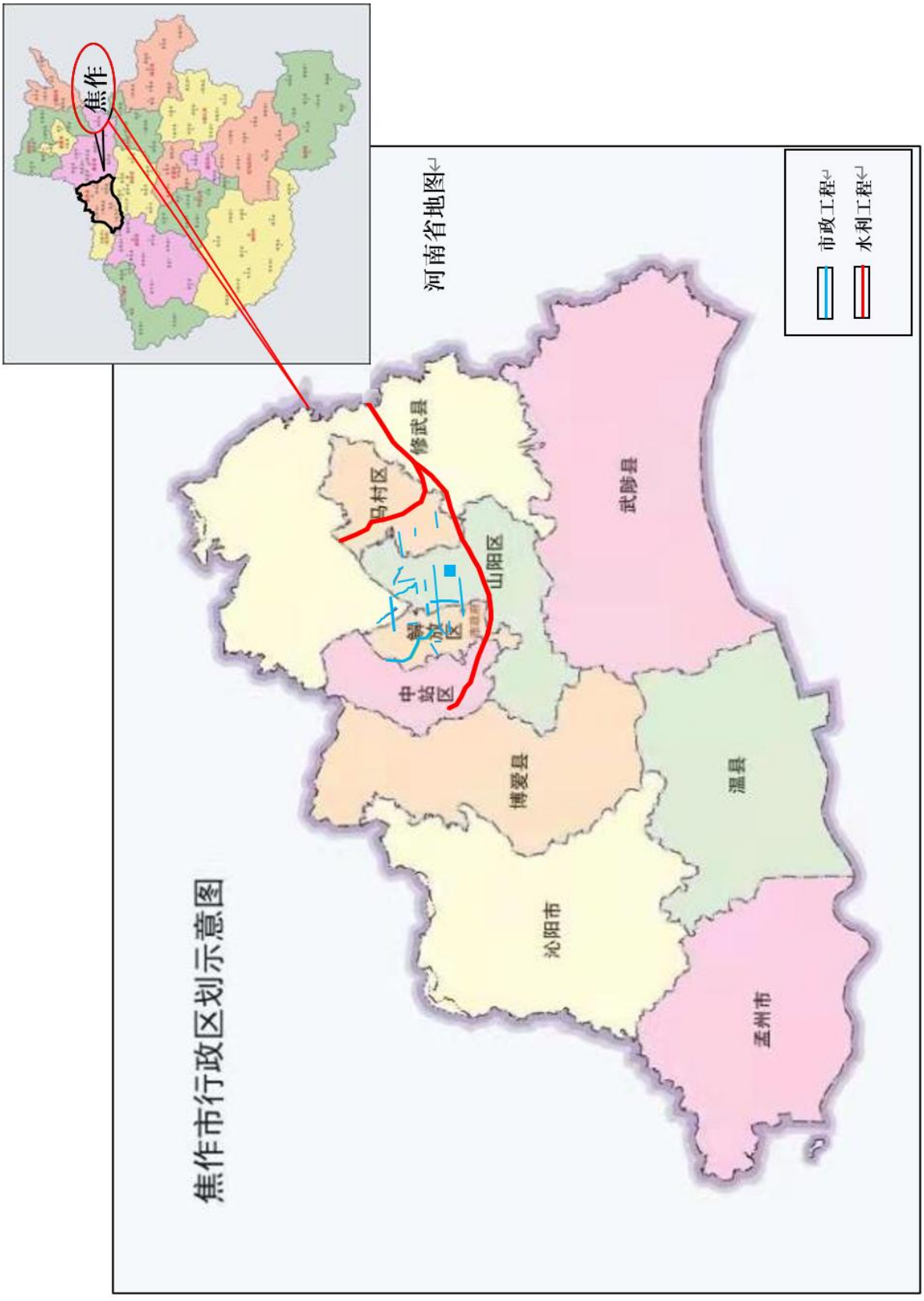


Figure 0.0-1 Range of the Subproject

4.2 Social impacts

The Subproject's social impacts include positive and negative ones.

The Subproject's positive social impacts include: 1) alleviating flood impacts; 2) creating a safer living environment; 3) alleviating local traffic congestion; 4) alleviating water loss and soil

erosion, and water pollution; 5) improving the surrounding natural environment (including dust suppression and landscape improvement); 6) realizing more convenient traffic; 7) beautifying the riverside landscape and increasing tourism income; and 8) bringing more job opportunities.

The Subproject's negative social impacts include: 1) LAR impacts: LA for the Subproject will affect 18 households with 70 persons in 11 villages in 6 sub-districts in Jiefang, Zhongzhan, Shanyang and Macun Districts, including no vulnerable group. 1,153.3718 mu of land will be occupied permanently for the Subproject, including 73.2258 mu of collective land and 1,080.146 mu of state-owned land. The Subproject does not involve the demolition of residential houses and nonresidential buildings. Temporary land occupation arises from construction camps, traffic, spoil grounds, etc. 905.11 mu of land will be occupied for the Subproject, including 862.11 mu of state-owned land (including 8.46 mu of river flat reclaimed by villagers in Xiuwu County, compensated for as temporarily occupied land) and 43 mu of collective land, affecting 7 households with 36 persons. The temporarily occupied state-owned land is mostly river flat, existing roads, and unused land along rivers and roads, and crops are grown on some state-owned river flat, and the temporarily occupied collective land is mostly irrigated / non-irrigated land, woodland and construction land; 2) The passage of construction vehicles through working and living areas, temporary traffic restrictions, disturbance to public facilities, slag, dust, noise, etc. will affect local residents' daily life and traffic; 3) Nonlocal workers will bring health risks and cultural conflicts, including religion and other customs; 4) GBV risks may arise during construction, including the discrimination against women during recruitment; 5) If any cultural relic is identified during construction, elusion and protection measures should be taken pursuant to Article 32 of the Cultural Relic Protection Law of the PRC.

Mitigation measures and an SMP have been developed based on the social risks identified: 1) reducing LAR risks; 2) preparing an education and training program in consultation with sub-district officials, and conducting regular education and training on flood control; 3) improving traffic safety facilities and strengthening regulation; 4) protecting women's labor rights and making jobs first available to local female laborers; 5) preventing and controlling GBV; 6) strengthening the management of nonlocal workers to prevent AIDS, COVID-19, etc.; 7) applying appropriate construction methods to protect local residents from construction impacts; and 8) improving the labor protection system and working conditions to protect workers' lawful rights and interests. The effectiveness of these measures will be monitored and evaluated for adjustment and improvement.

If any cultural relic is identified during construction, the following measures should be taken pursuant to Article 32 of the Cultural Relic Protection Law of the PRC: 1) stopping construction immediately; 2) protecting the spot; 3) reporting to the local cultural relic authority immediately; 4) adjusting the construction plan as instructed by the authority; and 5) resuming construction after the authority has made a field visit and taken appropriate measures.

5. Implementation arrangements

The Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs) will implement the Subproject in a unified manner. The Jiaozuo PMO will: 1) appoint an E&S coordinator to coordinate ESMP implementation; 2) include the ESMP, monitoring plan and mitigation measures in the bidding documents and contracts; 3) run the GRMs; 4) handle unforeseeable adverse impacts and report to AIIB timely; and 5) appoint qualified E&S external monitoring agencies. The Jiaozuo PMO will report the implementation of the ESMPF, and submit E&S monitoring reports quarterly in the first year and semiannually afterwards.

6. Stakeholder engagement

Primary stakeholders are direct beneficiaries of the Subproject and those affected negatively by the Subproject, including residents, vulnerable groups and persons affected by LA in 43 sub-districts in the 5 affected counties / districts. Secondary stakeholders include the Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), JLAO, natural resources bureau, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, affected sub-district offices, design agency, construction agency, supervising agency, etc.

At the preparation stage, the feasibility study agency, SIA agency and EIA agency conducted information disclosure, organizational interviews, field visits, FGDs, key informant interviews, a questionnaire survey, and other public consultation activities. It is found that local residents have urgent demand for the Subproject because their daily life is affected, and expect the Subproject to restore and improve local public infrastructure and landscapes. Poor residents and women are highly willing to participate in the Subproject, and highly recognize the mitigation measures for environmental impacts. Local residents are highly aware of and highly support the Subproject. On the basis of the questionnaire survey, FGDs, in-depth interviews and key informant interviews, the public participation plan has been developed through participatory observation, including subproject information disclosure, site selection survey, design consultation, EIA information disclosure and consultation, LA, construction information disclosure, and GRM disclosure at the preparation stage; reduction of construction impacts, participation in construction, management of nonlocal workers, and GRM disclosure at the construction stage; and flood safety and traffic safety education, and GRM disclosure at the operation stage.

7. GRM

The Subproject has two GRMs:

The first is the project-level GRM for APs, NGOs and business entities.

The second is the GRM for project workers, including direct and contracted workers.

The Jiaozuo PMO was established in December 2021, and 4 staff members of the Overall Coordination are responsible for GRM operation. If the Jiaozuo PMO receives a grievance, it will first check if such grievance relates to the Subproject. If yes, it will redress such grievance through coordination. If no, it will forward such grievance to the competent authority for the griever. All grievances will be recorded, and the whole grievance redress process notified to relevant staff. In addition, the PPM was established by AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement its Environmental and Social Policy (ESP) when their concerns cannot be addressed satisfactorily through Project-level grievance redress mechanisms or AIIB Management's processes. For more information, visit: https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html.

The Chinese and English versions of the ESMPF have been disclosed on the websites of the Henan Provincial Finance Department (https://czt.henan.gov.cn/2021/11-05/2342160.html) and AIIB (China: Henan Flood Emergency Rehabilitation and Recovery Project - Projects - AIIB). The Chinese and English versions of the ESF, ESIA Report and ESMP, including the GRMs, will be disclosed on the websites of the municipal finance bureau and AIIB before construction. In addition, the municipal finance bureau will prepare hardcopies of the ESIA Report and ESMP for public review.

1 Foreword

Jiaozuo City is located in northwestern Henan Province, and governs 5 districts – Jiefang, Shanyang, Macun and Zhongzhan Districts, and High-tech Zone, and belongs to the Yellow and Hai River systems. There are 5 rivers within a basin area of over 1,000 km^2, which are the Yellow, Qin, Dan, Dasha and Xinmang Rivers, and 18 small rivers with a basin area of over 100 km^2.

In July 2021, Jiaozuo experienced sustained heavy rains and mountain torrents rare in history, with rainfalls exceeding historical limits. Despite of the whole city's joint efforts, the city's infrastructure was seriously damaged, with economic losses amounting to 1.96 billion yuan.

20 small and medium reservoirs, and over 20 rivers including the Dasha, Manggai and Shanmen Rivers experienced bank collapse, and dam, road, sluice and office damage, and many national, provincial, county, township and village highways were damaged by collapse, landslides, mud-rock flows, etc., affecting economic and social development, and local residents' production and lives, and threatening personal safety seriously.

In order to eliminate rainstorm and flood impacts, and promote economic development and livelihood restoration, the Subproject has been proposed, which aims to promote the functional restoration of infrastructure, improve flood control and emergency management capacity, and protect people's personal and property safety.

The Subproject is located in disaster-hit areas, including the urban area and Xiuwu County, and includes water and municipal infrastructure restoration and improvement, emergency response and institutional capacity building, etc., including river dredging, embankment, slope improvement, ecological rehabilitation, structure, bridge, sluice, culvert and road construction, reconstruction and upgrading of damaged rivers, urban roads, auxiliary facilities, bridges, drainage facilities, building a smart water platform, a smart water environment (flood control) platform, a monitoring and early warning emergency command platform, project management and consulting services, professional skills training, technical support, external resettlement and environmental M&E, project management software system (MIS) procurement and application, etc. The Subproject will: 1) restore and reconstruct damaged roads, rivers and bridges, and protect local residents' personal and property safety, and provide leisure and recreational places to local residents; 2) reconstruct, restore and construct sewage and drainage facilities, improve the quality of the water environment and flood discharge capacity, and repair streetlamps and other auxiliary facilities; and 3) restore and upgrade urban sidewalks and roads to ensure traffic safety, and establish a smart water platform to improve disaster prevention and control capacity, and emergency response capacity.

This report consists of the following chapters:

1. Foreword
2. Policies, Laws and Regulatory Framework
3. Project Description
4. E&S Baseline
5. ESIA and Mitigation Measures
6. Option Selection
7. Climate Change and Response
8. Public Participation and Information Disclosure
9. GRM
10. ESMP

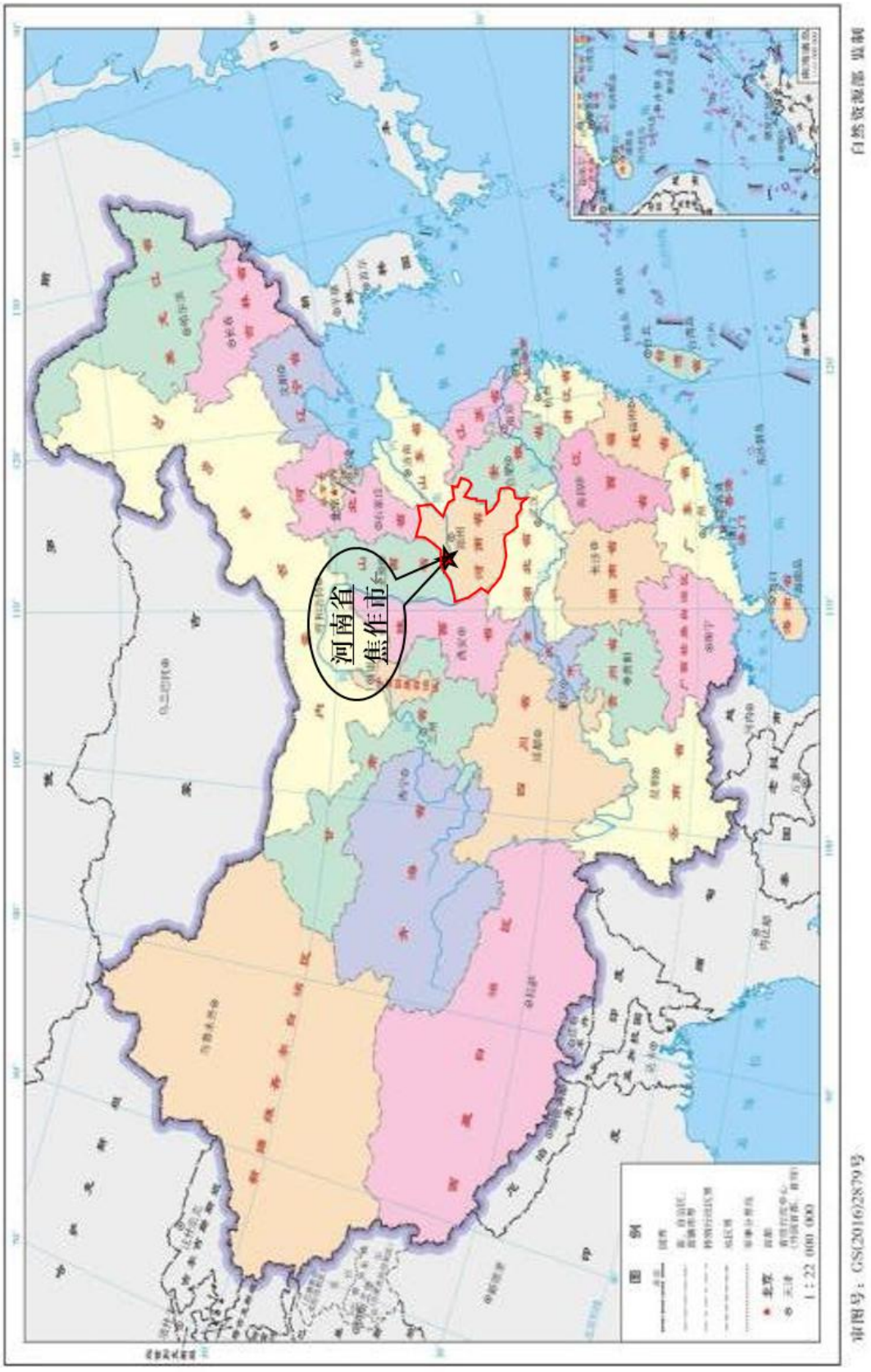


Figure 1.0-1 Location map of Jiaozuo City

2 Policies, Laws and Regulatory Framework

2.1 Applicable state legal framework

This report has been prepared in accordance with the applicable prevailing E&S laws and regulations of the PRC, local bylaws and regulations of Henan Province and Zhengzhou Municipality, relevant technical guidelines and standards, AIIB's ESF (amended in 2021), and the ESMPF disclosed in November 2021.

2.1.1 EIA laws and policies

2.1.1.1 State laws, regulations and policies on environmental protection

1) Environmental Protection Law of the PRC (January 1, 2015);
2) Environmental Impact Assessment Law of the PRC (amended on December 29, 2018);
3) Water Pollution Prevention and Control Law of the PRC (amended on June 27, 2017, effective from January 1, 2018);
4) Atmospheric Pollution Prevention and Control Law of the PRC (amended on October 26, 2018);
5) Ambient Noise Pollution Prevention and Control Law of the PRC (amended on December 29, 2018);
6) Solid Waste Pollution Prevention and Control Law of the PRC (amended on April 29, 2020);
7) Land Administration Law of the PRC (Amended) (January 1, 2020)
8) Highway Law of the PRC (November 4, 2017);
9) Water and Soil Conservation Law of the PRC (March 1, 2011);
10) Wild Animal Protection Law of the PRC (October 26, 2018);
11) Regulations on Wild Plant Protection of the PRC (October 7, 2017);
12) Cultural Relic Protection Law of the PRC (amended on November 5, 2017);
13) Regulations on the Implementation of the Cultural Relic Protection Law of the PRC (Order No.687 of the State Council, October 7, 2017);
14) Regulations on the Administration of Construction Project Environmental Protection (Order No.682 of the State Council, October 1, 2017);
15) Measures for the Administration of Environmental Protection of Transport Construction Projects (Order [2003] No.5 of the Ministry of Transport, June 1, 2003);
16) Decision of the State Council on Implementing a Scientific Outlook on Development and Strengthening Environmental Protection (SC [2005] No.39);
17) Regulations on Pollution Control of Drinking Water Reserves (December 22, 2010);
18) Interpretation of Provisions on Drinking Water Source Protection by the General Office of the Ministry of Environmental Protection (MEPO [2008] No.667);
19) Catalogue for Classified Management of Environmental Impact Assessment of Construction Projects (2021);
20) Measures for Public Participation in Environmental Impact Assessment (Order No.4 of the Ministry of Ecology and Environment);
21) Program for Information Disclosure Mechanism of Environmental Impact Assessment of Construction Projects (MEP [2015] No.162).

2.1.1.2 Provincial regulations and policies on environmental protection

1) Notice of the General Office of the Henan Provincial Government on Issuing the Zoning Plan of Urban Central Drinking Water Sources of Henan Province (HPGO [2007] No.125);
2) Notice of the General Office of the Henan Provincial Government on Issuing the Zoning

Plan of County-level Central Drinking Water Sources of Henan Province (HPGO [2013] No.107);

3) Notice of the General Office of the Henan Provincial Government on Issuing the Zoning Plan of Township-level Central Drinking Water Sources of Henan Province (HPGO [2016] No.23);

4) Regulations on Environmental Protection for Construction Projects of Henan Province (May 1, 2007, amended in 2016);

5) Notice of the Henan Provincial Government on Issuing the Zoning Plan of Major Functional Areas of Henan Province (HPG [2014] No.12);

6) Catalogue of Construction Documents for Approval of EIA Documents of the Henan Provincial Ecology and Environment Department (2019) (Announcement [2019] No.6 of the Henan Provincial Ecology and Environment Department);

7) 14th Five-year Water Security and Water Ecology Protection Plan of Henan Province (December 31, 2021)

8) 2022 Implementation Plan for Air, Water and Soil Pollution Prevention and Control of Henan Province (YHWB [2022] No.9);

9) Urgent Notice of the General Office of the Henan Provincial Natural Resources Department on Doing a Good Job in Flood Rescue and Post-disaster Reconstruction Land Supply Services (2021);

10) Notice of the General Office of the Henan Provincial Government on Accelerating Preparatory Work for Post-disaster Reconstruction Projects (HPGOMD (2021) No.37);

11) Work Plan for Post-disaster Reconstruction of Rural Housing of Henan Province (2021);

12) Notice on the Implementation of the Post-disaster Transport Infrastructure Reconstruction Plan of Henan Province (2021);

13) Some Policy Measures for Accelerating Post-disaster Restoration (2021).

2.1.1.3 Municipal regulations and policies on environmental protection

1) Master Urban Plan of Jiaozuo City (2011-2020)

2) Regulations on Ecological Protection of the North Mountain Area of Jiaozuo City

3) Regulations on Air Pollution Control of Jiaozuo City

4) Urban Water System Plan of Jiaozuo City

5) Urban Flood Control Plan of Jiaozuo City

6) Comprehensive Plan for Urban Drainage and Flood control in the Urban Center of Jiaozuo City

7) Management Plan for Black and Odorous Water Bodies of Jiaozuo City

8) Special Plan for Water Reclamation and Sludge Disposal of Jiaozuo City (2011-2020)

9) Urban Garden and Green Space System Plan of Jiaozuo City

10) Special Plan for Wastewater Works in the Urban Center of Jiaozuo City (2015-2020)

11) Ecological Admission List of Jiaozuo City

12) 2021 Work Plan for Air Pollution Control of Jiaozuo City

13) Guiding Opinions on Post-disaster Restoration of Jiaozuo City (draft for comment)

14) Master Plan for Ecological Protection and Utilization of the North Mountain Area of Jiaozuo City

2.1.1.4 Technical standards on EIA

1) Technical guidelines for environmental impact assessment—General principles (HJ2.1-2016);

2) Technical guidelines for environmental impact assessment—Atmospheric environment (HJ2.2-2018);

3) Technical guidelines for environmental impact assessment—Surface water environment

(HJ2.3-2018);

4) Technical guidelines for environmental impact assessment—Groundwater environment (HJ 610-2016);

5) Technical guidelines for environmental impact assessment—Sound environment (HJ2.4-2009)

6) Technical guidelines for environmental impact assessment—Ecological impacts (HJ19-2011);

7) Technical guidelines for environmental impact assessment—Soil environment (trial) (HJ964-2018);

2.1.1.5 Project documents

1) Letter of Authorization;

2) Feasibility Study Report of Dasha River Restoration, Preliminary Design of Dasha River Restoration, Henan Water & Power Engineering Consulting Co., Ltd.;

3) Feasibility Study Report of Dasha River Restoration in Xiuwu County, PowerChina Beijing Engineering Co., Ltd.; Preliminary Design of Dasha River Restoration in Xiuwu County, Henan Water & Power Engineering Consulting Co., Ltd.;

4) Feasibility Study Report of Shanmen River Restoration in Xiuwu County, Preliminary Design of Shanmen River Restoration in Xiuwu County, Henan Water & Power Engineering Consulting Co., Ltd.;

5) Feasibility Study Report of Shanmen River Restoration in Macun District, Preliminary Design of Shanmen River Restoration in Macun District, Henan Water & Power Engineering Consulting Co., Ltd.;

6) Feasibility Study Report of Qunying River Restoration, Luoyang Water Resources Survey and Design Co., Ltd.;

7) Feasibility Study Report of North Ring Road (Puji Road-Tabei Road) Restoration, Preliminary Design of North Ring Road (Puji Road-Tabei Road) Restoration, Henan Urban Planning Institute & Corporation;

8) Feasibility Study Report of Shanyang Road (Taihang Road-Jianshe Road) Restoration, Preliminary Design of Shanyang Road (Taihang Road-Jianshe Road) Restoration, Henan Urban Planning Institute & Corporation;

9) Feasibility Study Report of Fengshou Road Restoration, Preliminary Design of Fengshou Road Restoration, Henan Urban Planning Institute & Corporation;

10) Feasibility Study Report of Jiefang East Road Restoration, Preliminary Design of Jiefang East Road Restoration, Henan Urban Planning Institute & Corporation;

11) Feasibility Study Report of Wengjian River (North Ring Road-Shanyang Road) Restoration, Preliminary Design of Wengjian River (North Ring Road-Shanyang Road) Restoration, Henan Urban Planning Institute & Corporation;

12) Feasibility Study Report of Qunying River Restoration, Preliminary Design of Qunying River Restoration, Henan Urban Planning Institute & Corporation;

13) Feasibility Study Report of Urban River Facility Restoration, Preliminary Design of Urban River Facility Restoration, Henan Urban Planning Institute & Corporation;

14) Feasibility Study Report of Urban River Facility Restoration, Preliminary Design of Urban River Facility Restoration, Henan Urban Planning Institute & Corporation;

15) Feasibility Study Report of Urban Road Facility Restoration, Preliminary Design of Urban Road Facility Restoration, Henan Urban Planning Institute & Corporation;

16) Feasibility Study Report of Upgrading and Construction of Urban Flood Ditches,

Preliminary Design of Upgrading and Construction of Urban Flood Ditches, Henan Urban Planning Institute & Corporation;

17) Feasibility Study Report of Flood Control Upgrading of Urban Rivers and Bridges, Preliminary Design of Flood Control Upgrading of Urban Rivers and Bridges, Henan Urban Planning Institute & Corporation;

18) Feasibility Study Report of Longyuan Road (Minzhu Road-Shanyang Road) Restoration, Preliminary Design of Longyuan Road (Minzhu Road-Shanyang Road) Restoration, Henan Urban Planning Institute & Corporation;

19) Feasibility Study Report of Minzhu Road Restoration, Preliminary Design of Minzhu Road Restoration, Henan Urban Planning Institute & Corporation;

20) Feasibility Study Report of Industry Road Restoration, Preliminary Design of Industry Road Restoration, Henan Urban Planning Institute & Corporation;

21) Feasibility Study Report of Jiaowu Road Restoration, Preliminary Design of Jiaowu Road Restoration, Henan Urban Planning Institute & Corporation;

22) Feasibility Study Report of Jiaowu Road Restoration, Preliminary Design of Jiaowu Road Restoration, Henan Urban Planning Institute & Corporation;

23) Feasibility Study Report of Jianshe Road Restoration, Preliminary Design of Jianshe Road Restoration, Henan Urban Planning Institute & Corporation;

24) Feasibility Study Report of Urban Sewer Network Inspection and Restoration (Phase 1), Preliminary Design of Urban Sewer Network Inspection and Restoration (Phase 1), Henan Urban Planning Institute & Corporation;

25) Feasibility Study Report of Tianjian Ditch (Yingshi Road-Puji River) Management, Tianjian Ditch (Yingshi Road-Puji River) Management, Henan Yubei Water Resources Survey and Design Institute Co., Ltd.;

26) ESMFP of the Project;

27) Opinions on E&S Impacts and Risks Identification and Screening of the Subproject.

2.1.2 Key social policies

1) Opinions on Strengthening the Building of the Social Stability Risk Assessment Mechanism for Major Decisions in the New Situation (2021);

2) Notice on Issuing the Interim Measures for Social Stability Risk Assessment of Major Fixed Asset Investment Projects of the National Development and Reform Commission (NDRCI [2012] No.2492);

3) Notice of the General Office of the National Development and Reform Commission on Issuing the Outline for the Preparation of the Social Stability Risk Analysis Chapter and Assessment Report for Major Fixed Asset Investment Projects (Trial) (NDRCO [2013] No.428);

4) Notice of the General Office of the Henan Provincial Government on Deepening Social Stability Risk Assessment (HPGO [2010] No.14);

5) Opinions of the Henan Provincial Government on Complaint Assessment for Major Decisions concerning Public Interests (2007);

6) Notice of the General Office of the Henan Provincial Government on Regulating the Distribution and Use of Compensation for Acquired Collective Land(HPGO [2006] No.50);

7) Notice of the Henan Provincial Government on Adjusting Location-based Composite Land Prices of Henan Province (HPG [2016] No.48);

8) Regulations on House Expropriation on State-owned Land and Compensation (HPG [2012] No.39);

9) Opinions of the Henan Provincial Departments of Human Resources and Social Security,

Finance, and Natural Resources on Subsidizing Land-expropriated Farmers for Basic Endowment Insurance (HPHRSSD [2019] No.1);

10) Notice of the Henan Provincial Government on Issues concerning Location-based Composite Land Prices for Farmland (HPG [2020] No.16);

11) Notice of the Henan Provincial Departments of Human Resources and Social Security on Disclosing the Minimum Standard of Social Security Costs for Land-expropriated Farmers of 2021 (HPHRSSDO [2021] No.49);

12) Notice of the General Office of the Henan Provincial Government on Policy Measures for Accelerating the Post-disaster Restoration of the Service Industry (HPGO [2021] No.64);

13) Notice of the General Office of the Henan Provincial Government on Issuing the Emergency Plan for Natural Disaster Relief of Henan Province (HPGO [2016] No.201)

2.1.3 AIIB's relevant requirements

Since the Subproject will be funded by AIIB, AIIB's Environmental and Social Framework (ESF) applies to the Subproject. Its key elements are as follows:

The Environmental and Social Policy (ESP), Environmental and Social Standards (ESSs), and Environmental and Social Exclusion List: The ESP specifies the compulsory requirements for the identification, assessment and management of E&S risks and impacts of AIIB-funded projects.

ESS1: It aims to ensure the project's E&S soundness and sustainability, and include E&S factors in project decision-making and implementation. If the project may have adverse environmental or social risks and impacts (or both), ESS1 will apply. The scope of E&S assessment and management measures are proportional to the project's risks and impacts. ESS1 provides high-quality E&S assessment and management through effective mitigation and monitoring measures during project implementation.

ESS2: If the project screening process shows that the project involves involuntary resettlement (including near-term or foreseeable involuntary resettlement directly related to the project), ESS2 will apply. Involuntary resettlement includes physical displacement (relocation, loss of residential land or housing) and economic displacement (loss of land or access to land and natural resources; loss of assets; loss or income sources or livelihoods) for the following reasons:(a) involuntary land acquisition; and (b) involuntary restriction on land use or access to legally designated parks and protected areas, whether such loss or involuntary restriction is whole or partial, permanent or temporary. ESS2 identifies detailed requirements for resettlement planning of projects involving involuntary resettlement.

ESS3: If indigenous peoples (ethnic minorities) are found in or attached to the project area, and are likely to be affected by the project, ESS3 will apply.

2.2 Assessment standards

2.2.1 Environmental quality standards

1) Sound environment

According to the local policy, the area surrounded by Shanyang, Fengshou, Puji and Tianhe North Roads is a Class 1 functional area in sound environment, and other areas of Jiaozuo City are areas of Classes 2, 3, 4a and 4b. The subproject area falls into Classes 1, 2 and 4a. See Table 2.2-1.

Table 2.2-1 Environmental quality standard for noise

Applicable standard	Class	Item	Standard value

				Unit	Value
Environmental Quality Standard for Noise (GB3096-2008)	1	Equivalent sound level	Daytime	dB (A)	55
			Night	dB (A)	45
	2		Daytime	dB (A)	60
			Night	dB (A)	50
	4a		Daytime	dB (A)	70
			Night	dB (A)	55

2) Ambient air

According to the Ambient Air Quality Standard (GB3095-2012), Class I areas include natural reserves, environmental sensitive areas and other special areas, and Class II areas include all other areas, including urban and industrial areas. The subproject area is a Class II area. See Table 2.2-2.

Table 2.2-2 Environmental quality standard for air

Applicable standard	Class	Item		Standard value	
				Unit	Value
Ambient Air Quality Standard (GB3095-2012)	II	SO_2	Annual average	$\mu g/m^3$	60
			Daily average	$\mu g/m^3$	150
			1-hour average	$\mu g/m^3$	500
		NO_2	Annual average	$\mu g/m^3$	40
			Daily average	$\mu g/m^3$	80
			1-hour average	$\mu g/m^3$	200
		PM10	Annual average	$\mu g/m^3$	70
			Daily average	$\mu g/m^3$	150
		PM2.5	Annual average	$\mu g/m^3$	35
			Daily average	$\mu g/m^3$	75
		Ozone	Daily maximum 8-hour average	$\mu g/m^3$	160
			1-hour average	$\mu g/m^3$	200
		CO	Daily average	$\mu g/m^3$	4.0
			1-hour average	$\mu g/m^3$	10

3) Surface water

The Class IV standard in the Environmental Quality Standard for Surface Water applies to the Subproject, and the Class II standard applies to the open canal of the South-to-North Water Diversion Project. See Table 2.2-3.

Table 2.2-3 Environmental quality standard for surface water

Applicable standard	Class	Item	Unit	Class IV standard value	Class II standard value
Environmental Quality Standard for Surface Water (GB3838-2002)	IV	Chemical oxygen demand (COD)	mg/L	30	15
		5-day BOD (BOD5)	mg/L	6	3
		Ammonia nitrogen (NH3-N)	mg/L	1.5	0.5
		Total phosphorus (as P)	mg/L	0.3	0.1
		Total nitrogen (as N)	mg/L	1.5	0.5
		Dissolved oxygen	mg/L	3	6
		Fecal E. coli count	/L	20000	2000
		Fluorides	mg/L	1.5	1.0
		pH	/	6-9	6-9

4) Groundwater

The Class III standard in the Environmental Quality Standard for Groundwater (GB/T14848-2017) applies. See Table 2.2-4.

Table 2.2-4 Environmental quality standard for groundwater

Applicable standard	Class	Item	Standard value	
			Unit	Value
Environmental Quality Standard for Groundwater (GB/T14848-2017	III	pH	/	6.5-8.5
		Ammonia nitrogen	mg/L	0.5
		Nitrates	mg/L	20
		Nitrites	mg/L	1.0
		Volatile phenols	mg/L	0.002
		Cyanides	mg/L	0.05
		Arsenic	mg/L	0.01
		Mercury	mg/L	0.001
		Lead	mg/L	0.01
		Cadmium	mg/L	0.005
		Iron	mg/L	0.3
		Manganese	mg/L	0.1
		Chromium (sexavalent)	mg/L	0.05
		Total hardness	mg/L	450
		Total dissolved solids	mg/L	1000
		Oxygen consumption	mg/L	3.0
		Sulfates	mg/L	250
		Chlorides	mg/L	250
		Fluorides	mg/L	1.0
		Total coliform count	CFU/100mL	3.0
		Total bacterial count	CFU/mL	100

5) Soil and bottom mud

The Soil Environment Quality—Risk Control Standard for Farmland Soil Pollution (GB15618-2018) applies. See Table 2.2-5.

Table 2.2-5 Environmental quality standard for soil (unit: mg/kg)

Standard	Category	Pollution factor		Standard limit			
		pH		pH≤5.5	5.5<pH≤6.5	6.5<pH≤7.5	pH>7.5
Soil Environment Quality—Risk Control Standard for Farmland Soil Pollution (GB15618-2018)	Risk screening values for farmland soil pollution	Cadmium	Paddy fields	0.3	0.4	0.6	0.8
			Other	0.3	0.3	0.3	0.6
		Mercury	Paddy fields	0.5	0.5	0.6	1.0
			Other	1.3	1.8	2.4	3.4
		Arsenic	Paddy fields	30	30	25	20
			Other	40	40	30	25
		Lead	Paddy fields	80	100	140	240
			Other	70	90	120	170
		Chromium	Paddy fields	250	250	300	350
			Other	150	150	200	250
		Copper	Orchards	150	150	200	200
			Other	50	50	100	100
		Bromium		60	70	100	190
		Zinc		200	200	250	300

2.2.2 Pollutant discharge standards

1) Air pollutants

There will be no air pollutant at the operation stage, and the main air pollutant at the construction stage is flying dust. Table 2 in the Integrated Emission Standard for Air Pollutants (GB16297-1996) applies. See Table 2.2-6.

Table 2.2-6 Emission limits for air pollutants

Standard	Pollution factor	Monitored concentration limit for unorganized emission	
		Monitoring site	Level, mg/m^3
Integrated Emission Standard for Air Pollutants (GB16297-1996)	Pollutants	Highest level point out of the perimeter	1.0

2) Noise

Noise at the construction stage is from construction machinery and vehicles mainly. The Emission Standard of Environment Noise for Construction Site Boundaries (GB12523-2011) applies. See Table 2.2-7.

Table 2.2-7 Noise limits during construction (unit: dB (A))

Standard	Pollution factor	Daytime	Night
Emission Standard of Environment Noise for Construction Site Boundaries (GB12523-2011)	noise	70	55

3) Wastewater

No wastewater will be generated at the operation stage. Construction wastewater will be used for on-site dust suppression and road maintenance after treatment in a settling tank without discharge, and vehicle flushing water will be used for flushing after treatment in an oil separation tank. Domestic wastewater generated by construction workers in urban areas will be discharged into the municipal sewer network, and subject to the Wastewater Quality Standard for Discharge into Municipal Sewers (GB/T31962-2015), and that generated by construction workers in nonurban areas will be utilized after treatment in a septic tank or integrated wastewater treatment facility, and subject to Reuse of Urban Recycled Water—Water Quality Standard for Urban Miscellaneous Use (GB/T 18920-2002).

4) Solid waste

No solid waste will be generated at the operation stage. For ordinary solid waste, the Standard for Pollution Control on General Industrial Solid Waste Storage and Land-filling (GB18599-2020) applies. For hazardous waste, the Standard for Pollution Control on Hazardous Waste Storage (GB18597-2001) and the 2013 amendment apply.

3 Project Description

3.1 Current situation and development plan of flood control

3.1.1 Current situation

The urban area of Jiaozuo City is run through by 9 rivers, all belonging to the Wei River in the Hai River basin, including the Baimamen, Puji, Qunying, Wengjian, Li and Shanmen Rivers running from north to south, and the Xin, Dasha and Jianggou Rivers running from west to east.

The main canal of the central line of the South-to-North Water Diversion Project runs through the city from south to north and then from west to east, with a full length of 76km. It runs through the Dasha, Baimamen, Puji, Qunying, Wengjian, Li and Shanmen Rivers via inverted siphons.

In recent years, river management has been promoted energetically in the city, covering the Dasha, Baimamen (middle part), Qunying, Puji (lower part), Wengjian (lower part) and Li (lower part) Rivers, but there is still a waterlogging risk in some parts of the urban area. In sustained heavy rains and mountain torrents in July 2021, JMURCB and JMWRB dredged the Baimamen and Xin rivers urgently to meet current flood control demand.

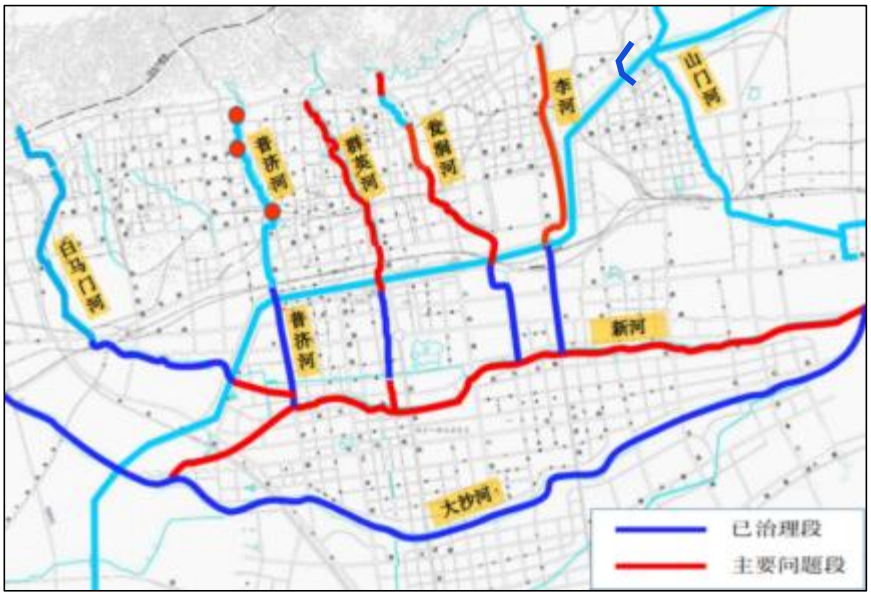


Figure 3.1-1 Managed river segments in the urban area

1) Dasha River in the urban area

The Dasha River originates from Duohuo Town, Lingchuan County, Shanxi Province, and runs through the urban area of Jiaozuo City from west to east, and finally flows into the Wei River in Hehe Town, Xinxiang City. This river flows from deep valleys into a pluvial-alluvial fan, with many gravels depositing on the riverbed, and its channels is U-shaped. Since 2010, the Jiaozuo Municipal Government has implemented many plans to manage different segments of the Dasha River, mainly including main channel dredging, ecological slope protection, embankment construction and reinforcement, submerged bridge reconstruction, overflow weir construction, landscaping, etc.

2) Dasha River in Xiuwu County

The 4.5km long Dasha River segment from the Fengshou Road Bridge to Madaohe Village in Xiuwu County was managed in 2013, including embankment construction and reconstruction, river dredging, and demolition and reconstruction of culverts, sluices, bridges and irrigation pump stations. In 2017, the 10km long bank-top road on the right side of the Dasha River (Renmin Road

Bridge-Changqiao Sluice) was hardened. In 2021, a 200m segment around the railway bridge and the embankments were managed.

3) Shanmen River

The Baizhuang segment of the Shanmen River in Macun District has been managed, including dredging for 2.66km, embankment construction for 8.23km (left: 4.01km, right: 4.22km) and slope protection for 0.42km (left: 0.31km, right: 0.11km). After the July 20 rainstorm in 2021, the affected segment of the Shanmen River in Macun District was restored urgently.

4) Current situation of urban river management

In recent years, the Jiaozuo Municipal Government has deodorized the Qunying, Wengjian, Li, Baimamen and Puji Rivers in the urban area, and planned to construct 3 flood intercepting facilities along Yingshi Road, Jianshe Road and the trunk canal of the South-to-North Water Diversion Project, which have not been completed.

5) Current situation of sewer network construction

The total length of sewer lines in Jiaozuo City is 761.83km. Most urban sewer lines are insufficient in capacity, aged and silted due to fund shortage.

According to the Three-year Action Plan for Quality and Efficiency Improvement of Urban Wastewater Treatment (2019-2021) (JC [2019] No.52), the efficiency improvement of sewer lines in the urban center will be implemented gradually. To date, wastewater and rainwater separation has been completed for Puji Road (Yingshi Road-Taihang Road), Jianshe Road (Muye Road—Puji Road) and Weixiao Street (Xinyuan Road-Jianshe Road).

3.1.2 Scope of construction of the Subproject

In July 2021, Jiaozuo experienced sustained heavy rains and mountain torrents rare in history. 20 small and medium reservoirs, and over 20 rivers including the Dasha, Manggai and Shanmen Rivers experienced bank collapse, and dam, road, sluice and office damage, and many national, provincial, county, township and village highways were damaged by collapse, landslides, mud-rock flows, etc. In order to eliminate rainstorm and flood impacts, and promote economic development and livelihood restoration, the Subproject has been proposed, which aims to promote the functional restoration of infrastructure, improve flood control and emergency management capacity, and protect people’s personal and property safety.

The Subproject is located in disaster-hit areas, including the urban area and Xiuwu County, and includes water and municipal infrastructure restoration and improvement, emergency response and institutional capacity building, etc., involving Dasha River, Shanmen River, Wengjian River, Qunying River, Tianjian Ditch, urban flood ditches, and over 10 urban roads. See Figures 3.1-2 and 3.1-3.

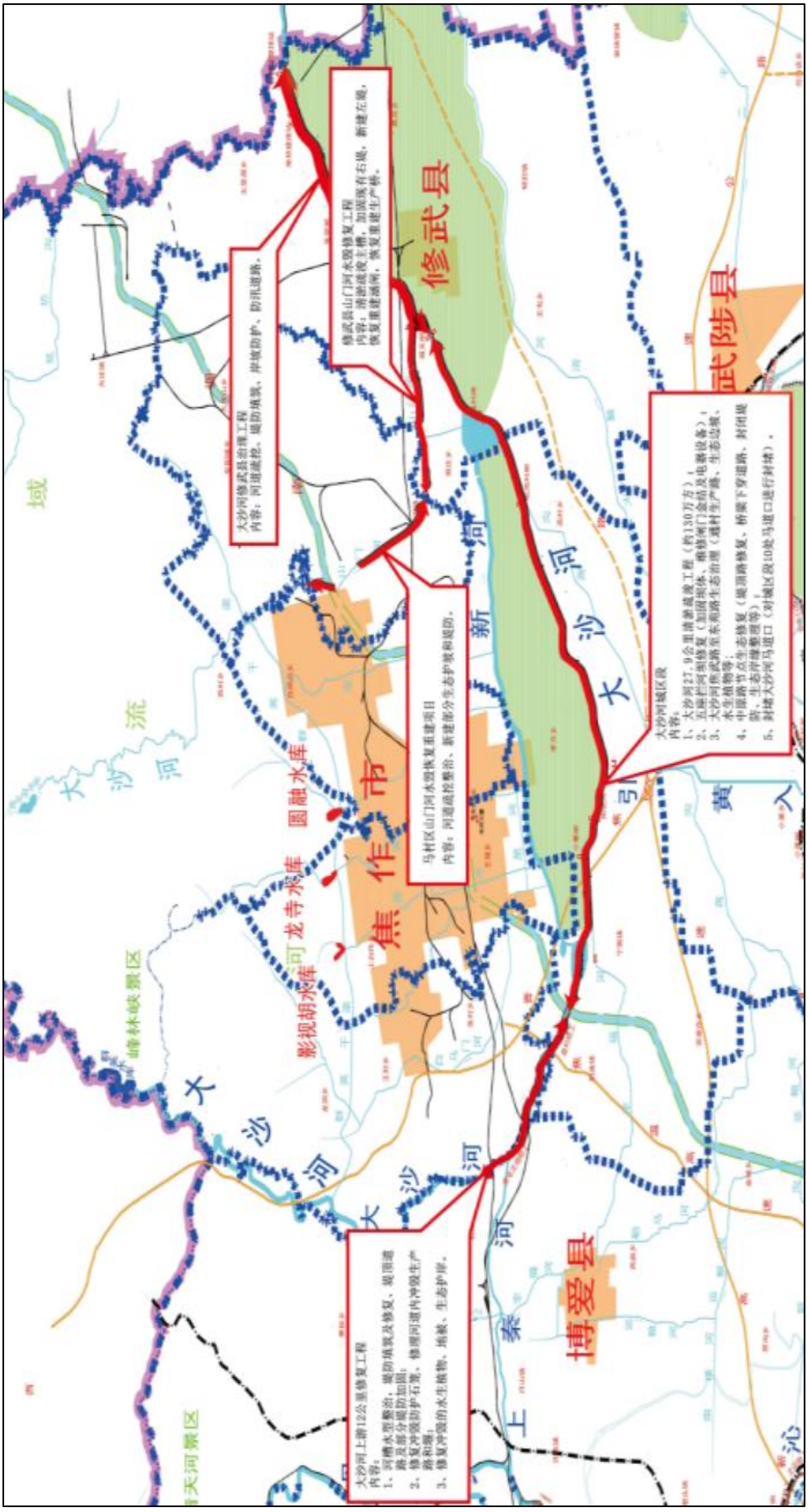


Figure 3.1-2 Location map of the Subproject

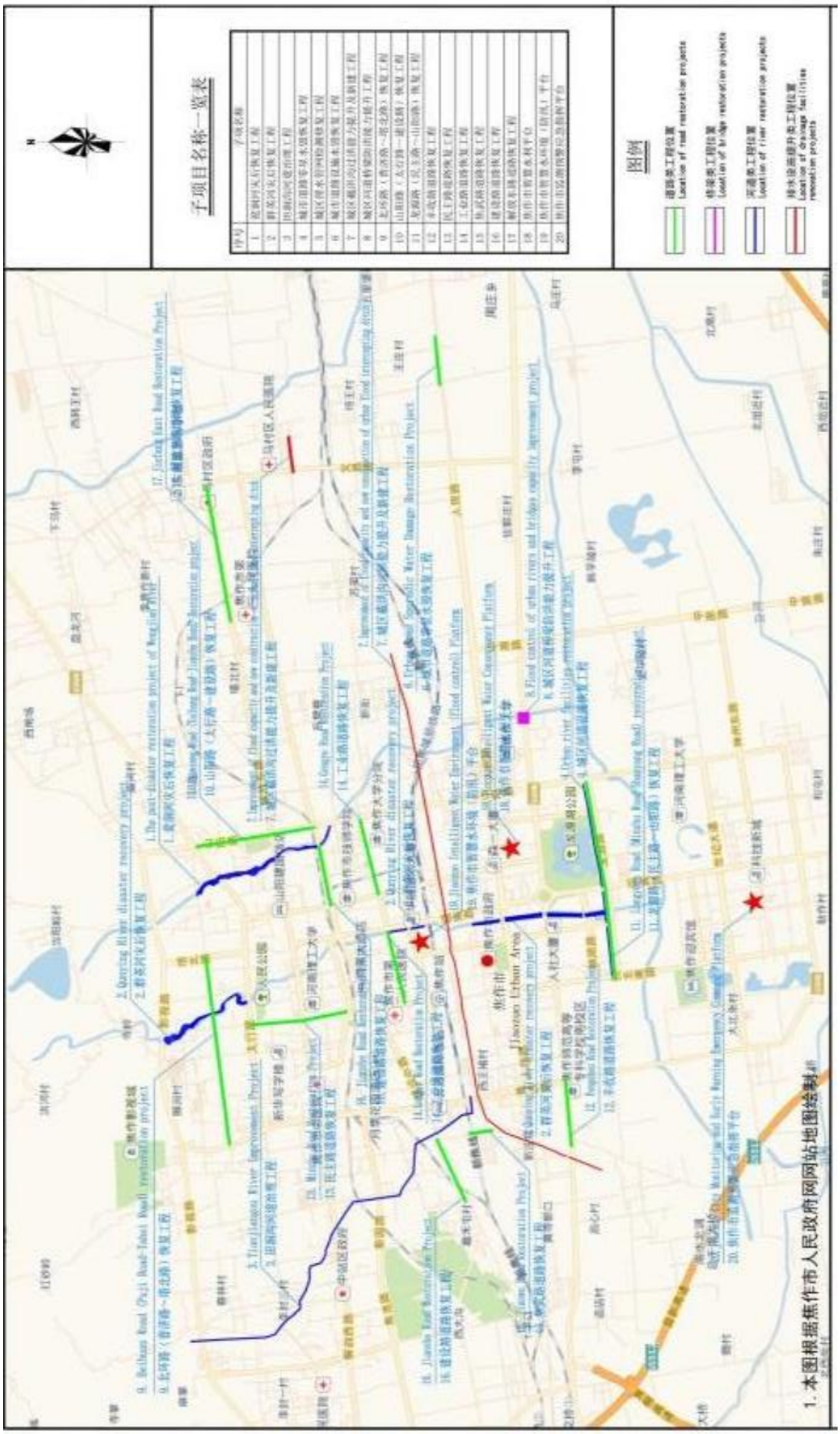


Figure 3.1-3 Location map of municipal and emergency response components in the urban center

3.1.3 Next-step plan

The Jiaozuo Municipal Government has prepared a medium- to long-term plan for municipal infrastructure affected slightly by the rainstorm out of the subproject area:

3.1.3.1 Conducting urban river management systematically

Strengthen river management for the existing problems in flood discharge.

1) Downstream Baimamen River management

From the South-to-North Water Diversion Project to the new river segment, with a design flood discharge capacity of 698 m^3/s and an estimated investment of 53.83 million yuan

2) Li River (Yingshi Road-flood ditch of the South-to-North Water Diversion Project) management

Covering a length of 5.44km, with an investment of 400.17 million yuan, including a construction investment of 254.92 million yuan and an ecological rehabilitation investment of 145.25 million yuan

3.1.3.2 Improving urban rainwater discharge channels

Plan urban rainwater discharge channels rationally based on the topography, road network and sewer network in conjunction with existing roads, drain ditches and pump stations to ensure that rainwater can enter receiving water bodies.

14 urban rainwater discharge channels have been planned, with focus on the northeast urban area and Macun District in the first 5 years.

3.1.3.3 Continuing to upgrade the urban sewer network

Implement urban waterlogging management and sewer network upgrading in conjunction with road restoration according to the Three-year Action Plan for Quality and Efficiency Improvement of Urban Wastewater Treatment (2019-2021) (JC [2019] No.52).

3.2 Components and distribution

The Subproject is located in disaster-hit areas, including the urban area and Xiuwu County, and includes water and municipal infrastructure restoration and improvement, emergency response and institutional capacity building, etc.

1) River infrastructure reconstruction and upgrading: including river dredging, embankment, slope improvement, ecological rehabilitation, structure, bridge, sluice, culvert and road construction, etc.

2) Municipal infrastructure reconstruction and upgrading: including the reconstruction and upgrading of damaged rivers, urban roads, auxiliary facilities, bridges, drainage facilities, etc.

3) Emergency response capacity building: building a smart water platform, a smart water environment (flood control) platform, a monitoring and early warning emergency command platform, etc.

4) Institutional capacity building: including project management and consulting services, professional skills training, technical support, external resettlement and environmental M&E, project management software system (MIS) procurement and application, etc.

The Subproject involve 24 components in 9 outputs, in which 21 components involve construction. See Table 3.2-1.

Table 3.2-1 Scope of construction of the Subproject

Contract	Component	Owner	Description	Gross investment (0,000	Construction period (month

				yuan)	
JZTJ101	Dasha River Restoration	JMWRB	1) River management: river dredging for 27.9km, bank protection for 10.128km, constructing embankments of 1.99km (1.123km in mountain exit-inverted siphon and 0.867km in inverted siphon-Zhongyuan Road), repairing two flooded roads and repairing 5 sluices; 2) Bridge works: demolishing flooded Nanzhang Road and reconstructing it into a 400m long and 10m wide bridge; 3) Ecological rehabilitation: creating diversified habitats, constructing ecological embankments, repairing roads and restoring aquatic plants in the mountain exit-inverted siphon segment; restoring river flat habitats, and creating barrier-free corridors for birds, fishes and amphibians in the inverted siphon-Zhongyuan Road segment	31910.15	16
JZTJ102	Dasha River Restoration in Xiuwu County	XCWRB	1) River dredging for 18.025km; 2) reinforcing the right embankment to resist floods occurring every 20 years, including standardization for 2km, slope protection for 5.245km and a right bank-top wave wall of 3.2km; 3) reinforcing the left embankment to resist floods occurring every 10 years for 6.504km; 4) hardening the existing bank-top flood control road of 9.705km; 5) Demolishing and reconstructing 5 bridges, 5 bank-crossing culverts and sluices, 1 check sluice and 1 flood drainage pump station, and upgrading 2 flood drainage pump stations; 6) Adding alley trees and streetlamps on the right bank from the upstream county border to Renmin Road, and adding streetlamps on the right bank below the Changqiao sluice, and landscaping at 3 points for a total of 0.84hm^2	12223.76	16
JZTJ103	Shanmen River Restoration in Xiuwu County	XCWRB	River dredging for 5.3km, heightening and reinforcing right embankment of 4.9km and Gaotun Village embankment of 1.73km, bank slope lining for 3.8km, constructing a right bank-top road of 4.9km and a Gaotun Village bank-top road of 1.73km, and demolishing and reconstructing 4 box culvert bridges, 2 sluices and 4 culverts	3637	9
JZTJ104	Shanmen River Restoration in Macun District	MDARAB	Including river dredging, bank protection, drainage culverts, etc., including river dredging for 8.15km, bank protection for 12.73km (8.15km on the left and 4.58km on the right), and two drainage culverts	14504.82	8
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	JMURCB	1) Restoration of river protection works: restoring damaged 6 secondary slopes and 2,525m riverbed of the Wengjian River; 2) River facility restoration and upgrading: restoring riverside green spaces of 1,2651 m^2, a rubber dam and sidewalks of 9,793 m^2, and constructing 230 solar streetlamps and two toolsheds	3124.22	9
JZTJ106	Qunying River Restoration	JMURCB	1) River management: river management and restoration for 4.578km, including managing damaged watercourse, banks and riverbed of the Qunying River (Yingshi Road-Taihang Road) of 1.808km; restoring riverbed and banks of the Qunying River (Industry Road-Xinyue Railway and Xin'an Road-Longyuan Road) of 2.77km; 2) Rubber dam restoration: restoring 3 rubber dams along the Qunying River (Renmin Road-Longyuan Road); 3) Streetlamp restoration: restoring light strips of 5,300m and auxiliary facilities along the Qunying River (Industry Road-Xinyue Railway, Xin'an Road-Longyuan Road), and 120 streetlamps and auxiliary facilities along the Qunying River (Xin'an Road-Longyuan Road); 4) Intercepting sewer and auxiliary facility restoration: restoring intercepting sewers, 42 inspection shafts and branch sewers of 0.15km along the Qunying River (Yingshi Road-Taihang Road, Industry Road-Xinyue Railway and Xin'an Road-Longyuan Road)	9525.81	12

JZTJ107	Urban River Facility Restoration	JMURCB	1) Xiaozhang River intercepting sewer restoration: restoring the 784m long Xiaozhang River intercepting sewer; 2) Qunying River reclaimed water pump station restoration: restoring and upgrading the secondary and tertiary reclaimed water pump stations of the Qunying River; 3) Hei River restoration and upgrading: from Minzhu Road to Shanyang Road, 3,202m long	1358.55	6
JZTJ108	Urban Sewer Network Inspection and Restoration (Phase 1)	JMURCB	1) Drainpipe dredging for a total length of 173.19km; 2) Sewer network inspection: inspecting sewer pipes with a total length of 173.19km, and establishing a geographic information database; 3) Sewer network restoration: restoring defective pipes of 7,077m, including 990m restored without excavation and 6,087m restored through excavation; 4) Reconstruction of improperly connected sewer pipes of 4,345m	7925.87	18
JZTJ109	Urban Road Facility Restoration	JMURCB	1) Water-logging site reconstruction: reconstructing 16 water-logging sites, and constructing and restoring rainwater pipes of 0.11 km, sewer pipes of 0.145 km, rainwater connecting pipes of 0.605km and 40 rainwater inlets, dredging rainwater pipes of 0.15 km, and restoring pavement of 180 m^2; 2) Road restoration: restoring damaged pavement of 3,492 m^2 on Renmin Road (Dongjing Road-Donghai Avenue), and reconstructing sewer pipes of 0.898 km; 3) Streetlamp restoration: restoring 62 Chinese-style streetlamps, 100 double-arm streetlamps, 36 single-arm streetlamps, 4 spotlights and 86 LED lamp bases on Zhengyi Street, Zheng'er Street, Xinyuan West Road (Puji Road-Muye Road), Xinhua Street (Taihang Road-Yingshi Road), Nantong Road (Jianshe Road—Zhanqian Road), Zhongyuan Road (Renmin Road-New Vehicle Administration Office)	2288.54	8
JZTJ110	Upgrading and Construction of Urban Flood Ditches	JMURCB	1) Flood discharge capacity improvement: dredging and lining the flood ditch on the left bank with a length of 9.27km to resist floods occurring every 10 years and urban waterlogging occurring every 30 years; 2) Haihe Road rainwater discharge passage construction: constructing the 330m long Haihe Road (Wenchang Road-East Lake) rainwater discharge passage	4566.09	9
JZTJ111	Flood Control Upgrading of Urban Rivers and Bridges	JMURCB	Including bridge and culvert works, approach works and other auxiliary works, including reconstructing the Wengjian River Bridge on Fengshou Road, from 113.539m on the west to 87.787m on the east, and a 235.526m long and 67m wide approach (including a 34.2m bridge), connected to existing Wenhui Road on the north and south	3240.29	9
JZTJ112	North Ring Road (Puji Road-Tabei Road) Restoration	JMURCB	1) Road works: broadening easting roads and optimizing the cross section to realize the separation of motorized and non-motorized vehicles, including North Ring Road (Puji Road-Jiankang Road), North Ring Road (Jiankang Road-Minzhu Road), North Ring Road (Minzhu Road-Tabei Road) and Qunying River Bridge; 2) Bridge works: broadening the existing bridge of North Ring Road across the Qunying River by 7.5m on both sides and using 1x20m pre-stressed concrete hollow slabs; 3) Drainage works: inspecting and restoring existing drainpipes, and upgrading segments with insufficient drainage capacity, including sewer pipes of 3.354km and rainwater pipes of 1.939km; 4) Lighting: replacing lamps and auxiliary devices; 5) Landscaping: planting trees on North Ring Road (Puji Road-Jiankang Road) and North Ring Road (Jiankang Road-Tabei Road); 6) Traffic works: adding road marking lines and facilities, and adding traffic signals at the junctions of North Ring Road-Jiankang Road and North Ring Road-Lingnan Road	8441.11	13
JZTJ113	Shanyang Road	JMURCB	Restoring Shanyang Road (Jianshe Road-Jiefang Road) and Shanyang Road (Jiefang Road-Taihang Road), and	5791.17	13

	(Taihang Road-Jianshe Road) Restoration		reconstructing rainwater and sewer pipes with insufficient drainage capacity, and aged lamps and lines		
JZTJ114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration	JMURCB	1) Road works: reconstructing sidewalks on both sides of Longyuan Road (Minzhu Road-Yingbin Road) and on the south side of Longyuan Road (Yingbin Road-Shanyang Road), the non-motorized lanes of Longyuan Road (Minzhu Road-Shanyang Road) with 3cm asphalt concrete AC-10C + 4cm asphalt concrete AC-13C + 0.6cm ES-2 slurry seal, the motorized vehicle lanes of Longyuan Road (Yingbin Road-Jianye Forest Peninsula Community), and the traffic islands at the junction of Longyuan and Shanyang Roads; 2) Drainage works: inspecting and upgrading existing drainpipes of Longyuan Road of 6.252km, reconstructing improperly connected pipes of 1.85km, and upgrading existing inspection shaft covers and rainwater grates; 3) Traffic works: redrawing traffic marking lines; 4) Landscaping: involving the traffic islands of Longyuan and Shanyang Roads	4533.12	13
JZTJ115	Fengshou Road Restoration	JMURCB	1) Road works: restoring the surface and base layers to a thickness of 48.8cm for segments in good condition and to 68.8cm for seriously damaged segments, and restoring non-motorized lanes to 55.6cm; 2) Drainage works: improving the drainage system, including shaft cover and rainwater grate replacement, local rainwater and wastewater integration, and construction of drainpipes of 120m; 3) Lighting: replacing lamps and auxiliary devices; 4) Landscaping: involving the traffic islands at the junction of Fengshou and Puji Roads, including Chinese pipes and alley trees; 5) Traffic works: adding traffic signals at the junction of Fengshou and Tianhe North Roads, adding marking lines for the whole segment, and conducting special traffic design for school entrances	4590.43	13
JZTJ116	Minzhu Road Restoration	JMURCB	1) Road works: reconstructing existing pavements to a thickness of 63.8cm and sidewalks to a thickness of 34cm; 2) Drainage works: upgrading the existing drainage system of Minzhu Road to realize rainwater and wastewater separation, constructing sewer pipes of 1.783km, with diameters of DN400-DN900, and rainwater pipes of 1.584km, with diameters of DN500-DN1000; 3) Lighting: replacing aged lamps; 4) Traffic works: updating marking lines and adding traffic signals at some road junctions	2550.36	16
JZTJ117	Industry Road Restoration	JMURCB	1) Road works: restoring the pavement of Industry Road (Minzhu Road-Qunying River) and Industry Road (Jiaodong Road-Shanyang Road) to a thickness of 64.8cm, the sidewalks to a thickness of 34cm, and the non-motorized vehicles to a thickness of 47.6cm; 2) Bridge works: constructing a bridge with 1x20m pre-stressed concrete hollow slabs, a pile abutment and a bored pile foundation; 3) Drainage works: reconstructing the drainpipe with diameters of DN400-DN500 and a length of 269m and the rainwater pipe with diameters of DN500-DN1200 and a length of 334m on Industry Road (Minzhu Road-Qunying River), inspecting and upgrading the existing pipes of Industry Road (Minzhu Road-Qunying River, Jiaodong Road-Shanyang Road), and reconstructing two water-logging sites at the parking lot of Wanji Mall on Industry Road, and the junction of Industry and Zhongzhou Roads; 4) Lighting: replacing some damaged lighting facilities on Industry Road (Minzhu Road-Qunying River, Jiaodong Road-Shanyang Road); 5) Traffic works:	6213.73	16

			updating traffic marking lines on Industry Road (Minzhu Road-Qunying River, Jiaodong Road-Shanyang Road)		
JZTJ118	Jiaowu Road Restoration	JMURCB	1) Road works: paving 18cm cement stabilized gravels and 4cm asphalt concrete AC-13C + 5cm asphalt concrete AC-16C on existing driveways, and constructing sidewalks and driveways in seriously damaged segments; 2) Traffic works: improving traffic facility design, and adding traffic signals at the junction of Jiaowu and Tianhe North Roads; 3) Drainage works: installing rainwater pipes of 811m on Jiaowu Road, with diameters of DN300-DN1000 to restore the drainage function; 4) Lighting: reconstructing lighting facilities; 5) Landscaping: planting alley trees	744.12	13
JZTJ119	Jianshe Road Restoration	JMURCB	1) Jianshe Road (Power Plant No.2 Community-Jiaowu Road restoration: restoring and improving the sidewalks with a thickness of 34cm; 2) Jianshe Road (Jiaodong Road-Shanyang Road) restoration: reconstructing the sidewalks of the Jiaodong Road-Wengjian River segment, with a thickness of 34cm, and the non-motorized vehicles of Jianshe Road (Chengfeng Road-Wengjian River); 3) Replacing damaged streetlamps on Jianshe Road (Jiaodong Road-Shanyang Road); 4) Inspecting and upgrading rainwater and sewer pipes of 121m on Jianshe Road (Power Plant No.2 Community-Jiaowu Road) and Jianshe Road (Jiaodong Road-Shanyang Road), and reconstructing two water-logging sites at the junction of Jianshe and Chengfeng Roads, and the civil affairs bureau alley in Shanyang District	2799.87	13
JZTJ120	Jiefang East Road Restoration	JMURCB	1) Road works: paving 18cm cement stabilized gravels and 4cm asphalt concrete AC-13C + 8cm asphalt concrete + 0.8cm ES-3 slurry seal on existing driveways, and constructing a 68.8cm thick asphalt pavement for seriously damaged motorized vehicle lanes, a 55.6cm thick asphalt pavement for seriously damaged non-motorized vehicle lanes and 34cm thick sidewalks in seriously damaged segments; 2) Drainage works: reconstructing existing drainpipes, constructing rainwater pipes of 4.345km with diameters of DN600-DN2200 and sewer pipes of 3.205km with diameters of DN400-DN600, and inspecting and restoring rainwater pipes south of Jiefang East Road (railway-Zhongxing Road); 3) Traffic works: redrawing traffic marking lines, and improving the traffic signals at the junctions of Jiefang East Road with Yongxing and Yichun Roads; 4) Lighting: replacing lamps and auxiliary devices, and adding 110 double-arm streetlamps, 2 single-arm streetlamps, 11 spotlights and lighting lines of 5,200m; 5) Landscaping: constructing local green belts, and landscaping the traffic islands at the junction of Jiefang East and Zhongxing Roads	9824.42	16
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	JMURCB	1) Water works: ①River dredging: within Yingshi Road-Puji Road (pile No.: 0+000-6+785), with a length of 6,596m; ②Bank protection: constructing concrete retaining walls of 6,678m; ③Structure construction: demolishing and reconstructing 5 bridges and culverts across Zijing Road, Sunny Garden access road, Jiefang West Road, Xinyuan Road and Jianshe West Road; 2) Intercepting sewer works: ①Intercepting sewer construction: constructing intercepting sewers with a diameter of DN400 and a length of 1,482m on the left bank, and diameters of DN400-DN500 and a length of 1,427m on the right bank, totaling 2,909m in the Yingshi Road-Yuejin Road segment; ②Rerouting the 1,660m long Yuejin Road-Puji Road intercepting sewer	17478.32	9

3.3 Quantities of work

The quantities of work of the river management and municipal components of the Subproject are as shown in Tables 3.3-1 and 3.3-2.

Table 3.3-1 Quantity list of river management components

Contract	Component	Earth excavation, /0,000 m^3	Earth backfilling /0,000 m^3	Earth transfer in /0,000 m^3	Earth transfer out /0,000 m^3	Spoil /0,000 m^3	Waste rock /0,000 m^3	Concrete /0,000 m^3	Masonry /0,000 m^3	Steel bars, t	Dredging /0,000 m^3	Construction waste /0,000 m^3	Roads, km	Pipe laying, m	Pipe demolition, m
JZTJ101	Dasha River Restoration	194.83	66.31	11.56	/	135.47	/	4.29	10.86	2159.95	99.7	7.54	16.969	/	/
JZTJ102	Dasha River Restoration in Xiuwu County	69.8	28.5	22.77	22.77	41.55	/	1.4	0.77	998.87	9	0.08	9.705	/	/
JZTJ103	Shanmen River Restoration in Xiuwu County	13.99	9.26	7.35	/	10.42	/	0.72	0.99	346.11	1.06	0.04	6.63	/	/
JZTJ104	Shanmen River Restoration in Macun District	102.05	19.08	/	/	82.97	3.78	3.033	/	323.75	/	0.4	/	/	/
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	1.58	0.35	/	/	1.23	/	0.87	0.73	231.5	/	0.93	3.26	/	/
JZTJ106	Qunying River Restoration	17.11	3.89	/	/	13.22	/	4.27	1.8	2434.5	/	0.41	/	/	900
JZTJ107	Urban River Facility Restoration	1.06	0.47	/	/	0.59	/	0.27	0.05	220.3	/	0.09	/	784	794
JZTJ110	Upgrading and Construction of Urban Flood Ditches	14.93	3.25	/		11.67	/	1.19	/	80.1	/	0.46	/	434	750
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	68.04	22.47	/	/	42.74	/	9.45	2.49	1341.31	1.713	1.74	/	4569	/
Total		483.39	153.58	41.68	22.77	339.86	3.78	25.493	17.69	8136.39	111.473	11.69	36.564	5787	2444

Table 3.3-2 Quantity list of municipal components

Contract	Component	Earth excavation, /0,000 m^3	Earth backfilling /0,000 m^3	Spoil /0,000 m^3	Concrete /0,000 m^3	Sludge /0,000 m^3	Construction waste /0,000 m^3	Pipe demolition, m
JZTJ108	Urban Sewer Network Inspection and Restoration (Phase 1)	/	/	/	0.27	0.138	0.086	6037
JZTJ109	Urban Road Facility	/	/	/	0.109	/	0.27	/

	Restoration							
JZTJ111	Flood Control Upgrading of Urban Rivers and Bridges	1.91	0.0838	1.8262	0.58	/	0.726	/
JZTJ112	North Ring Road (Puji Road-Tabei Road) Restoration	1.862	0.176	1.686	0.63	/	1.151	/
JZTJ113	Shanyang Road (Taihang Road-Jianshe Road) Restoration	0.163	0.032	0.131	0.23	/	0.897	1508
JZTJ114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration	0.0879	0.0812	0.0067	0.44	/	1.799	/
JZTJ115	Fengshou Road Restoration	0.1991	0.0021	0.197	0.234	/	1.9791	/
JZTJ116	Minzhu Road Restoration	0.4584	0.0132	0.4452	0.0725	/	1.919	/
JZTJ117	Industry Road Restoration	1.076	0.0354	1.0406	0.49	/	3.499	/
JZTJ118	Jiaowu Road Restoration	/	/	/	0.048	/	0.001	/
JZTJ119	Jianshe Road Restoration	0.086	0.0159	0.0701	0.452	/	0.671	675
JZTJ120	Jiefang East Road Restoration	0.0623	0.0598	0.0025	0.678	/	0.897	5650
Total		5.9047	0.4994	5.4053	4.2335	0.138	13.8951	13870

3.4 Land occupation

The components involving LA include Shanmen River Reconstruction in Macun District, Qunying River Restoration and Tianjian Ditch (Yingshi Road-Puji River) Management, involving the acquisition of 36.59 mu, 5.14 mu and 31.4985 mu of land respectively, totaling 73.2285 mu.

Temporary land occupation arises from construction camps, traffic, spoil grounds, etc. 905.11 mu of land will be occupied temporarily for the Subproject.

See Table 3.4-1, and Attached Figures 1, 2-14, 15-29 and 30.

Table 3.4-1 Summary of occupied land

Contract	Component	LA area (mu)	Temporarily occupied land area				Remarks
			Construction camp (mu)	Spoil ground (mu)	Drying yard (mu)	Temporary road (mu)	
JZTJ101	Dasha River Restoration	/	30	180	30	0	The construction camp, spoil ground and drying yard are located within the range of land use.
JZTJ102	Dasha River Restoration in Xiuwu County	/	18	185.5	22.5	/	The construction camp is an existing idle workshop, and the drying yard and spoil ground occupy 208 mu of river flat.
JZTJ103	Shanmen River Restoration in Xiuwu County	/	/	64.4	/	7.5	The construction camp and drying yard are on existing idle industrial land, and the spoil ground and temporary road occupy 71.9 mu of river flat.
JZTJ104	Shanmen River Restoration in Macun District	36.59	12	155.49	/	31	The construction camp and temporary road occupy 43 mu of cultivated land temporarily, and the spoil ground occupies 155.49 mu of unused state-owned land.
JZTJ105	Wengjian River	/	7.50	/	/	/	The construction camp occupies riverside

	(North Ring Road-Shanyang Road) Restoration						green space, the construction road is located on the construction site, and the spoil ground is a designated one.
JZTJ106	Qunying River Restoration	5.14	9.00		/	/	
JZTJ107	Urban River Facility Restoration	/	7.50		/	/	
JZTJ108	Urban Sewer Network Inspection and Restoration (Phase 1)	/	7.50	/	/	/	The construction camp is located on the construction site.
JZTJ109	Urban Road Facility Restoration	/	2.25	/	/	/	The construction camp is located on the construction site.
JZTJ110	Upgrading and Construction of Urban Flood Ditches	/	5.25		/	/	The construction camp is an existing idle workshop, the construction road is located on the construction site, and the spoil ground is a designated one.
JZTJ111	Flood Control Upgrading of Urban Rivers and Bridges	/	1.80		/	/	The construction camp is located on the construction site, and the spoil ground is a designated one.
JZTJ112	North Ring Road (Puji Road-Tabei Road) Restoration	/	7.50		/	/	
JZTJ113	Shanyang Road (Taihang Road-Jianshe Road) Restoration	/	3.30		/	/	
JZTJ114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration	/	3.75	/	/	/	
JZTJ115	Fengshou Road Restoration	/	3.75		/	/	
JZTJ116	Minzhu Road Restoration	/	2.25		/	/	
JZTJ117	Industry Road Restoration	/	5.40		/	/	
JZTJ118	Jiaowu Road Restoration	/	3.00		/	/	
JZTJ119	Jianshe Road Restoration	/	2.25		/	/	
JZTJ120	Jiefang East Road Restoration	/	4.20		/	/	
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	31.4985	6.00	14.29	/	72.23	The construction camp occupies unused land along roads, and the construction road and spoil ground occupy 82.52 mu of river flat.
Total		73.2285	142.2	599.68	52.5	110.73	/

3.5 Domestic environmental approval procedure

According to the Catalogue for Classified EIA Management of Construction Projects (2021), 3 EIA reports, 3 EIA report forms and 11 registration forms will be submitted for the 21 components for approval or registration. See Table 3.5-1.

Table 3.5-1 Classification of domestic EIA approval

Component	IA	Domestic EIA requirements				Remarks	Land pre-approval
		Project category	EIA category	Approval authority	Approval status		

JZTJ101-Dasha River Restoration	JMWRB	51-128 river / lake management (excl. rural ponds, weirs and canals)	One report form	Jiaozuo Municipal Ecology And Environment Bureau	Not submitted for approval	Not involving environmental sensitive site	/
JZTJ102-Dasha River Restoration in Xiuwu County	XCWRB	51-128 river / lake management (excl. rural ponds, weirs and canals), 51-127 flood control works-other	One report form	Xiuwu County Ecology And Environment Bureau	Not submitted for approval	Not involving environmental sensitive site	/
JZTJ103-Shanmen River Restoration in Xiuwu County		51-128 river / lake management (excl. rural ponds, weirs and canals)				Not involving environmental sensitive site	/
JZTJ104-Shanmen River Restoration in Macun District	MDARAB	51-128 river / lake management (excl. rural ponds, weirs and canals)	One report	Macun District Ecology And Environment Bureau	Pending	Involving environmental sensitive site	/
JZTJ105-Wengjian River Restoration	JMURCB	51-128 river / lake management (excl. rural ponds, weirs and canals)	One report	Jiaozuo Municipal Ecology And Environment Bureau	Not submitted for approval	Not involving environmental sensitive site	/
JZTJ106-Qunying River Restoration		51-128 river / lake management (excl. rural ponds, weirs and canals)				Involving environmental sensitive site	Obtained by the end of Dec.
JZTJ107-Urban River Facility Restoration		51-128 river / lake management (excl. rural ponds, weirs and canals)				Not involving environmental sensitive site	/
JZTJ110-Upgrading and Construction of Urban Flood Ditches		51-127 flood control works-other				Not involving major construction	/
JZTJ108-Urban Sewer Network Inspection and Restoration		52-146 urban pipe network and corridor construction	Registration	Registration system	Registered	Other	/
JZTJ109-Urban Road Facility Restoration		52-146 urban pipe network and corridor construction	Registration	Registration system	Registered	Other	/
JZTJ111-Flood Control Upgrading of Urban Rivers and Bridges		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	One report form	Shanyang District Ecology And Environment Bureau	Not submitted for approval	Involving urban bridge	Obtained in Dec. 2021
JZTJ112-North Ring Road (Puji Road-Tabei Road) Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ113-Shanyang Road (Taihang Road-Jianshe Road) Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ114-Longyuan Road (Minzhu Road-Shanyang Road) Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and	Registration	Registration system	Registered	Other	/

		underpasses)					
JZTJ115-Fengshou Road Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ116-Minzhu Road Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ117-Industry Road Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ118-Jiaowu Road Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ119-Jianshe Road Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ120-Jiefang East Road Restoration		52-131 urban road (excl. maintenance, branch roads, overpasses and underpasses)	Registration	Registration system	Registered	Other	/
JZTJ121-Tianjian Ditch (Yingshi Road-Puji River) Management		51-128 river / lake management (excl. rural ponds, weirs and canals)	One report	Jiaozuo Municipal Ecology And Environment Bureau	Not submitted for approval	Involving environmental sensitive site	Obtained in Feb. 2021

Note: A social stability risk assessment has been conducted in the relevant sections of the feasibility study report and preliminary design of each component, and no social stability risk assessment report has been prepared separately.

3.6 Construction organization design

3.6.1 Construction diversion

In the Subproject, embankment construction, river dredging, slope protection, culvert, bridge, pipe and road construction involve diversion.

3.6.1.1 Diversion mode

In local urban rivers, floods mostly occur in the flood period of June-September, and construction diversion will be from November to April.

1) Wengjian River (North Ring Road-Shanyang Road) Restoration, Qunying River Restoration, and Upgrading and Construction of Urban Flood Ditches will not be constructed in the flood period, for which curbs will be excavated on the riverbed for diversion.

2) Tianjian Ditch (Yingshi Road-Puji River) Management: The construction curb uses a trapezoidal cross section, 0.8m deep, with a slope gradient of 1:1.5, designed to divert floods occurring every 10 years. To ensure structure construction progress and safety, a transverse cofferdam will be set up 10m upstream of each of the 4 culverts to be demolished and reconstructed, and the top level of each cofferdam is higher than the construction period water

level by 0.5m. A longitudinal cofferdam with a top width of 1.5m and a slope gradient of 1:1.5 will be constructed at the end. All cofferdams will be removed after construction before the flood period.

3) Urban River Facility Restoration: The structure to be diverted is the Qunying River check sluice, which is designed to divert floods occurring every 5 years, and will be not constructed in the flood period. Cofferdams will be used to intercept the riverbed, and floods will be diverted via an open canal. Its ground level is above the riverbed by 3.7m, and a trapezoidal cross section is used, with a longitudinal gradient of i=1/1000, a bottom width of 1.0m and a slope gradient of 1:1.5, a depth of 0.6m and a length of 45m. The upstream and downstream cofferdams use a trapezoidal cross section, with a top width of 2m, a slope gradient of 1:2 and a length of 15m.

4) Dasha River Restoration: A U-shaped cofferdam is used for diversion in bridge reconstruction, which is 3m high and 3m wide, with a slope gradient of 1:2. Full cross section cofferdams are used for diversion for the ecological overflow weir. All cofferdams are in earth and stone structure, designed to divert floods occurring every 10 years and 5 years respectively.

5) Shanmen River Restoration in Xiuwu County: The structures involving construction diversion mainly include box culverts, pipe culverts, and north and south drainage sluices. The diversion cofferdams are in earth and stone structure, designed to divert floods occurring every 5 years. A full cross section cofferdam is used for the box culverts on the main waterway, U-shaped cross section cofferdam used for the pipe culverts, and full cross section cofferdams will be used for the north and south drainage sluices.

Dasha River Restoration in Xiuwu County: Full cross section cofferdams will be used for construction diversion, 3.0m high and 3.0m wide, with a slope factor of 1:2 and a full length of 362.00m. For the submerged bridge (12+425), a stage cofferdam will be used for diversion, 3.0m high and 3.0m wide, with a slope factor of 1:2 and a full length of 240.00m.

6) In some downstream segments of the Shanmen River in Macun District, excavated earth is used for diversion.

For river dredging, earth is excavated using a 1.0-2.0m^3 excavator, and transferred to the spoil ground via a 8t-15t dump truck. Earth is excavated from the top down layer by layer, and each layer is 1.5m thick. When groundwater is encountered during excavation, drainage is conducted via a drain ditch and a collecting well to ensure dry construction.

3.6.1.2 Foundation pit drainage

Some river segments have high groundwater levels, and foundation pit drainage includes early-stage drainage before excavation and regular drainage during excavation. Early-stage drainage involves accumulated and infiltrated water, and is conducted using fixed water pumps. Regular drainage involves infiltrated water and rainwater, and is conducted using drain ditches and collecting wells.

3.6.2 Construction schedule

The preparation period is one month, the closing period one month, and the remainder is the construction period of the main part. In the preparation period, road, camp and factory construction, land leveling, earth excavation and foundation cleanup will be completed; in the closing period, site cleanup and final inspection will be completed.

Table 3.6-1 Construction schedule

Contract	Component	Starting date	Ending date	Construction period
JZTJ101	Dasha River Restoration	2022.9	2023.12	16 months

Contract	Component	Starting date	Ending date	Construction period
JZTJ102	Dasha River Restoration in Xiuwu County	2022.9	2023.12	16 months
JZTJ103	Shanmen River Restoration in Xiuwu County	2022.10	2023.6	9 months
JZTJ104	Shanmen River Restoration in Macun District	2022.10	2023.5	8 months
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	2022.8	2023.4	9 months
JZTJ106	Qunying River Restoration	2022.7	2023.6	12 months
JZTJ107	Urban River Facility Restoration	2022.9	2023.2	6 months
JZTJ108	Urban Sewer Network Inspection and Restoration (Phase 1)	2022.12	2024.6	19 months
JZTJ109	Urban Road Facility Restoration	2022.7	2023.2	8 months
JZTJ110	Upgrading and Construction of Urban Flood Ditches	2022.8	2023.4	9 months
JZTJ111	Flood Control Upgrading of Urban Rivers and Bridges	2022.8	2023.5	10 months
JZTJ112	North Ring Road (Puji Road-Tabei Road) Restoration	2022.9	2023.9	13 months
JZTJ113	Shanyang Road (Taihang Road-Jianshe Road) Restoration	2022.9	2023.9	13 months
JZTJ114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration	2022.9	2023.9	13 months
JZTJ115	Fengshou Road Restoration	2022.9	2023.9	13 months
JZTJ116	Minzhu Road Restoration	2022.9	2023.12	16 months
JZTJ117	Industry Road Restoration	2022.9	2023.12	16 months
JZTJ118	Jiaowu Road Restoration	2022.9	2023.9	13 months
JZTJ119	Jianshe Road Restoration	2022.9	2023.9	13 months
JZTJ120	Jiefang East Road Restoration	2022.9	2023.12	16 months
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	2023.9	2024.5	9 months

3.7 Associated facilities

According to the ESMPF for the Project, an “associated facility” means an activity not included in the project description in the project management agreement, but is inherently connected to the project, and identified after consultation between AIIB and the PMO. The key principles for identification are: (a) being directly and substantially related to the project; (b) being implemented or planned along with the project; and (c) being feasibly necessary for the project, and would not be constructed or expanded without the project.

The Subproject is located in disaster-hit areas, including the urban area and Xiuwu County, and includes water and municipal infrastructure restoration and improvement, emergency response and institutional capacity building, etc., including river dredging, embankment, slope improvement, ecological rehabilitation, structure, bridge, sluice, culvert and road construction, reconstruction and upgrading of damaged rivers, urban roads, auxiliary facilities, bridges, drainage facilities, building a smart water platform, a smart water environment (flood control) platform, a monitoring and early warning emergency command platform, project management and consulting services, professional skills training, technical support, external resettlement and environmental M&E, project management software system (MIS) procurement and application, etc. The Subproject does not involve any of the above 3 principles. The Subproject is not subject to any other project, will function immediately after completion, and will not affect the surrounding environment and the public adversely.

4 E&S Baseline

4.1 Overview of the Natural Environment

4.1.1 Geographical location

Jiaozuo City is located in the northwest of Henan Province, at the southern foot of the Taihang Mountains, and is situated at the bordering zone of the piedmont sloping fields and plains, with the Taihang Mountains in the north, the Yellow River in the south, Shanxi Province in the west and Xinxiang City in the east. As it is located at the intersection of north and south, east and west of China, with the pivotal position of linking east and west, south and north, Jiaozuo City now has jurisdiction over two county-level cities, Qinyang City and Mengzhou City, four counties, Xiuwu County, Wuzhi County, Wen County and Boai County, and five urban districts, Jiefang District, Shanyang District, Zhongzhan District, Macun District and Gaoxin District, with a total area of 4,071km^2.

The central urban area of Jiaozuo City is located at 35°8'-35°18'N and 113°9'-113°22'E. It is adjacent to Taihang in the north, Wuzhi in the south, Xiuwu in the east and Boai in the west, with a total area of about 424km^2 under its jurisdiction, and the current built-up area has exceeded 95km^2.

Xiuwu County is located in the east of Jiaozuo City, adjacent to Huojia County and Huixian City in Xinxiang City to the east, Wuzhi County in Jiaozuo City to the south, Jiaozuo Urban District to the west, and Jincheng City, Zechou City and Lingchuan County in Shanxi Province to the north. Its geographical coordinates are 35°07'39"-35°28'32" N and 113°08'17"-113°32'03" E. Its jurisdiction is 40km long from north to south, 36km wide from east to west, and 4km at its narrowest part, with a total area of 611km^2.

The Subproject involves Macun District, Jiefang District, Zhongzhan District, Shanyang District and Xiuwu County in Jiaozuo City.

4.1.2 Topography and landforms

Jiaozuo City is located in the transition zone between the Taihang Mountains and the Northern Henan Plain. The terrain consists of two fundamental structural units, i.e. plain and mountainous area, with the topography inclining from northwest to southeast and declining from north to south. There is a step change from the northern mountainous area to the southern plain with distinct gradations. Its landforms from north to south are mountainous area - hilly area - piedmont diluvial plain - piedmont (gully) geosyncline intersection depression - Xunfeng Ridge downland - the Qin River floodplain, the Huangqin River alluvial plain + the Old Yellow River floodplain - the Qingfeng Ridge downland - the Yellow River floodplain (the Yellow River belted alluvial plain). The natural average gradient is 2%. The highest altitude is 1,955m, and the lowest altitude is 90m. The main geomorphic features in the area are mountains, hills and plains, respectively accounting for 33.3%, 56.1% and 10.6%.

The terrain of Macun District is high in the northwest and low in the southeast, with the Taihang Mountains to the north. There are mountainous and hilly areas in the north, and plains in the middle and south, with the terrain altitude of 87.7-299.4m. Jiefang District is mostly piedmont alluvial and diluvial plains, with the terrain high in the northwest corner and low in the southeast. It is 700m above sea level in the north and 102m above sea level in the south, with an average gradient of 20%. There are some gullies and dry valleys by erosion, and the area to the south is the edge of alluvial fan with a flat terrain. In Zhongshang District, the topography inclines from northwest to southeast, and is divided into mountainous area, piedmont slope mound and plain

terrain according to the geomorphic unit and morphology. The altitude of mountainous area ranges is 900-200m, with exposed bedrock, developed valley system, strong erosion of valleys, steep banks, curved river channels, mainly lateral erosion, large gravel deposits on the riverbed, "U" shaped river channel, and outcrop of spring in the upstream; the piedmont slope mound is 200-95m above sea level, composed of piedmont alluvial deposits, with varying overburden thickness, developed north-south gully, strong erosion, undulating ridge-and-ravine topography, uneven distribution of cross soil and sand gravel in the area, and 1/100-1/600 surface slope; the plain terrain is a piedmont inclined plain formed by diluvial and alluvial fan group, with flat ground and inclination topography from northwest to southeast, and gully gradually atrophies and disappears in this area. Shanyang District is located in the hilly area, with the topography high in the north and low the south, with a north-south divide of 80m, and crisscrossed gullies.

Xiuwu County is located in the southern foot of the Taihang Mountains, with mountainous areas and hills in the north and alluvial plains in the south. Its topography is high in the north and low in the south, with an average altitude of 692.7m.

4.1.3 Soil

There are one soil class, four subclasses, nine soil genera and twenty-one soil species in Jiaozuo, mainly a wide range of soil types such as moisture soil, cinnamon soil, stony soil, skeleton soil and brown soil. The moisture soil has the largest area in the city and is the most important soil for cultivation in the plain terrain, widely distributed in the piedmont intersection depression, the alluvial plain of the Yellow River and the Qin River and the Yellow River floodplain. By region, the soil nutrient content is high in the central plain, followed by the southern part and then the northern mountainous area.

4.1.4 Climate and weather

4.1.4.1 Climatic characteristics

Jiaozuo City belongs to the warm temperate subhumid climate, and has the characteristics of continental monsoon climate, influenced by the seasonal advance and retreat of the frontal surface of polar high-pressure cold air mass and Pacific warm air mass: cold and dry in winter, dry and windy in spring, hot and rainy in summer, bright and clear in autumn, with four distinct seasons.

1. Precipitation and evaporation

According to years of data from Jiaozuo meteorological station, the mean years annual precipitation is 562.6mm, the maximum annual precipitation is 753.3mm, and the minimum annual precipitation is 299.7mm. The precipitation is unevenly distributed in the year. The annual precipitation is mainly concentrated in the flood season (June to September), which accounts for 68% of the total amount of precipitation, with the most concentrated precipitation in July and August, accounting for 46% of the total annual precipitation. The precipitation in October, November and December accounts for 11% of the annual total; and the precipitation in January, February, March, April and May accounts for 21% of the annual total. The evaporation is strongly correlated with precipitation, with uneven seasonal distribution and large interannual variation. The multi-year average annual evaporation is 1,538.6mm (E20), and the average monthly evaporation is 128.2mm. Figure 4.1-1 shows the average monthly precipitation and evaporation for the calendar year.

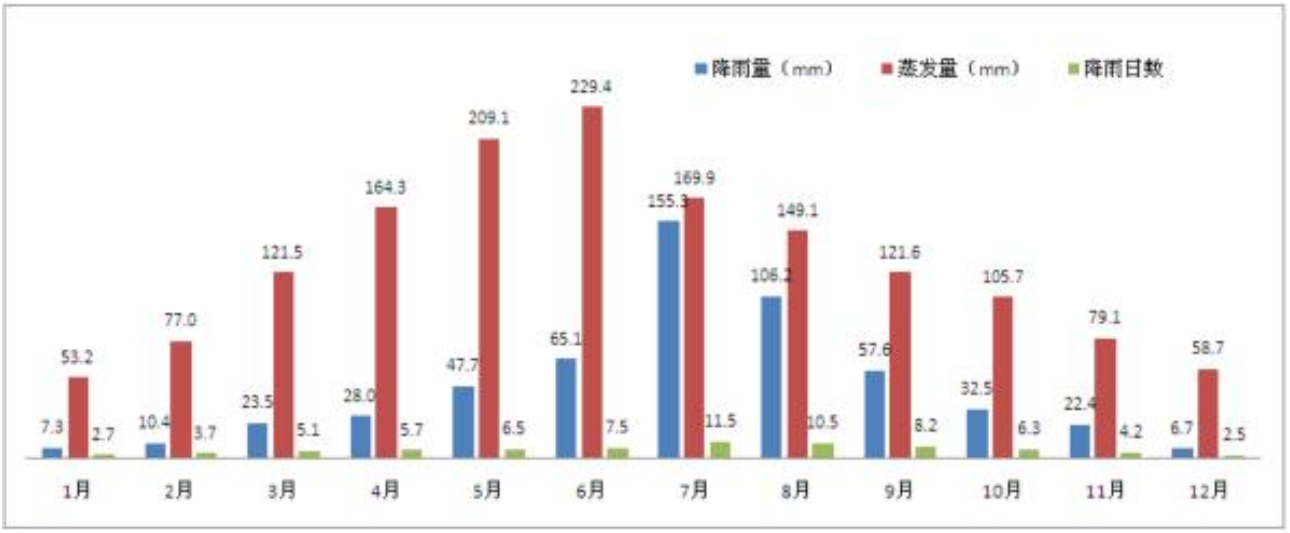


Figure 4.1- 1 Distribution of monthly average precipitations and evaporations of Jiaozuo City

2. Sunshine, temperature and wind speed

The multi-year average annual sunshine duration is 2,422.7h and the frost-free period is 231d in Jiaozuo City. The multi-year average temperature is 15.2℃. Influenced by the seasonal circulation and the Taihang Mountains, the northerly and southerly winds are small, and the winds are mostly northeasterly and southwesterly in all seasons, with a multi-year average wind speed of 2.3m/s (1971-2000).

3. Drought index

The drought index of Jiaozuo City is 1.56, and the project area is located in a semi-humid region according to the climate dryness and wetness classification index.

4. Frost-free period

The average first-frost date in Jiaozuo City is in early November, with the earliest first-frost date in mid-October; the average last-frost date is in mid-March, with the last-frost date in mid-April at the latest. The multi-year average frost period is 128 days, the longest frost period is 163 days, and the shortest frost period is 99 days.

5. Air pressure

The annual average air pressure in Jiaozuo City is 1,003.5mba, the extreme maximum air pressure is 1,018.7mba, and the extreme minimum air pressure is 989.3mba.

6. Humidity

The average humidity in Jiaozuo City is 62%, higher than 65% from July to October and lower than 58% from December to June, with the minimum one in January and the maximum one in August.

4.1.4.2 Rainstorm

Rainstorms in Jiaozuo City are mainly caused by a combination of weather systems and topographic conditions. From the rainstorm census data, the weather that produces rainstorms at an altitude of 700m mainly includes typhoons, typhoon troughs, east-west and north-south shear lines, and cross-sectional weather systems are mainly cold fronts, cyclone waves and low-pressure troughs. From the terrain features, the topography of the region is high in the northwest and low in the southeast, with the Taihang Mountains in the northwest and plains in the southeast. In summer and autumn, the region is subject to the Pacific subtropical high, with mostly southeasterly winds, and the warm moist air is blocked and lifted by the Taihang Mountains, easily causing rainstorms on the piedmont windward slopes. Rainstorms mainly occur in July to August, especially in late July to early August. From the data of Jiaozuo meteorological station in

1953-2003, the maximum one-day precipitation is 265.5mm (August 17, 1955).

4.1.4.3 Flood

Floods in the basin of the Subproject are formed by rainstorms. The mountainous area is steep with a large slope, and the flood peak is mainly influenced by the change in intensity of short-duration rainstorms. The floods rise and fall steeply, with the characteristics of short duration and sharp peaks. The floods often cause serious mountain torrent disasters.

From 20:00 on July 18 to 15:00 on July 22, 2021, there was continuous heavy rainfall in Jiaozuo City, with an average rainfall of 416mm in the city, 546.8mm in urban district, 568mm in Xiuwu, 404.6mm in Wuzhi, 399.1mm in Boai, 330.6mm in Wen County, 310.6mm in Qinyang, and 335.4mm in Mengzhou. The four-day rainfall from July 18 to 22 (416mm) accounted for 71.4% of the multi-year average rainfall (582.3mm from 1956 to 2016) in the city, and the four-day rainfall (546.8mm) accounted for 90.9% of the multi-year average rainfall (601.3mm from 1956 to 2016) in the urban district.

4.1.5 Geology

4.1.5.1 Formation lithology

In the engineering area, the formation is mainly composed of heavy slit loam, medium slit loam, pebble (Q2alpl) of the middle Pleistocene series of the quaternary system, heavy slit loam (Q3alpl) of the upper Pleistocene, and pebble, medium slit loam (Q41alpl), light slit loam (Q42alpl) and artificial fill (gravelly soil) (Q42ml) of the Holocene series of the quaternary system.

4.1.5.2 Geological structure and earthquake

The geological structure of Jiaozuo City is located in the southern region of the Taihang Mountains uplift of the neocathaysian structural system, the front margin of the reflex arc of the eastern region of the epsilon-type structure of southeastern Shanxi, and the northern margin of the latitudinal tectonic zone of the Eastern Qinling Mountains. The ground motion peak acceleration in engineering area is 0.10g, the eigenperiod of seismic response spectrum is 0.40s, and the relevant seismic basic intensity is VI in accordance with the *Seismic Ground Motion Parameter Zonation Map of China* (GB18306- 2015).

4.1.6 Hydrology

4.1.6.1 Surface water

There are nine rivers within the planning area of Jiaozuo City, including six rivers in the order from west to east: the Baimamen River, the Puji River, the Qunying River, the Wengjian River, the Li River and the Shanmen River, which cross the urban district in a comb shape from north to south and flow into the west-east Xinhe River and Dasha River in the south of the city; The Jianggou River is a tributary of the Dasha River, which runs from southwest to northeast and finally joins the Dasha River at Beigao Village. These rivers form a river network system of three horizontal and six vertical rivers.

The upper reaches of the six rivers in the north-south direction in the urban district are mostly canyons, and the riverbeds gradually atrophy or disappear after they enter the piedmont mound and the plain terrain after leaving the mountain pass. The upper reaches of the said six rivers are all seasonal mountain torrent channels, and show the characteristics of flash flood, fast convergence, short duration and fierce flooding. The Middle Route of the South-to-North Water Transfer Project crosses from the urban district.

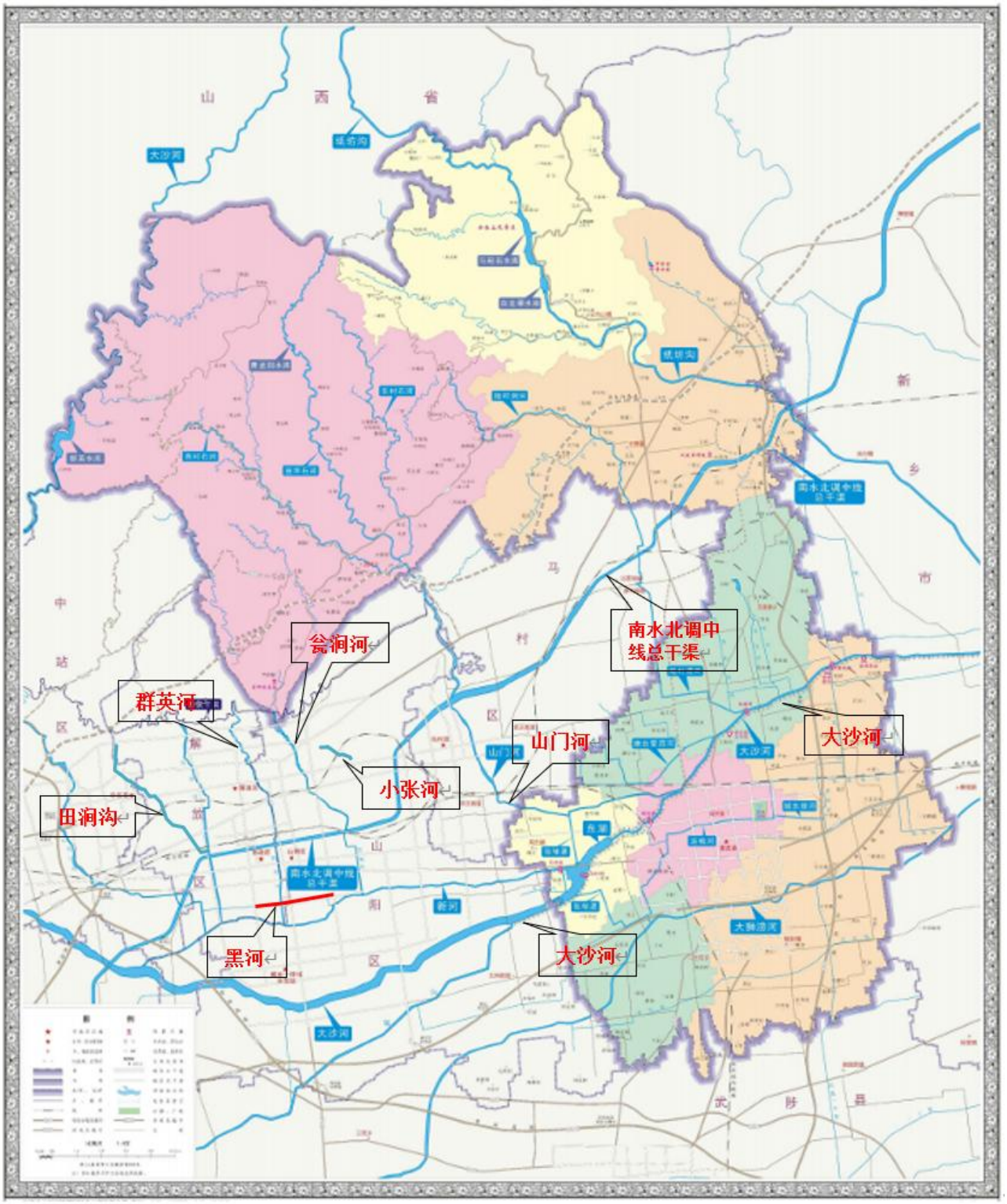


Figure 4.1- 2　Current situation of local water systems

(1)　Dasha River

The Dasha River is the source tributary of the Weihe River in the Haihe River Basin, originating in Duohuo Town, Lingchuan County, Shanxi Province, and entering the communist canal in Xinxiang, with a total length of 115.5km and a drainage area of 2,688km^2, of which the drainage area within the province is 1,972km^2 and that above the outbound cross-section of Jiaozuo is about 1,664km^2. The Dasha River is a mountain torrent river, and its northern part is a piedmont belted hilly area, while the southern part is a shallow mountain plain transition zone. Its left bank is used for drainage of flood water in the Taihang Mountains and right bank is used for

flood in the plain north of the Qin River.

(2) Shanmen River

The Shanmen River is a first-class tributary on the left bank of the Dasha River, which originates from Zhenghe Mountain in Lingchuan County, Shanxi Province, with three upstream tributaries of the Dadong River, the Tianping River and the Xicun River converging in Xiaodong Village, going south out of the mountain and flowing to the Dasha River in the south of Xinxiang-Jinan Highway. The part of the Shanmen River above Xunfan Village, Macun District is located in a hilly area, with a drainage area of 119km^2, the main channel is 28.5km long, and the average gradient is 22.5%. The Shanmen River intersects with the main canal of the Middle Route of the South-to-North Water Transfer Project in the northeast of Baizhuang Village, Daiwang Township, with a catchment area of 139.8km^2 above the cross section, the main channel is 33.5km long, and the average gradient is 19.1‰. The topography of the watershed is high in the northwest and low in the southeast, inclining from northwest to southeast, with an elevation of 107-1,200m.

(3) Qunying River

The Qunying River, also known as the Yan River, is a tributary of the Xinhe River and a secondary tributary of the Dasha River, originated in the northern mountainous area, with a total drainage area of 43.8km^2. The river flows southward from the mountain pass along the west side of Tanan Road to join the Xinhe River near the license plate factory in Jiaozuo City, and the length of the river is about 9.0km after the mountain pass. The river reach from the mountain pass to Heping Street is a gully by strong erosion, in which the river reach from People's Park to Heping Street was comprehensively treated, with a compound cross-section, a river width of 30-40m, a depth of 4-5m, and concrete retaining walls on both banks. The river reach after Heping Street crosses the old city, with a regular river cross-section, in which the river reach from Xin'an Road to Longyuan Road has been treated in recent years, with a compound cross-section, a river width of 18~23m, a depth of 3~4m, and concrete retaining walls on both banks.

(4) Wengjian River

The Wengjian River is a tributary of the Xinhe River and a secondary tributary of the Dasha River, originating in the northern mountainous rarea, with a main stream length of 19.6 km and a total drainage area of 42.8 km^2. It runs from north to south and enters the hills via the path from Aiqu Village and Beiwa Village of Xicun Township to Danyangyu Village, crosses the eastern part of the urban district of Shanyang District and flows southward into the Xinhe River in Zhangjiantun Village, with a river width of 30-75m and an average gradient of 2% in the main stream.

(5) Tianjian Ditch

Tianjian Ditch is a tributary on the right bank of the Puji River, which originates in the mountainous area north of Yingshi Road in Jiaozuo City, crosses the Xinxiang-Yueshan Railway from north to south and flows into the Puji River on the north side of Zhannan Road. The main stream of Tianjian Ditch is 9.0km long, with a drainage area of 14.4km^2 and an average gradient of 0.0235. The river is a seasonal river, and its inflow is mainly from rainfall runoff during the flood season.

(6) Heihe River

The Heihe River is located on the north side of Longyuan Road. At present, the river starts from Minzhu Road and ends at Shanyang Road, with a total length of about 3.2km. The river mainly passes through the Qunying River and Shanyang Road drainage pipes and finally flows into Xinyang in sections. At present, the Heihe River has been treated for black and odorous water body. Then, the river was constructed into a trapezoidal cross-section, with ecological slope

protection. The river is 2-3m wide and 1.5m deep at normal water level. Its south is a road and north is mainly communities and green belts. The river was constructed with an ecological wetland, originally planted with lotus and dwarf lilyturf. In case of rainstorms, the water level of the river overflows the ground, and the ecological wetland is destroyed by rush of water and forms siltation in the river.

(7) Flood interception ditch of the South-to-North Water Transfer Project

The flood interception ditch on the left bank of the South-to-North Water Transfer Project commenced construction at the end of 2017, and its entire length was completed by the end of 2020. The flood interception ditch is set in the south side of the sidewalk of Zhannan Road and the north edge of the green belt, 100-200m away from the center line of the main canal of the South-to-North Water Transfer Project. The flood interception ditch features an open channel with a trapezoidal cross-section. The flood interception ditch flows into the Baimamen River, the Puji River, the Qunying River, the Wengjian River and the Li River respectively. The flood interception ditch is divided into five sections according to different channels, namely the Puji Road-Baimamen River section, the Nantong Road-Puji River section, the Nantong Road-Qunying River section, the Tanan Road- Wengjian River section and the Wengjian River-Li River section, totaling 9,268m.

4.1.6.2 Groundwater

① Shallow groundwater: There exist 54,814×104m^3/a of shallow groundwater resources in Jiaozuo City. The shallow groundwater is generally located 40m-60m below the surface, and the lithology of the aquifer is composed of a set of coarse and fine sand, sand gravel and muddy loose deposit of diluvial and alluvial genesis. The areas with extremely rich shallow groundwater in Jiaozuo City are mainly located in the alluvial-proluvial fans of the Qin River, the Dan River, the Xishi River and the Shanmen River. The areas with rich shallow groundwater are mainly located in the front margin of piedmont alluvial-proluvial fans and the vast alluvial plains of the Huangqin River. The areas with medium-low water richness are mainly located around Jiegou Township-Liwan Subdistrict, Jiaozuo City-Xiuwu County in the intersection depression of alluvial-proluvial fans and the Huangqin River alluvial plain in the south of Boai County, followed by loess hills and downland in the northwest of Mengzhou City.

② Medium-deep aquifer: The extractable medium-deep groundwater in the city is 64.013 million m^3/a. The buried depth of groundwater is 60m-150m, with a zonal distribution of water content. The areas with rich water are mainly located in the alluvial-proluvial fans of the Qin River, the Dan River, the Shanmen River and Zhifang Ditch and the alluvial-proluvial plains of the Yellow River, where the buried depth of groundwater and the lithology of aquifer vary greatly in different areas, but are generally supplemented by vertical seepage from the shallow water layer. The areas with medium water richness are mainly located in the transition zone of alluvial-proluvial fan and the Yellow River alluvial plains and between proluvial sloping fields and alluvial-proluvial fans. The layer thickness is 11m-26m, mainly thin layer of cobbles and gravels, mostly containing mud. The areas with low water richness are located in the depression in front of the Shanmen River alluvial-proluvial fan, covering a small area, and the aquifer is dominated by silty and silver sand.

③ Karstic groundwater: The deep aquifer in Jiaozuo City is mainly karst groundwater, which belongs to the karst aquifer of the middle Ordovician carbonate fissure, and the annual exploitable karstic water is 233.89 million m^3. It is mainly composed of thick-layer limestone, dolomite limestone and argillaceous limestone, with a thickness of about 350m. The areas with extremely rich karstic groundwater are distributed around Gangzhuang, Jiulishan, Gohanshan and the northern side of the Zhucun Fault. The areas with rich karstic groundwater are located in most of the area south of the Zhaozhuang Fault. The areas with medium-low water richness are located

around Encun Village-Daiwang Township-Wuliyuan Township.

4.1.7 Animal and plant resources

4.1.7.1 Vegetation distribution

Jiaozuo City is rich in plant resources, with more than 1,440 species of higher vascular plants belonging to 159 families and 685 genera, accounting for 50% of the total number of plants in the province. There are plants under second class state protection, including ophioglossum thermale, cercidiphyllum japonicum, sinowilsonia henryi, and taihangia rupestris. The main vegetation is warm temperate broadleaved deciduous forests and mixed broadleaved deciduous forests and evergreen coniferous forests. The original vegetation in the mountains has been destroyed for a long time. Except for small natural forests of white bark pines in the Taihang Mountains area, there are mainly secondary vegetation of broadleaved deciduous forests and mixed coniferous and broadleaved forests or artificial forests. The floral element is dominated by the temperate North China flora, with the main dominant tree species of oak, oriental arborvitae, Chinese pine, cotinus coggygria, carpinus turczaninowii, etc., dominant shrubs of fructus forsythiae, lespedeza bicolor, gleditsia japonica and vitex negundo, and dominant herbs of pennisetum centrasiaticum, eriophorum, oplismenus compositus, themeda japonica, rabdosia rubescens, lilium and tanacetum; the dominant tree species in the plains are Euramerican poplar, populus tomentosa, paulownia, ulmus pumila, styphnolobium japonicum, salix matsudana, ailanthus altissima, etc. The major economic tree species in the city are malus, pyrus, prunus persica, prunus armeniaca, prunus, vitis vinifera, crataegus pinnatifida, diospyros kaki, ziziphus jujuba, juglans regia, zanthoxylum, etc.

There are no endangered or protected species within the project area, and the vegetation within the project area mainly includes common aeschynomene herb, vitex negundo, artemisia capillaris, bermuda grass, etc. Scattered and scattered arbors mainly include oriental arborvitae, actinodaphne, etc. The secondary forest is dominated by oak and miscellaneous trees. In addition, there are artificial protection forests and economic forests dominated by crataegus pinnatifida, toona sinensis, juglans regia, diospyros kaki, etc. The trees with four seasons are mainly poplars and a few populus tomentosa. Other works of the Subproject are mainly located in the urban district and suburbs, mainly with artificial vegetation, including wheat, peanuts and other crops, and there are a large number of poplars, styphnolobium japonicum and populus tomentosa in the site along the river banks.

4.1.7.2 Animal distribution

The wildlife in Jiaozuo City belongs to the warm temperate North China forest fauna of the Palaearctic realm, and is located at the south of the horizon at the junction of the Loess Plateau subregion and the Huanghe-Huaihe Plain subregion. There are 697 species of wild animals in the city, including 34 beasts, 140 birds, 8 amphibian reptiles, 30 mollusks, and 485 insects.

Animals under first class state protection include panthera pardus and moschus berezovskii, and those under second class state protection include macaca mulatta, nemorhaedus and lutra lutra; 25 birds are under national key protection, including 4 species (ciconia ciconia, ciconia nigra, aquila chrysaetos, and haliaeetus leucoryphus) under first class state protection and 21 species under second class state protection. The overall ecological regime of wild animals in the city is as follows: rodents are effectively controlled in the territory under the influence of snakes, falcons and owls; forest pests and diseases are mild and do not become a disaster due to the birds of Galliformes, Columbiformes and Passeriformes and the natural enemies of insects.

The most representative animal species in Jiaozuo City is the Taihang Mountains macaque, which is now the wild macaque in the north most in the world, mainly distributed in Baisong Ridge,

the Xianshin River and the Dan River Canyon in Qinyang, the Qingtian River and Jinjia Ridge in Boai, Ying Temple and Qunying Reservoir in Xiuwu, etc. There are about 12 groups of more than 1,000 macaques, with the main range of activity from Jiulikou in the east (there is a saying that: macaques do not go out of Jiulikou) and the north of Jiyuan in the west, where they enter Shanxi Province, with an east-west width of 15km and north-south length of 20km. There are about three groups of about 260 macaques near Ying Temple in Xiuwu County, including two groups of macaques in Ying Temple region (110 in Ying Temple and 60 in Matou Mountain), and one group of 90 macaques in the suburb of Xiuwu. Their main range of activity is from Xiuwu Forestry in the east to Jiaozuo Forestry in the west, and from Qunying Reservoir in the south to Taihang Mountains in Shanxi in the north. Tthe construction area of the Subproject does not involve their activity areas. In addition, no endangered or protected animals are found within the project area through data collection and field investigation.

4.1.8 Scenic spots and cultural relics conservation

Jiaozuo has an excellent geographical location and thousands of years of history and culture, which have created a variety of unique natural and cultural landscape there. There are six A-class tourist attractions in the city, including three scenic spots of AAAA-class or above. The "Jiaozuo Landscape", which consists of five major scenic spots such as Yuntai Mountain, Qinglong Canyon, the Qingtian River, Shennong Mountain and Fenglin Canyon, and ten major attractions such as Chenjiagou, Jiaying Temple, Jiaozuo Film and Television City, Longyuan Lake Park, Forest Park, Zhu Zaiyu Memorial Hall, Han Yu Cemetery, the Dan River Canyon and Shunjian Lake (Ancient Zhou City), has beautiful natural scenery and unique landscape, as well as a great variety of cultural relics and sites such as Qianfo Pavilion, the site of the Northern Expedition of the Taiping Heavenly Kingdom, the site of Shanyang City in the Han Dynasty, Cisheng Temple, Miaole Temple Pagoda, Shengguo Temple, Ancient Yangchang Mountain Road, Yaowang Temple, and the site of the Prefectural City in the Early Shang Dynasty.

No scenic spots or cultural relic protection sites are found in the construction area of the Subproject and its affected area.

4.2 Socioeconomic baseline

By the end of 2021, Jiaozuo had a land area of 4,071km^2, with per capita disposable income of 36,291 yuan for urban residents and 22,180 yuan for rural residents. The per capita GDP was 60,705 yuan and the per capita GDP index was 3.2%. The gross regional domestic product (GRDP) in the city was 276.11 billion yuan, an increase of 8.0% over the previous year. Specifically, the added value of the primary industry was 14.98 billion yuan, up by 4.2%; the added value of the secondary industry was 148.02 billion yuan, up by 8.7%; and the added value of the tertiary industry was 113.12 billion yuan, up by 7.5%. The three-industry structure changed to 5.4:53.6:41.0 from 5.5:53.9:40.6 in the previous year, and the proportion of tertiary industries increased by 0.4% over the previous year.

The Subproject involves Jiefang District, Shanyang District, Zhongzhan District, Macun District and Xiuwu County in Jiaozuo City. Among them, the expropriation of collective land and cultivated land affects Jiefang District, Zhongzhan District and Shanyang District in Jiaozuo City. In terms of socio-economic development, Xiuwu County has the largest cultivated land among the five districts and counties, followed by Zhongzhan District and Macun District, and Jiefang District and Shanyang District are comparable. The per capita disposable income of urban residents is the highest in Jiefang District and the lowest in Macun District. The per capita disposable income of rural residents is the highest in Shanyang District, followed by Jiefang District and Zhongzhan

District, and the lowest in Macun District. The total fiscal revenue is the highest in Shanyang District, followed by Xiuwu County and Jiefang District, and the lowest in Macun District.

Table 4.2- 1 Summary of key indicators of economic and social development of the subproject area (2021)

Province/City/County	Land Area (km^2)	Per Capita Disposable Income of Urban Residents (yuan)	Per Capita Disposable Income of Rural Residents (yuan)	Per Capita GDP (yuan)	Total Fiscal Revenue (00m yuan)	Per Capita GDP Index
Jiaozuo City	4071	36291	22180	60705	2137	3.2
Jiefang District	67	37267	24530	8400	13.67	4.2
Shanyang District	65.7	37180	24790	78300	15.2	0.8
Zhongzhan District	162	31274	23089	110200	8.86	3.4
Macun District	122	27000	19850	44900	6.5	6.7
Xiuwu County	611	29558	20460	8600	13.85	6.2

Source: Statistical yearbooks or statistical reports on national economic and social development collected by the task force from each district.

4.2.1 Demographic situation

According to the statistical report on national economic and social development of each district, there is a total registered population of 1,076,000 households and 3,521,000 people by the end of 2021, of which 1,775,400 are male, accounting for 50.42%, and 1,745,600 are female, accounting for 49.58%. The male-female ratio is 102:100. The agricultural population is 1,302,000, accounting for 36.98%%, and the non-agricultural population is 2,219,000, accounting for 63.02%. The population density is 865 people/km^2.

There are 90,100 households and 347,400 people registered in Jiefang District, of which 171,100 are male, accounting for 49.27%, and 176,300 are female, accounting for 50.73%. The male-female ratio is 97:100. The agricultural population is 56,100, accounting for 0.2%, and the non-agricultural population is 22,120, accounting for 99.98%. The population density is 4,865 people/km^2.

There are 95,800 households and 303200 people registered in Shanyang District, of which 148,200 are male, accounting for 48.88%, and 155,000 are female, accounting for 51.12%. The male-female ratio is 96:100. The agricultural population is 362,000, accounting for 11.94%, and the non-agricultural population is 267,000, accounting for 88.06%. The population density is 4,615 people/km^2.

There are 31,000 households and 122,000 people registered in Zhongzhan District, of which 54,400 are male, accounting for 50.71%, and 52,900 are female, accounting for 49.29%. The male-female ratio is 103:100. The agricultural population is 23,200, accounting for 21.58%, and the non-agricultural population is 84,100, accounting for 78.42%. The population density is 753 people/km^2.

There are 35,600 households and 120,600 people registered in Macun District, of which 61,600 are male, accounting for 51.1%, and 59,000 are female, accounting for 48.9%. The male-female ratio is 104:100. The agricultural population is 42,600, accounting for 38.14%, and the non-agricultural population is 78,000, accounting for 61.86%. The population density is 1,017

people/km^2.

There are 70,100 households and 248,600 people registered in Xiuwu County, of which 127,700 are male, accounting for 51.36%, and 120,900 are female, accounting for 48.64%. The male-female ratio is 106:100. The agricultural population is 117,200, accounting for 47.14%, and the non-agricultural population is 131,400, accounting for 52.86%. The population density is 407 people/km^2.

Table 4.2- 2 Summary of populations of subproject counties / districts (0,000) (2021)

Demographic Indicators	Jiaozuo City	Jiefang District	Shanyang District	Zhongzhan District	Macun District	Xiuwu County
Total Households at the End of Year (0,000)	107.6	9.01	9.58	3.48	3.56	7.01
Total Population at the End of Year (0,000)	352.1	34.74	30.32	12.2	12.06	24.86
Male Population (0,000)	177.54	17.11	14.82	5.44	6.16	12.77
Female Population (0,000)	174.56	17.63	15.5	5.29	5.9	12.09
Population Density (people/km^2)	865	4865	4615	753.08	1017	407
Rural Population (0,000)	130.2	5.61	36.2	2.32	4.26	11.72
Urban Population (0,000)	221.9	22.12	26.7	8.41	7.8	13.14

Source: population data are obtained from the statistical reports on national economic and social development of each project.

4.2.2 Minority population in the project area

From February 17 to 19 and June 9 to 16 in 2022, the Jiaozuo PMO and the task force conducted special field investigation on the situation of ethnic minorities and a series of public participation activities. The population and ethnic composition in project areas, identification of ethnic minority villages, and whether minority residents live in a compact community, are understood in detail in accordance with the identification criteria established in ADB's *Environmental and Social Framework* ESS3 - Guidelines for Ethnic Minorities.

The areas benefited from the Subproject involve towns/subdistricts and villages along the Dasha River in Jiaozuo City, such as Jiefang District, Shanyang District, Zhongzhan District, Macun District and Xiuwu County. The population of direct benefits along the project route is about 492,000, with 4,405 minority residents.

The ethnic minorities are mainly the Hui nationality (98.9% of the ethnic minorities in the project area), the Mongolian, the Manchu, the Tu nationality, etc. living scattered or together, accounting for 0.89% of the total population. There are no minority population living in a compact community in the project area. The minority population are few and scattered. Most of them live with the Hui, Mongolian, Manchu and Tu nationality in the project area due to marriage and job transfer.

The ethnic minorities in the project implementation area enjoy the same social public service with Han nationality. In terms of social welfare, rights, security, cultural customs and living habits, they are not different from the Han nationality, the mainstream group in the project area.

The ethnic minorities are not the directly affected population, but the indirect beneficiaries of the project construction. The proposed project will have almost no negative impact on the minority population.

Table 4.2-3 Screening form of local ethnic minorities

Project Area	Total population (0,000)	Minority population (people)	Proportion of minority population (%)	Composition of minority population
Jiefang District	34.74	104	0.03	Hui, Mongolian, Manchu and Tu
Shanyang District	30.32	121	0.04	Hui, Mongolian, Manchu and Tu
Zhongzhan District	12.2	61	0.05	Hui, Mongolian, Manchu and Tu
Macun District	12.06	60	0.05	Hui, Mongolian, Manchu and Tu
Xiuwu County	24.86	124	0.05	Hui, Mongolian, Manchu and Tu
Total	114.18	470	0.04	Hui, Mongolian, Manchu and Tu

Source: The population data comes from the statistical reports on national economic and social development in each project area and the data of the Bureau of Religious Affairs.

It was found in the identification and survey of ethnic minorities:

Table 4.2-4 Identification of ethnic minorities (ESS3)

Identification criteria	Yes	No	Remarks
1. Is he or she self-identified as a member of a distinct indigenous cultural group and recognized by others?		X	All the respondents, including the ethnic minorities and Han nationality, believed that local ethnic minorities were not different from the Han nationality and they were completely integrated with the Han nationality.
2. Are they collectively reluctant to leave the geographically different habitats or ancestral territories within the project area and the natural resources of these habitats and territories?		X	
3. They have a customary cultural, economic, social or political system that is different from the mainstream society and culture;		X	
4. They speak a distinct language that is usually different from the official language of the country or region.		X	They do not have their own language or roles. They speak the local dialects and Chinese Mandarin, and are completely integrated with Han nationality.

(1) There are no ethnic minorities triggering the ESS3 criterion within the 5 affected counties and districts.

(2) Within the 5 regions of project construction, there are no ethnic minorities living in a compact community, no traditional territory, no language of ethnic minorities or traditional culture, and no independent ethnic minorities.

Therefore, there is no need to formulate a development plan for the ethnic minorities in the Subproject.

4.3 Ecological environment survey and evaluation

4.3.1 Overview of investigation

4.3.1.1 Scope of investigation

The evaluation unit conducted a comprehensive investigation and field survey on the scope of investigation from June to July 2022. The investigation covers the complete natural ecosystems of the region and focused on the following areas: the directly affected districts, including the areas occupied by the main works, such as the dredging works, embankment works, bank slope protection works, embankment crossing drainage culvert works, embankment top/bank top road works, bridge works, and the temporary occupied areas such as temporary roads and construction camps.

4.3.1.2 Contents of investigation

(1) Natural geographical conditions of the evaluated area, such as the geology, landform, elevation, soil type, etc.

(2) Ecological status of the evaluated area, such as the vegetation type and spatial distribution, species and distribution of the rare animals and plants, and soil erosion intensity.

4.3.1.3 Method of investigation

(1) Investigation of vegetation

The investigation on the characteristics of the vegetation mainly adopts the quadrat method, which is divided into three types: forest land, shrub and grassland. The quadrat area of forest land is 100m^2 (10m×10m), the quadrat area of shrub is 25m^2 (5m×5m), and the quadrat area of grassland is 1m^2 (1m×1m). The types, diameter at breast height, tree height and growth status of arbors in the quadrat are recorded. The composition, types and abundance of the shrubs and herbs are recorded.

(2) Investigation of rare animals and plants

The investigation on the current status of the plant resources adopts the combination of line transect method and quadrat method. The line transect method is to set up a number of general and representative investigation routes in the evaluated area, walk to record the plant species distributed in the routes, collect the specimens and take photos of the unknown plants for identification with reference to various map data such as topographic maps and vegetation distribution. It focuses on investigating the rare and endangered plants and endemic plants, and recording their names, distribution locations (geographical coordinates), population quantity and protection levels; The quadrat method is carried out in combination with the investigation of vegetation quadrat, which is to set the quadrat in the representative areas and conduct a more detailed investigation of the plant communities. The interview method is mainly adopted for the investigation of wildlife.

4.3.2 Investigation and Evaluation of Current Land Ecological Environment

4.3.2.1 Investigation of Current Terrestrial Plants

(1) Quadrat investigation procedure

The quadrat includes three types: arbors, shrubs and grasslands. The specific investigation contents are as follows:

Quadrat of arbors: Within the sample plot of 100m^2, based on the topography of the sample plot, the quadrat of 10m×10m is set in the quadrat according to the plum distribution sampling method to make a statistic of the species and number of arbors in the quadrat. At the same time,

the GPS coordinates are recorded, and the photos of the quadrat and environment are taken.

Quadrat of shrubs: Within the sample plot of 25m^2, based on the topography of the sample plot, the quadrat of 5m×5m is set according to the plum distribution sampling method to make a statistic of the species and number of shrubs in the quadrat. At the same time, the samples are weighed, the GPS coordinates are recorded, and the photos of the quadrat and environment are taken.

Quadrat of grasslands: Within the sample plot of 1m^2, the quadrat of 1m×1m is set according to the plum distribution sampling method to make a statistic of the species and number of herbs in the quadrat, observe the growth of them, and estimate the coverage. At the same time, the GPS coordinates are recorded, and the photos of the quadrat and environment are taken.

(2) Statistical results

A total of 19 quadrats have been set this time. See Table 4.3-1(1) for the summary of the quadrat data. The arbor species along urban rivers in Jiaozuo City are planned and planted by the government. After the field investigation, see Table 4.3-1(2) for the types of arbors on both sides of the river. See the Attached Figure 31 for the locations of the quadrats.

Table 4.3-1 Summary of quadrat information

No.	Longitude and latitude	Type of land	Type of community	Location	Photo	Plant species
Y1	113°19′11.24″E 35°18′20.14″N	Waste grassland	Gaura parviflora douglas grassland	Lower reaches of Jinjiang Industry Stake No. 2+000		Gaura parviflora douglas and Roegneria kamoji
Y2	113°19′44.76″E 35°16′40.87″N	Waste grassland	Artemisia capillaris grassland	Intersection between Weibei Road and Shanmen River		Artemisia capillaris, Bothriochloa ischaemum, Lespedeza potaninii, and Bidens pilosa
Y3	113°21′28.69″E 35°14′3.96″N	Waste grassland	Bothriochloa ischaemum grass	Wulibao Village Stake No. 12+100		Artemisia annua, Roegneria kamoji, Bothriochloa ischaemum, and Scilla scilloides

No.	Longitude and latitude	Type of land	Type of community	Location	Photo	Plant species
Y4	113°19′11.11″E 35°18′20.19″N	Shrubs	Vitex negundo shrubs	Lower reaches of Jinjiang Industry Stake No. 2+000		Vitex negundo
Y5	113°18′49.10″E 35°18′0.51″N	Shrubs	Gleditsia microphylla shrubs	Upper reaches of Jiaozuo Shengmei Calcium Industry Co., Ltd. Stake No. 2+970		Gleditsia microphylla and Vitex negundo
Y6	113°19′44.74″E 35°16′40.5″N	Shrubs	Maclura tricuspidata shrubs	Intersection between Weibei Road and Shanmen River		Maclura tricuspidata
Y7	113°20′47.68″E 35°14′21.98″N	Forest land	Poplars	Intersection between Xinxiang-Yueshan Railway and Shanmen River		Poplars
Y8	113°20′13.88″E 35°14′41.25″N	Forest land	Poplars	Intersection between Jiudai Line and Shanmen River		Poplars
Y9	113°21′28.85″E 35°14′4.07″N	Forest land	Poplars	Wulibao Village Stake No. 12+100		Poplars, Artemisia annua, Roegneria kamoji, Bothriochloa ischaemum, Scilla scilloides, and Toona sinensis

No.	Longitude and latitude	Type of land	Type of community	Location	Photo	Plant species
Y10	113°6′23.4″E 35°12′55.8″N	Waste grassland	Bermuda grass	Lower reaches of Xinyuan Road, Dasha River		Rumex dentatus, Artemisia lavandulaefolia, and Bermuda grass
Y11	113°6′23.4″E 35°12′55.8″N	Shrubs-grasslands	Broussonetia papyrifera shrubs	Lower reaches of Xinyuan Road, Dasha River		Broussonetia papyrifera, Vitex negundo, Conyza canadensis, Artemisia annua, and Gaura parviflora douglas
						Broussonetia papyrifera, Gaura parviflora douglas, Artemisia annua, Roegneria kamoji, Datura innoxia, Althaea rosa, Tamarix chinensis, and Conyza canadensis
Y12	113°7′59.52″E 35°11′36.24″N	Grass	Bothriochloa ischaemum grass	Upper reaches of Fengshou Road		Bothriochloa ischaemum, Potentilla reptans var. Sericophylla, and Kalimeris indica
Y13	113°8′28.68″E 35°11′19.68″N	Forest land	Cotinus coggygria and Sophora japonica forest	Right bank near Xiaoshang Village, Dasha River		Cotinus coggygria and Sophora japonica
Y14	113°21′7.56″E 35°14′4.92″N	Forest land	Poplars	Left bank in the lower reaches of Wulibao Bridge		Poplars, Artemisia annua and Bothriochloa ischaemum

No.	Longitude and latitude	Type of land	Type of community	Location	Photo	Plant species
Y15	113°23′4.2″E 35°14′7.8″N	Waste grassland	Tarragon grass	Left bank of the bridge in the lower reaches of Zhanggongpu		Artemisia annua, Conyza canadensis, and Artemisia carvifolia
Y16	113°13′38.16″E 35°15′44.65″N	Grasslands	Setaria viridis grass	Under the bridge of Yingshi Road, Qunying River		Tribulus terrestris, Setaria viridis, Artemisia lavandulaefolia, Polygonum aviculare, and Artemisia capillaris
Y17	113°15′19.98″E 35°15′17.85″N	Grassland	Roegneria kamoji grass	30m northward under the bridge of Taihang Road, Wengjian River		Artemisia capillaris, Artemisia lavandulaefolia, Oxalis corniculata, Conyza canadensis and Roegneria kamoji
Y18	113°15′23.11″E 35°15′15.83″N	Grassland	Cyperus iria grass	50m sorthward under the bridge of Taihang Road, Wengjian River		Artemisia capillaris, Artemisia lavandulaefolia, Oxalis corniculata, Convolvulus arvensis, Artemisia argyi, Conyza canadensis, and Cyperus iria

Table 4.3-1(2) Survey on arbor species along urban rivers in Jiaozuo City

No.	River Section	Coordinates of the photo	Photo	Tree species
1	Qunying River (Yingshi Road - North Ring Road)	113°13′44.17″E 35°15′34.09″N		Toona sinensis, Pomegranate and Walnut Tree

No.	River Section	Coordinates of the photo	Photo	Tree species
2	North of Taihang Road, Qunying River	113°13′44.17″E 35°15′34.09″N		Broussonetia papyrifera and Toona sinensis
3	Qunying River (Yinghu Road - Longyuan Road)	113°14′59.6″E 35°12′2.96″N		Willow
4	Qunying River (Fengshou Road - Yinghu Road)	113°15′0.75″E 35°12′17.04″N		Poplars
5	Qunying River (Renmin Road - Fengshou Road)	113°15′0.72″E 35°12′27.19″N		Willow

No.	River Section	Coordinates of the photo	Photo	Tree species
6	Qunying River (Industrial Road - Xinxiang-Yueshan Railway)	113°14′50.6″E 35°13′37.62″N		Sycamore and Toona sinensis
7	Wengjian River (Taihang Road - Shanyang Road)	113°15′22.79″E 35°15′16.41″N		Willow, Poplars, Pines, and Sycamore
8	Wengjian River (Yingshi Road - Taihang Road)	113°15′14.38″E 35°15′26.84″N		Toona sinensis and willow
9	Wengjian River (Taihang Road - Shanyang Road)	113°15′49.65″E 35°14′20.6″N		Toona sinensis

No.	River Section	Coordinates of the photo	Photo	Tree species
10	Heihe River	113°14′53.04″E 35°11′53.2″N		Sycamore, Poplars and Toona sinensis

According to the field investigation, the plant types within the construction scope of the river management section this time mainly include the herbs and arbors, and the plant species are all the common and widely distributed species. Most of them are herbs that are mainly distributed within the existing river channel. Arbors are mainly concentrated in the periphery of herbs. The dominant herb species are Artemisia lavandulaefolia, Artemisia capillaris, Conyza canadensis, Roegneria kamoji, Bothriochloa ischaemum, Bermuda grass, etc. The dominant shrub species are Broussonetia papyrifera and Vitex negundo; The dominant arbor species are Willow, Toona sinensis, Sycamore, Poplars, Sophora japonica, etc. In recent years, due to the reclamation activities, there is less and less original meadow vegetation, which is only scatteredly distributed in the field, roadside and ditches, or under the trees in the river beach. The crops in the area include the wheat, corn, soybean and sweet potatoes. No important species or rare and endangered protected plants are found in the engineering area. There is a small vegetation coverage in the river channel.

4.3.2.2 Investigation of Current Terrestrial Animals

According to the field investigation, the ecological environment in the upper reach section of Dasha River in the Subproject is good. According to the news reports, it has been observed and recorded that there are 129 kinds of birds in Dasha River, including 4 kinds of Grade-I national protected animals, namely, Aythya baeri, Mergus squamatus, Ciconia nigra and Emberiza aureola. There are nearly 14 kinds of Grade-II national protected animals such as Falco tinnunculus, Platalea leucorodia, Otus sunia and Bubo bubo. There are more than 50 kinds of national and provincial protected birds and the protected animals with important ecological, scientific and social values protected by the state, among which the species of herons include egret, Ardea cinerea, Bubulcus ibis, Nycticorax nycticorax and Ardeola bacchus.

The terrestrial animals involved in the scope of works in the Subproject such as Shanmen River, Wengjian River and Qunying River include the breeding animals and wild animals. The breeding animals mainly include the sheep, pigs, chickens, ducks and rabbits; Wild animals are rare and the existing species are mainly domesticated livestock and poultry in rural areas. Wild animals mainly include some common hares, snakes, rats, sparrows, magpies and other species widely distributed in this area. The evaluated area is greatly affected by human activities, and there are no residential big animals or rare wild animals.

4.3.3 Investigation and Evaluation of Current Aquatic Ecological Environment

According to the investigation of the current situation, the water quality of Dasha River can meet the Class IV standard in the *Environmental Quality Standard for Surface Water*

(GB3838-2002). The aquatic organisms in the lower reaches of Dasha River are mainly the fishes in the river plain, and the species of aquatic organisms mainly include the carp, crucian carp, silver carp and grass carp. There are no other rare aquatic organisms. The aquatic plants in the river are mainly planted manually, and the main species are reeds, water lilies, etc.

The Shanmen River, Wengjian River, Qunying River and Tianjian Ditch in the Subproject are seasonal rivers. At the same time, Tianjian Ditch and Heihe River are the main drainage channels in the urban area, which only undertake the flood discharge function in the flood season in a year. Xiaozhang River is a tributary of the Li River, which is located in the northeast of Jiaozuo urban area. It is a natural gully developed from the north mountain to the urban area. The river channel is a natural bank slope. Along the bank, it is mainly the residential area and planting belt, and there is no water sources in the upper reaches. According to the field investigation, the aquatic habitat structure of the river channel is simple. The aquatic organisms are mainly the mosquitoes, earthworms and a small amount of weeds. There are no fishes or other rare aquatic organisms.

4.3.4 Current situation of water and soil loss

The hilly area of Jiaozuo City is 1080.5km^2, including 460.5km^2 in Yellow River Basin and 620km^2 in Haihe River Basin. The existing water and soil loss area is 633km^2, including 263.8km^2 in Yellow River Basin, with 67.9km^2 area of intense water and soil loss, 123.42km^2 area of medium water and soil loss, and 72.48km^2 area of light water and soil loss, as well as 369.2km^2 in Haihe River basin, with 54.26km^2 area of intense water and soil loss, 153.74 km^2 area of medium water and soil loss, and 161.2km^2 area of light water and soil loss.

According to the *Water and Soil Conservation Plan of Henan Province (2016-2030)*, the construction area of the Subproject is located in the key control area of water and soil loss at the provincial level. It is mainly the water erosion in the project area, and often occurs in the flood season, especially during the harvesting of summer grain crops and planting of autumn grain crops, as well as the seedling period of grain crops. The project area belongs to the water and soil conservation area in the eastern mountainous hilly areas of Taihang Mountains in China in the national hydraulic erosion zoning, with an allowable soil loss of 200t/km^2.a and a soil erosion modulus of 500t/km^2.a. The corresponding plans for pollution control and water and soil conservation have been formulated in the project. During the construction process, the requirements of the water and soil conservation plan shall be followed to control the water and soil loss, and the vegetation shall be restored in time after the construction.

4.4 Current situation and evaluation of enviromental quality

4.4.1 Current situation of ambient air quality and the evaluation

The evaluation quotes the data of *Jiaozuo Ecological Environment Quality Status Bulletin* published by Jiaozuo Ecology and Environment Bureau in 2021, and the average value of the atmospheric routine monitoring data in 2021 from the monitoring stations of Environmental Protection Bureau and Meteorological Bureau of Xiuwu County to evaluate the current situation of ambient air quality in the region. See Table 4.4-1 for the statistical results of the specific monitoring data.

Table 4.4-1(1) Evaluation of ambient air quality in Jiaozuo City

Year	Pollutants	Evaluation indicator	Evaluation standard μg/m^3	Current concentration μg/m^3	Ratio of concentration to standard concentration %	Excess multiple	Up-to-standard conditions
2021	PM10	Average mass	70	101	1.44	0.44	Out of limit

		concentration					
	PM2.5	Average mass concentration	35	47	1.34	0.34	Out of limit
	SO_2	Average mass concentration	60	10	0.17	/	Up to standard
	NO_2	Average mass concentration	40	26	0.65	/	Up to standard
	O_3	Maximum 8-hour average mass concentration of 90 percentile day	160	183	1.14	0.14	Out of limit
	CO	95 percentile daily average mass concentration	4000	1400	0.35	/	Up to standard

Table 4.4-1(2) Evaluation of ambient air quality in Xiuwu County

Year	Pollutants	Evaluation indicator	Evaluation standard μg/m^3	Current concentration μg/m^3	Ratio of concentration to standard concentration %	Excess multiple	Up-to-standard conditions
2021	PM10	Average mass concentration	70	86	1.23	0.23	Out of limit
	PM2.5	Average mass concentration	35	51	1.46	0.46	Out of limit
	SO_2	Average mass concentration	60	9	0.15	/	Up to standard
	NO_2	Average mass concentration	40	29	0.73	/	Up to standard
	O_3	Maximum 8-hour average mass concentration of 90 percentile day	160	174	1.09	0.09	Out of limit
	CO	95 percentile daily average mass concentration	4000	1400	0.35	/	Up to standard

According to the above statistical data, the SO_2, NO_2 and CO of Jiaozuo City and Xiuwu County in 2021 can meet the Grade-II standard requirements of *Ambient Air Quality Standard* (GB3095-2012). The PM10, PM2.5 and O_3 exceed the standard, and the area where they are located belongs to the substandard area. The reason for exceeding the standard may be due to the heavy wind and sand in the north region in winter and spring, the rapid development of regional industry, energy consumption, rapid growth of motor vehicle consumption, and the impact of waste gas pollutant emission during the heating season.

In view of the phenomenon that the conventional ambient air quality in the area where the project is located exceeds the standard, Jiaozuo Municipal Government actively takes measures to promulgate and implement the *Notice on Printing and Distributing the Work Plan for Air Pollution Prevention and Control in Jiaozuo City in 2021* (JHGJB [2021] No.24), and implement a series of measures to improve the regional ambient air quality. The regional ambient air quality will be further improved.

4.4.2 Current situation of surface water environmental quality and evaluation

4.4.2.1 Environmental quality of surface water in the region

According to the *Letter on Environmental Quality Objectives of Surface Water During the 14th Five-Year Plan Period and 2021* (YHH[2021] No.154), the cross section of Xiuwu Hydrological Station of Jiaozuo City belongs to the Grade IV water body. The section data of Xiuwu

Hydrological Station in the "Monthly Report on Surface Water Responsible Target Section of Jiaozuo City" published by Jiaozuo Ecology and Environment Bureau from January 2021 to December 2021 are adopted for the evaluation. See the table below for the statistics of the monitored water quality.

Table 4.4-2 Summary of surface water monitoring data during January-December 2021

Section	Monitoring month	Chemical oxygen demand (mg/L)	Permanganate index (mg/L)	Ammonia nitrogen (mg/L)	Total phosphorus (mg/L)
Xiuwu Hydrological Station	January 2021	24	/	0.67	0.107
	February 2021	14	/	0.4	0.102
	March 2021	/	4.9	0.68	0.152
	April 2021	/	5.4	0.63	0.157
	May 2021	/	5.5	0.53	0.153
	June 2021	/	6.4	0.48	0.202
	July 2021	/	6.3	0.94	0.283
	August 2021	/	5.8	0.69	0.311
	September 2021	/	5	0.41	0.332
	October 2021	/	4.7	0.44	0.264
	November 2021	/	4.4	0.38	0.209
	December 2021	/	3.9	0.27	0.163
Class IV in the *Environmental Quality Standard for Surface Water* (GB3838-2002)		30	10	1.5	0.3
Whether it meets the standard or not		Up to standard	Up to standard	Up to standard	Up to standard

As can be seen from the above table, except for the total phosphorus exceeding the standards in the cross section of Xiuwu Hydrological Station of Dasha River in August and September 2021, others can meet the Class IV standard in the *Environmental Quality Standard for Surface Water* (GB3838-2002).

4.4.2.2 Supplementary monitoring on the current situation of the surface water environmental quality

(1) Monitoring section and monitoring factors

In order to understand the current situation of surface water environmental quality within the evaluation scope of this project, a total of 5 surface water monitoring sites have been set in Shanmen River, Dasha River and Tianjian Ditch this time. See the table below and Attached Figures 32-33 for the specific monitoring sites and monitoring factors.

Table 4.4-3 Summary of surface water monitoring sites and factors

No.	Monitoring sites	Monitoring factors	Monitoring time
W1	Intersection between Daiwang Road Bridge and Shanmen River	Water volume, water temperature, water depth, flow velocity, water surface width, pH, dissolved oxygen, COD, BOD5, ammonia nitrogen, total phosphorus, total nitrogen, fecal coliform, and fluoride	Monitoring for 3 days and 1 time a day
W2	500m in the lower reaches of the mouth of Jianggou River into Dasha River		
W3	500m in the lower reaches of the total sewage outlet of the sewage treatment plant		
W4	500m in the lower reaches at the end of the Dasha River Restoration section in Xiuwu County		
W5	Place where Tianjian Ditch flows into Puji	pH, COD, BOD5, ammonia nitrogen, total	

No.	Monitoring sites	Monitoring factors	Monitoring time
	River	phosphorus, suspended solid and petroleum	

(2) Monitoring time and frequency

The monitoring sites W1, W3 and W4 for monitoring the current situation of the surface water environmental quality are monitored by Henan Zhengjie Testing Technology Co., Ltd. from June 23 to June 25, 2022. The monitoring location W2 is monitored by Henan Zhengjie Testing Technology Co., Ltd. from June 24 to June 26, 2022, and the monitoring location W5 is monitored by Henan Jingcheng Testing Co., Ltd. from June 24 to June 26, 2022. The monitoring was carried out continuously for 3 days. The sampling was conducted once a day and 2 groups of valid data were reported every day.

(3) Monitoring and analysis methods

See the table below for the specific monitoring and analysis methods of surface water.

Table 4.4-4 Surface water monitoring factors and analysis methods

No.	Item	Monitoring and analysis methods	Method source	Testing limit
1	pH	Water quality - Determination of pH - Electrode method	HJ 1147-2020	/
2	Dissolved oxygen	Water quality - Determination of dissolved oxygen - Electrochemical probe method	HJ 506-2009	/
3	COD	Water quality-Determination of the chemical oxygen demand-Dichromate method	HJ 828-2017	4mg/L
4	BOD5	Water quality - Determination of biochemical oxygen demand after 5 days (BOD5) - Dilution and seeding method	HJ 505-2009	0.5mg/L
5	Ammonia Nitrogen	Water quality - Determination of ammonia nitrogen - Nessler's reagent spectrophotometry	HJ 535-2009	0.025mg/L (as N)
6	TN	Water quality-Determination of total nitrogen-Alkaline potassium persulfate digestion UV spectrophotometric method	HJ 636-2012	0.05mg/L
7	TP	Water quality - Determination of total phosphorus - Ammonium molybdate spectrophotometric method	GB 11893-1989	0.01mg/L
8	Fecal coliform	Water quality - Determination of total coliforms and fecal coliforms - Paper strip method	HJ 755-2015	20MPN/L
9	Fluoride	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.006mg/L

(4) Evaluation standard

The evaluation of surface water quality adopts the limit value of Class IV standard in the *Environmental Quality Standard for Surface Water* (GB3838-2002). See the following table for details.

Table 4.4-5 Surface water evaluation criteria (unit: mg/L)

No.	Evaluation factor	*Environmental Quality Standard for Surface Water* (GB3838-2002) Class IV standard limits
1	pH	6-9
2	Dissolved oxygen	3
3	COD	30
4	BOD5	6
5	Ammonia Nitrogen	1.5
6	TN	1.5
7	TP	0.3
8	Fecal coliform (nr/L)	20000
9	Fluoride	1.5

(5) Evaluation method

According to the monitoring results of current surface water environmental quality, the single standard index method is adopted to evaluate the current situation of surface water environmental quality.

(6) Statistics of monitoring results

See the table below for the monitoring results of current surface water quality status.

Table 4.4-6 Summary of surface water quality monitoring results

Monitoring sites	Monitoring factors	Monitoring scope	Average value	Standard limit	Average value of standard index	Over standard rate (%)	Maximum excess multiple
Intersection between Daiwang Road Bridge and Shanmen River	Flow (m^3/s)	0.0486-0.0503	0.0495	/	/	/	/
	Water temperature (℃)	34.2-35.1	34.6	/	/	/	/
	Water depth/ m	0.25	0.25	/	/	/	/
	Flow velocity (m/s)	0.1295-0.1342	0.132	/	/	/	/
	Water surface width/m	1.5	1.5	/	/	/	/
	pH value (dimensionless)	6.3-6.5	6.4	6-9	0.6	0	0
	Dissolved oxygen	6.37-6.65	6.49	3	/	/	/
	Chemical oxygen demand (mg/L)	22-25	23.33	30	0.78	0	0
	Biochemical oxygen demand (mg/L)	2.5-2.9	2.73	6	0.455	0	0
	Ammonia nitrogen (calculated with N, mg/L)	0.758-0.81	0.79	1.5	0.53	0	0
	Total nitrogen (mg/L)	1.19-1.34	1.25	1.5	0.83	0	0
	Total phosphorus (mg/L)	0.12-0.16	0.14	0.3	0.47	0	0
	Fluoride (mg/L)	1.06-1.22	1.15	1.5	0.77	0	0
	Fecal coliform (nr/L)	1700-2400	2067	20000	0.10	0	0
500m in the lower reaches of the mouth of Jianggou River into Dasha	Flow (m^3/s)	33-34	33.43	/	/	/	/
	Water temperature (℃)	30.1-31.4	30.87	/	/	/	/
	Water depth/ m	0.8	0.8	/	/	/	/
	Flow velocity (m/s)	0.3442-0.3541	0.3483	/	/	/	/
	Water surface width/m	120	120	/	/	/	/
	pH value (dimensionless)	7.2-7.4	7.30	6-9	0.75	0	0
	Dissolved oxygen	5.42-6.31	5.82	3	/	/	/
	Chemical oxygen	23-26	24.67	30	0.82	0	0

Monitoring sites	Monitoring factors	Monitoring scope	Average value	Standard limit	Average value of standard index	Over standard rate (%)	Maximum excess multiple
River	demand (mg/L)						
	Biochemical oxygen demand (mg/L)	2.6-3.1	2.80	6	0.47	0	0
	Ammonia nitrogen (calculated with N, mg/L)	0.377-0.441	0.40	1.5	0.27	0	0
	Total nitrogen (mg/L)	1.2-1.3	1.25	1.5	0.83	0	0
	Total phosphorus (mg/L)	0.1-0.14	0.12	0.3	0.40	0	0
	Fluoride (mg/L)	1.19-1.31	1.24	1.5	0.83	0	0
	Fecal coliform (nr/L)	150-190	170.00	20000	0.01	0	0
500m in the lower reaches of the total sewage outlet of the sewage treatment plant	Flow (m^3/s)	2.35-2.5	2.42	/	/	/	/
	Water temperature (℃)	34.6-36.2	35.50	/	/	/	/
	Water depth/ m	1.5	1.5	/	/	/	/
	Flow velocity (m/s)	0.3667	0.3667	/	/	/	/
	Water surface width/m	4.5	4.5	/	/	/	/
	pH value (dimensionless)	6.9-7.1	7.03	6-9	0.3	0	0
	Dissolved oxygen	5.9-6.47	6.13	3	/	/	/
	Chemical oxygen demand (mg/L)	21-24	22.00	30	0.73	0	0
	Biochemical oxygen demand (mg/L)	2.3-2.6	2.43	6	0.41	0	0
	Ammonia nitrogen (calculated with N, mg/L)	0.969-0.990	0.98	1.5	0.65	0	0
	Total nitrogen (mg/L)	1.25-1.29	1.27	1.5	0.85	0	0
	Total phosphorus (mg/L)	0.19-0.24	0.21	0.3	0.70	0	0
	Fluoride (mg/L)	1.06-1.17	1.13	1.5	0.75	0	0
	Fecal coliform (nr/L)	210-240	226.67	20000	0.01	0	0
500m in the lower reaches at the end of the Dasha River Restoration section in Xiuwu County	Flow (m^3/s)	2.91-3.04	2.97	/	/	/	/
	Water temperature (℃)	33.6-37.1	35.40	/	/	/	/
	Water depth/ m	0.8	0.8	/	/	/	/
	Flow velocity (m/s)	0.5204-0.5431	0.5312	/	/	/	/
	Water surface width/m	7.0	0.7	/	/	/	/
	pH value (dimensionless)	6.9-7.2	7.07	6-9	0.35	0	0
	Dissolved oxygen	4.26-6.51	5.08	3	/	/	/
	Chemical oxygen demand (mg/L)	20-26	23.33	30	0.78	0	0
	Biochemical oxygen demand (mg/L)	2.3-3.2	2.67	6	0.45	0	0
	Ammonia nitrogen (calculated with N, mg/L)	0.121-0.146	0.13	1.5	0.09	0	0
	Total nitrogen (mg/L)	1.12-1.19	1.15	1.5	0.77	0	0
	Total phosphorus (mg/L)	0.15-0.18	0.16	0.3	0.53	0	0
	Fluoride (mg/L)	1.06-1.17	1.11	1.5	0.74	0	0
	Fecal coliform (nr/L)	160-230	193.33	20000	0.01	0	0
Place where Tianjian Ditch flows into Puji River	pH (dimensionless)	7.3-7.36	7.33	6-9	0.22	0	0
	COD(mg/L)	28-29	28.67	30	0.96	0	0
	BOD5(mg/L)	5.4-5.8	5.63	6	0.94	0	0
	Ammonia nitrogen (mg/L)	1.22-1.24	1.23	1.5	0.82	0	0
	Total phosphorus (mg/L)	0.12-0.13	0.13	0.3	0.43	0	0
	Suspended solid (mg/L)	32-39	35.67	/	/	/	/
	Petroleum (mg/L)	0.01	0.01	0.5	0.02	0	0

As can be seen from the above table, the water quality factors of river in the Subproject can meet the requirements of Class IV standard in the *Environmental Quality Standard for Surface Water* (GB3838-2002).

4.4.3 Monitoring and evaluation of current river bottom mud quality status

4.4.3.1 Monitoring sites

The layout of monitoring sites for the investigation and evaluation of bottom mud pollution should reflect the requirements of the spatial distribution characteristics of bottom mud pollutants. In order to understand the current situation of environmental quality of bottom mud within the evaluation scope of this project, 9 monitoring sites for bottom mud have been arranged in Shanmen River, Dasha River, Qunying River and Tianjian Ditch. See the following table and Attached Figures 34-35 for specific monitoring sites.

Table 4.4-7 Summary of bottom mud monitoring sites

No.	Monitoring sites	Monitoring factors	Monitoring frequency
D1	Mountain pass from Shanmen River	pH, Copper, Zinc, Lead, Cadmium, Arsenic, Mercury, Chromium, and Nickel	The monitoring of bottom mud was carried out for 1 day. The sampling was conducted once.
D2	Junction between Shanmen River and Jianshe Road		
D3	Northwest side of Wulibao Village (Shanmen River)		
D4	500m in the lower reaches of the mouth of Jianggou River into Dasha River (consistent with the monitoring site W2 of surface water)		
D5	500m in the lower reaches of the total sewage outlet of the sewage treatment plant of Kangda Environmental Protection Water Co., Ltd. (consistent with the monitoring site W3 of surface water)		
D6	500m in the lower reaches at the end of the Dasha River Restoration section in Xiuwu County (consistent with the monitoring site W4 of surface water)		
D7	Qunying River		
D8	Middle Section of Tianjian Ditch		
D9	Intersection between Tianjian Ditch and Puji River (consistent with the monitoring site W5 of surface water)		

4.4.3.2 Monitoring time and frequency

The monitoring sites D1, D2, D3, D5 and D6 for monitoring the bottom mud are monitored by Henan Zhengjie Testing Technology Co., Ltd. on June 23, 2022. The monitoring sites D4 and D7 are monitored by Henan Zhengjie Testing Technology Co., Ltd. on June 24, 2022, and the monitoring sites D8 and D9 are monitored by Henan Jingcheng Testing Co., Ltd. on June 26, 2022. The monitoring was carried out for 1 day. The sampling was conducted once and 1 group of valid data was reported.

4.4.3.3 Monitoring factors and sampling methods

The monitoring factors of bottom mud are pH, copper, zinc, lead, cadmium, arsenic, mercury, chromium and nickel. See the table below for the testing and analysis methods.

Table 4.4-8 Bottom mud monitoring factors and analysis methods

No.	Monitoring items	Monitoring and analysis methods	Monitoring basis	Testing limit
1	pH	Determination of soil pH value	HJ 962-2018	/
2	Copper	Soil and sediment - Determination of Aqua regia extracts of 12 metal elements - Inductively coupled plasma mass spectrometry	HJ 803-2016	0.5mg/kg
3	Nickel			2mg/kg
4	Cadmium			0.07mg/kg
5	Lead			2mg/kg

No.	Monitoring items	Monitoring and analysis methods	Monitoring basis	Testing limit
6	Chromium			2 mg/kg
7	Zinc			7mg/kg
8	Mercury	Soil quality - Analysis of total mercury, arsenic and lead contents-Atomic fluorescence spectrometry - Part 1: Analysis of total mercury contents in soils	GB/T 22105.1-2008	2.00×10-3mg/kg
9	Arsenic	Soil quality - Analysis of total mercury, arsenic and lead contents-Atomic fluorescence spectrometry - Part 2: Analysis of total arsenic contents in soils	GB/T 22105.2-2008	0.01mg/kg

4.4.3.4 Evaluation standard

The evaluation standard of current situation of the bottom mud adopts the standard in the *Soil Environmental Quality - Risk Control Standard for Soil Contamination of Agricultural Land (Trial) (Gb15618-2018)*. See the table below for the details.

Table 4.4-9 Standards for bottom mud evaluation (unit: mg/kg)

No.	Monitoring factors	Risk screening value (pH>7.5)	Criteria
1	Lead	240	*Soil Environmental Quality - Risk Control Standard for Soil Contamination of Agricultural Land (Trial)* (GB15618-2018)
2	Copper	100	
3	Cadmium	0.8	
4	Chromium	350	
5	Mercury	1.0	
6	Arsenic	20	
7	Zinc	300	
8	Nickel	190	

4.4.3.5 Monitoring results

See the table below for the statistical monitoring results of the current situation of bottom mud.

Table 4.4-10 Summary of monitoring results of bottom mud environment quality (unit: mg/kg)

Monitoring items	pH value	Copper	Zinc	Lead	Cadmium	Arsenic	Mercury	Chromium	Nickel
Mountain pass from Shanmen River	8.35	16.8	41	14	0.13	9.7	0.021	36	18
Junction between Shanmen River and Jianshe Road	8.27	16.1	33	13	0.13	6.22	0.035	32	18
Northwest side of Wulibao Village (Shanmen River)	7.81	25.4	46	22	0.12	6.84	0.276	60	31
500m in the lower reaches of the mouth of Jianggou River into Dasha River	8.55	24	52	20	0.38	13.8	0.019	60	29
500m in the lower reaches of the total sewage outlet of the sewage treatment plant of Kangda Environmental Protection Water Co., Ltd.	8.32	21.6	62	19	0.46	10.1	0.031	49	28
500m in the lower reaches at the end of the Dasha River Restoration section in Xiuwu	8.19	31.5	56	15	0.11	6.82	0.339	75	39

Monitoring items	pH value	Copper	Zinc	Lead	Cadmium	Arsenic	Mercury	Chromium	Nickel
County									
Qunying River	8.39	8.5	17	5	0.1	1.54	0.005	11	15
Middle Section of Tianjian Ditch	7.61	23	97	21.3	0.05	0.89	0.643	73	45
Intersection between Tianjian Ditch and Puji River	8.35	24	106	23.6	0.06	0.91	0.313	77	42

As can be seen from the statistical monitoring results in the above table, the monitoring factors for bottom mud in the river channel within the scope of works meet the requirements of the standard for risk screening value in the *Soil Environmental Quality - Risk Control Standard for Soil Contamination of Agricultural Land (Trial)* (GB15618-2018).

4.4.4 Monitoring and evaluation of current acoustic environment status

4.4.4.1 Monitoring sites

According to the areas and types of works involved in the project, a total of 42 sensitive locations have been selected for monitoring the status of the acoustic environment after a comprehensive consideration of the different types of sensitive locations such as schools, hospitals and villages near the project. According to the *Notice of Jiaozuo Municipal Government Office on Revising and Distributing the Classification Plan of Acoustic Environment Functional Zoning in Jiaozuo City* (JZB[2021) No. 7], the Xinxing Residence Community and Four-Season City of Flower as the monitoring sites are located in Class I acoustic environment functional zone, and implements the Class I standard in the *Environmental Quality Standard for Noise* (GB3096-2008); Other monitoring sites are located in the Class 2 acoustic environment functional areas and are in line with Class 2 Standard of *Environmental Quality Standard for Noise* (GB3096-2008). See the following table and Attached Figures 34 - 35 for specific monitoring sites.

Table 4.4-11 Summary of acoustic environment quality monitoring sites

No.	Position of sampling point	Azimuth	Distance/m	No.	Position of sampling point	Azimuth	Distance/m	Monitoring factors
N1	Xunfan Village	Right bank	198	N22	Family Courtyard of Pharmaceutical Company	Right bank	40	Equivalent sound level dB(A)
N2	Xunfan Primary School	Right bank	290	N23	Yanhe Village	Right bank	20	
N3	Villages on the southeast of Shangma Village	Right bank	380	N24	Taihang Nursing Home of Bus Company	Left bank	43	
N4	East campus of Macun Village Industrial Primary School	Right bank	150	N25	Xinxing Residence Community	Right bank	160	
N5	Liyuan Community	Right bank	125	N26	Four-Season City of Flower	Right bank	26	
N6	Baizhuang Cuiyuan Community	Right bank	30	N27	Jinhua Nanyuan Community of Dongyu Village	Left bank	7	
N7	Affiliated Kindergarten of Macun District Experimental School	Right bank	10	N28	Huiyuan Community	Left bank	6	
N8	Baizhuang Village	Right bank	25	N29	Zhengyun Yuecheng Community	Right bank	115	

No.	Position of sampling point	Azimuth	Distance/m	No.	Position of sampling point	Azimuth	Distance/m	Monitoring factors
N9	Villages on the southeast of Baizhuang Village	Right bank	130	N30	Xiaobai Village	/	5	
N10	Daiwang Village	Right bank	15	N31	Wangchu Town Xinzhuang Primary School	Left bank	120	
N11	Xiaozhuang Village	Right bank	210	N32	Branch of Jiaozuo No. 5 People's Hospital	Left bank	166	
N12	Wulibao Village	Right bank	100	N33	Jiaozuo Shanyang Hospital	Left bank	234	
N13	Xiaoshang Village	Left bank	15	N34	Enzhou Garden	Left bank	21	
N14	Lucun Village	Left bank	15	N35	Xinli Village	Right bank	10	
N15	Qintun Village	Left bank	63	N36	Tianjian Village	Left bank	20	
N16	Tiejiangzhuang Village	Right bank	24	N37	Xiaozhuang Village	Left bank	50	
N17	Madao River	Left bank	300	N38	Xintazhang Village	Left bank	12	
N18	Daditun Village	Right bank	230	N39	Hengyu Community	Left bank	33	
N19	Residents' committee of Qunying Xincun Community	Left bank	22	N40	Yuanlin Community	Left bank	35	
N20	China Life Insurance	Right bank	15	N41	Zhengda Garden Comminuty	Left bank	10	
N21	Jiaozuo Disabled Person Employment Service Center	Right bank	15	N42	Lifeng Village	Left bank	10	

4.4.4.2 Monitoring results

The acoustic environment quality on the monitoring sites N1 - N34 were monitored by Henan Zhengjie Testing Technology Co., Ltd. from June 23 to June 24, 2022, and the acoustic environment quality on the monitoring sites N35- N42 were monitored by Henan Jingcheng Testing Co., Ltd. from June 24 to June 25, 2022 for 2 consecutive days. The monitoring results statistics of the noise environment quality status once at day and night are shown in the following table.

Table 4.4-12 Monitoring results of acoustic environment quality

No.	Name of monitoring site	Monitoring value [dB(A)]				*Environmental Quality Standards for Noise* (GB3096-2008)		Up to standard/Out of limits
		The first day		The second day				
		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	
N1	Xunfan Village	48	42	47	43	60	50	Up to standard
N2	Xunfan Primary School	48	43	50	43			Up to standard
N3	Villages on the southeast of Shangma Village	54	45	53	45			Up to standard
N4	East campus of Macun Village Industrial	54	44	52	44			Up to standard

No.	Name of monitoring site	Monitoring value [dB(A)]				*Environmental Quality Standards for Noise* (GB3096-2008)		Up to standard/Out of limits
		The first day		The second day				
		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	
	Primary School							
N5	Liyuan Community	51	42	53	42			Up to standard
N6	Baizhuang Cuiyuan Community	52	46	52	44			Up to standard
N7	Affiliated Kindergarten of Macun District Experimental School	51	45	53	44			Up to standard
N8	Baizhuang Village	50	44	49	43			Up to standard
N9	Villages on the southeast of Baizhuang Village	49	43	48	44			Up to standard
N10	Daiwang Village	47	43	48	42			Up to standard
N11	Xiaozhuang Village	46	42	46	41			Up to standard
N12	Wulibao Village	47	44	46	44			Up to standard
N13	Xiaoshang Village	49	43	48	43			Up to standard
N14	Lucun Village	50	44	49	43			Up to standard
N15	Qintun Village	51	44	50	44			Up to standard
N16	Tiejiangzhuang Village	49	43	50	44			Up to standard
N17	Madao River	45	38	46	38			Up to standard
N18	Daditun Village	45	40	46	39			Up to standard
N19	Residents' committee of Qunying Xincun Community	51	45	52	44			Up to standard
N20	China Life Insurance	53	45	53	43			Up to standard
N21	Jiaozuo Disabled Person Employment Service Center	52	45	52	43			Up to standard
N22	Family Courtyard of Pharmaceutical Company	50	46	55	47			Up to standard
N23	Yanhe Village	51	44	52	44			Up to standard
N24	Taihang Nursing Home of Bus Company	53	42	52	43			Up to standard
N25	Xinxing Residence Community	53	44	52	44	55	45	Up to standard
N26	Four-Season City of Flower	52	43	52	44			Up to standard
N27	Jinhua Nanyuan Community of Dongyu Village	51	44	52	44			Up to standard
N28	Huiyuan Community	52	45	52	41			Up to standard
N29	Zhengyun Yuecheng Community	51	45	52	42			Up to standard
N30	Xiaobai Village	51	44	53	43			Up to standard
N31	Wangchu Town Xinzhuang Primary School	53	46	53	46	60	50	Up to standard
N32	Branch of Jiaozuo No. 5 People's Hospital	56	46	54	46			Up to standard
N33	Jiaozuo Shanyang Hospital	50	45	53	47			Up to standard
N34	Enzhou Garden	51	45	53	46			Up to standard
N35	Xinli Village	53	44	53	44			Up to standard
N36	Tianjian Village	52	43	52	43			Up to standard
N37	Xiaozhuang Village	51	42	51	42			Up to standard

No.	Name of monitoring site	Monitoring value [dB(A)]				*Environmental Quality Standards for Noise* (GB3096-2008)		Up to standard/Out of limits
		The first day		The second day				
		Daytime	Nighttime	Daytime	Nighttime	Daytime	Nighttime	
N38	Xintazhang Village	51	42	52	43			Up to standard
N39	Hengyu Community	52	43	52	43			Up to standard
N40	Yuanlin Community	52	44	52	43			Up to standard
N41	Zhengda Garden Comminuty	52	43	52	43			Up to standard
N42	Lifeng Village	53	44	53	44			Up to standard

From the above table, it can be seen that the daytime and nighttime monitoring values of noise at each environmentally sensitive point during the monitoring period can meet the requirements of acoustic environment functional zoning in Jiaozuo City.

Considering that the above sites involve schools and hospitals that are more sensitively affected by noise, the acoustic environment quality of Xunfan Primary School, East campus of Macun Village Industrial Primary School, Affiliated Kindergarten of Macun District Experimental School, Taihang Nursing Home of Bus Company, Wangchu Town Xinzhuang Primary School, Branch of Jiaozuo No. 5 People's Hospital and Jiaozuo Shanyang Hospital is analyzed with reference to Class 1 Standard (daytime 55 dB, nighttime 45 dB) of *Environmental Quality Standards for Noise* (GB3096-2008). Among which, the Wangchu Town Xinzhuang Primary School, Branch of Jiaozuo No. 5 People's Hospital and Jiaozuo Shanyang Hospital are near the road, so the noise is slightly out of limits.

4.4.5 Monitoring and evaluation of current soil environment quality status

4.4.5.1 Monitoring sites

In order to understand the soil environment quality status in the evaluated area, three surface monitoring points and four surface monitoring points are set up respectively within and outside the project area according to the subproject involved and the project type. The layout of monitoring sites for soil status is shown in the following table and Attached Figure 32.

Table 4.4-13 Soil environment monitoring sites

No.	Position of sampling point	Location	Monitoring factors
T1	Original concave channel straight position of the mountain outlet of Shanmen River	Within the site	Lead, Copper, Cadmium, Total Chromium, Mercury, Arsenic, Nickel, Zinc; pH, cation exchange capacity, redox potential, saturated hydraulic conductivity, soil bulk density, porosity, total water soluble salt
T2	Agricultural land of 800m away from the west side of Beikongzhuang Village	Outside the site	
T3	Agricultural land of 200m away from the north side of Wulibao Village		
T4	Bank slope of Dasha River on the southwest of Dajiazuo Village	Within the site	
T5	Agricultural land of 200m away from the south of Tiejiangzhuang Village	Outside the site	
T6	Agricultural land of 100m away from the north of Xichangwei Village		
T7	Surface soil on the north side of Daditun Village and bank slope of Dasha River	Within the site	

4.4.5.2 Monitoring factors and frequency

The soil monitoring factors in the Subproject include lead, copper, cadmium, total chromium, mercury, arsenic, nickel, zinc and total water-soluble salt, and the physical and chemical properties of the soil are investigated. A representative surface mixed soil sample (0-20cm) is taken from each monitoring site and a set of effective data is reported. The *Technical Specifications for Soil Environmental Monitoring* (HJ/T166-2004) and other relevant requirements are followed when sampling.

4.4.5.3 Soil Environmental Monitoring and Analysis Methods

See the following table for the soil environmental monitoring and analysis methods.

Table 4.4-14 Analysis methods for soil environment monitoring factors

No.	Test items	Testing and analysis methods	Test basis	Instrumentation	Testing limit
1	Mercury	Soil quality - Analysis of total mercury, arsenic and lead contents-Atomic fluorescence spectrometry - Part 1: Determination of total mercury in soil --- Atomic fluorescence method	GB/T 22105.1-2008	Atomic fluorescence spectrophotometer/AFS-10B/Z1-564	0.002mg/kg
2	Arsenic	Soil quality - Analysis of total mercury, arsenic and lead contents-Atomic fluorescence spectrometry - Part 2: Determination of total arsenic in soil --- Atomic fluorescence method	GB/T 22105.2-2008	Atomic fluorescence spectrophotometer/AFS-10B/Z1-563	0.01mg/kg
3	Chromium	Soil and sediment - Determination of Aqua regia extracts of 12 metal elements - Inductively coupled plasma mass spectrometry	HJ 803-2016	Inductively coupled plasma-mass spectrometer/ICAP-RQ/Z1-001	2 mg/kg
4	Lead				2 mg/kg
5	Cadmium				0.07mg/kg
6	Copper				0.5mg/kg
7	Nickel				2mg/kg
8	Zinc				7mg/kg
9	Total water soluble salt	Analysis of water soluble salt in forest soil (3.1 Determination of total salt --- Mass Method)	LY/T 1251-1999	Electronic scale/ATX224 /Z2-420	/
10	pH	Soil --- Determination of pH value --- Potential Method	HJ 962-2018	Bench PH meter /RPB1000 type /Z2-019	/
11	Cation exchange capacity	Soil --- Determination of cation exchange capacity --- cobalt hexaammonide trichloride extraction -	HJ 889-2017	Ultraviolet-visible spectrophotometer/ T6 New Century/Z2-015	0.8cmol+/kg

No.	Test items	Testing and analysis methods	Test basis	Instrumentation	Testing limit
		spectrophotometric method			
12	Redox potential	Soil --- Determination of redox potential --- Potential Method	HJ 746-2015	Portable pH/ORP meter /RPB100 type /X2-407	/

4.4.5.4 Monitoring time

The soil quality monitoring sites T1, T2, T3 and T7 were monitored by Henan Zhengjie Testing Technology Co., Ltd. on June 23, 2022, and the monitoring sites T4, T5 and T6 were monitored by Zhengjie Testing Technology Co., Ltd. on June 24, 2022.

4.4.5.5 Evaluation standard

The evaluation standards for soil environment quality shall be in line with the limits of relevant pollutant standard for *Soil Environmental Quality - Risk Control Standard for Soil Contamination of Agricultural Land (Trial)* (GB15618-2018). The limits of the soil environment quality standard are shown in the following table.

Table 4.4-15 Screening values of farmland soil pollution risks (basic items) (unit: mg/kg)

No.	Pollutant items		Risk screening value (pH>7.5)
1	Cadmium	Other	0.6
2	Mercury	Other	3.4
3	Arsenic	Other	25
4	Lead	Other	170
5	Chromium	Other	250
6	Copper	Other	100
7	Nickel	/	190
8	Zinc	/	300

4.4.5.6 Monitoring results

The monitoring results of soil status are shown in Table 4.4-16.

Table 4.4-16 Summary of soil condition monitoring results (except pH) (unit: mg/kg)

Testing Item	Soil Contamination Risk Screening Values of Agricultural Land	Original concave channel straight position of the mountain outlet of Shanmen River	Agricultural land of 800m away from the west side of Beikongzhuang Village	Agricultural land of 200m away from the north side of Wulibao Village	Bank slope of Dasha River on the southwest of Dajiazuo Village	Agricultural land of 200m away from the south of Tiejiangzhuang Village	Agricultural land of 100m away from the north of Xichangwei Village	Surface soil on the north side of Daditun Village and bank slope of Dasha River
pH (dimensionl	/	8.36	8.07	8.23	8.45	7.95	7.94	8.49

ess)								
Cadmium	0.6	0.16	0.30	0.30	0.12	0.29	0.28	0.21
Mercury	3.4	0.015	0.057	0.052	0.010	0.012	0.012	0.029
Arsenic	25	8.80	7.38	7.38	13.9	10.3	7.60	7.07
Lead	170	17	21	20	15	21	19	16
Chromium	250	49	39	48	45	48	42	42
Copper	100	21.6	19.0	22.5	21.3	21.8	21.8	17.9
Nickel	190	27	22	27	26	26	20	20
Zinc	300	42	39	57	41	49	58	39
Up to standard	/	Up to standard	Up to standard	Up to standard	Up to standard	Up to standard	Up to standard	Up to standard

Table 4.4-17 Summary of survey results on physical and chemical properties of soil

Monitoring sites		Original concave channel straight position of the mountain outlet of Shanmen River	Agricultural land of 800m away from the west side of Beikongzhuang Village	Agricultural land of 200m away from the north side of Wulibao Village	Bank slope of Dasha River on the southwest of Dajiazuo Village	Agricultural land of 200m away from the south of Tiejiangzhuang Village	Agricultural land of 100m away from the north of Xichangwei Village	Surface soil on the north side of Daditun Village and bank slope of Dasha River
Time		2022.06.23	2022.06.23	2022.06.23	2022.06.24	2022.06.24	2022.06.24	2022.06.23
Longitude and latitude		113.31260741E 35.31735320N	113.35432649E 35.25446394N	113.36520016E 35.23102453N	113.13429952E 35.19579133N	113.30065012E 35.16931804N	113.37630987E 35.19807084N	113.44552190E 35.26171188N
Level		0--0.2m	0--0.2m	0--0.2m	0--0.2m	0--0.2m	0--0.2m	0--0.2m
On-site record	Color	Brown	Brown	Brown	Brown	Dark brown	Dark brown	Brown
	Structure	Lump	Lump	Lump	Lump	Lump	Lump	Lump
	Texture	Light loam	Light loam	Light loam	Sandy soil	Floury soil	Light loam	Light loam
	Gravel content (%)	4%	1%	1%	5%	2%	2%	2%
	Other foreign matter	Stone	None	None	None	None	None	None
Laboratory measurement	pH value	8.36	8.07	8.23	8.45	7.95	7.94	8.49
	Cation exchange capacity (cmol/kg)	15.5	14.2	17.7	12.6	20.4	15.6	15.3
	Redox potential (mV)	256	296	304	278	296	309	289
	Saturated hydraulic conductivity/ (cm/s)	1.18×102	1.34×102	1.27×102	1.19×102	1.27×102	1.15×102	1.24×102
	Soil bulk density/	1.35	1.21	1.34	1.11	1.18	1.25	1.28

	(g/cm^3)							
	Total water soluble salt/(mg/kg)	1.10	0.68	0.82	0.73	3.79	3.54	0.81
	Porosity	57.5	52.5	58.2	46.8	52.2	50.8	55.4

From the above table, it can be seen that the monitoring results of soil monitoring factors at each monitoring sites meet the *Soil Environmental Quality - Risk Control Standard for Soil Contamination of Agricultural Land (Trial)*.

4.4.6 Monitoring and evaluation of current groundwater quality status

4.4.6.1 Layout of water quality monitoring sites

In order to understand the groundwater environment quality status within the evaluation scope of this Subproject, a total of 8 groundwater quality monitoring points and 16 groundwater level monitoring points are laid out, and the specific monitoring sites are shown in the following table and Attached Figures 32-33.

Table 4.4-18 Summary of groundwater monitoring sites

No.	Monitoring point		Monitoring items		Monitoring time
	Name	Location			
S1	Liugujian Village	Phreatic aquifer	Water quality	Water level	Monitoring for 1 day
S2	Xihanwang Village		Water quality	Water level	
S3	Wulibao Village		Water quality	Water level	
S4	Shandi Village		/	Water level	
S5	Jinzuo Village		/	Water level	
S6	Dongkongzhuang Village		/	Water level	
S7	Yanhe Village		Water quality	Water level	
S8	Jiaozuo Coal Senior Technical School		Water quality	Water level	
S9	Qiuhuazhuang Village		Water quality	Water level	
S10	Xinzhuang Village		Water quality	Water level	
S11	Encun Village		Water quality	Water level	
S12	Qunying Xincun Village		/	Water level	
S13	Wukong Bridge Park		/	Water level	
S14	Dongyu Village		/	Water level	
S15	Fengzhuang Village		/	Water level	
S16	Xiaobai Village		/	Water level	

4.4.6.2 Monitoring time and frequency

The groundwater status monitoring sites were monitored by Henan Zhengjie Testing Technology Co., Ltd. from June 23 to June 24, 2022 for one day. Every day, sampling was conducted once, a set of effective data was reported, and the well depth and water temperature were monitored and recorded.

4.4.6.3 Monitoring factors and analysis methods

The monitoring factors of groundwater quality status are selected as follows: K+, Na+, Ca2+, Mg2+, CO32-, HCO3-, SO_4^{2-}, Cl^-, pH, ammonia nitrogen, nitrate, nitrite, volatile phenols, cyanide,

arsenic, mercury, chromium (hexavalent), total hardness, lead, fluoride, cadmium, iron, manganese, total dissolved solids, oxygen consumption, sulfate, chloride, total coliform, total bacterial count and petroleum, while the well depth, water level and water temperature are monitored.

The groundwater monitoring factors and analysis methods are shown in the following table.

Table 4.4-19 Summary of groundwater quality monitoring analysis methods

No.	Monitoring factors	Test method	Test basis	Testing limit
1	pH value	Water Quality - Determination of pH value - Electrode Method	HJ 1147-2020	/
2	Oxygen consumption (permanganate index)	Standard test methods for drinking water - Comprehensive index of organic matter (1.1 oxygen consumption-acid potassium permanganate titration method)	GB/T 5750.7-2006	0.05mg/L
3	Ammonia nitrogen (calculated by N)	Water quality - Determination of ammonia nitrogen - Nessler's reagent spectrophotometry	HJ 535-2009	0.025 mg/L (calculated by N)
4	Nitrate (calculated by N)	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.016mg/L
5	Nitrite (calculated by N)	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.016mg/L
6	Sulfate	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.018mg/L
7	Chloride	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.007mg/L
8	Fluoride	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.006mg/L
9	Volatile phenols (calculated with phenols)	4-amino antipyrine spectrophotometry	HJ503-2009	0.0003
10	HCO	Alkalinity - Acid-base indicator titration	*Water and Waste Water Monitoring and Analysis Method* (enlarged edition for the fourth edition) SEPA (2002)	/
11	Carbonate radical			/
12	Chloride ion	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.007mg/L
13	Sulphate Ion	Water quality - Determination of Inorganic Anions (F^-, Cl^-, NO_2^-, Br-, NO_3^-, PO_4^{3-}, SO_3^{2-} and SO_4^{2-}) - Ion Chromatography	HJ 84-2016	0.018mg/L
14	Magnesium	Water quality - Determination of 65 elements -- Inductively	HJ 700-2014	1.94μg/L

No.	Monitoring factors	Test method	Test basis	Testing limit
		coupled plasma-mass spectrometry		
15	Calcium	Water quality - Determination of 65 elements -- Inductively coupled plasma-mass spectrometry	HJ 700-2014	6.61μg/L
16	Total hardness	Water quality - Determination of total calcium and magnesium - EDTA titrimetric method	GB 7477-1987	0.05mmol/L
17	Total cyanide	Standard test methods for drinking water - Inorganic nonmetallic index - Isonicotinic acid-pyrazoldone spectrophotometric method	4.1 in GB/T 5750.5-2006	2.00×10-3mg/L
18	Chromium (hexavalent)	Standard test methods for drinking water - Metal index - Dibenzoyl dihydrazine spectrophotometric method	10.1 in GB/T 5750.6-2006	4.00×10-3mg/L
19	Total dissolved solids	Standard test methods for drinking water - Organoleptic and physical parameters -Weighing method	8.1 in GB/T 5750.4-2006	/
20	Total number of colonies	Water quality - Determination of total bacterial count - Plate counting method	HJ 1000-2018	1CFU/ml
21	Cadmium	Water quality - Determination of 65 elements -- Inductively coupled plasma-mass spectrometry	HJ 700-2014	0.05μg/L
22	Total coliform group	Water quality - Determination of total coliforms and fecal coliforms - Paper strip method	HJ 755-2015	20 MPN/L
23	Iron	Water quality - Determination of 65 elements -- Inductively coupled plasma-mass spectrometry	HJ 700-2014	0.82μg/L
24	Manganese	Water quality - Determination of 65 elements -- Inductively coupled plasma-mass spectrometry	HJ 700-2014	0.12μg/L
25	Potassium	Water quality - Determination of 65 elements -- Inductively coupled plasma-mass spectrometry	HJ 700-2014	4.5μg/L
26	Sodium	Water quality - Determination of 65 elements -- Inductively coupled plasma-mass spectrometry	HJ 700-2014	6.36μg/L
27	Mercury	Water quality - Determination of mercury, arsenic, selenium, bismuth and antimony - Atomic fluorescence method	HJ 694-2014	0.04μg/L
28	Arsenic	Water quality - Determination of mercury, arsenic, selenium, bismuth and antimony - Atomic fluorescence method	HJ 694-2014	0.3μg/L
29	Lead	Water quality - Determination of 65 elements -- Inductively	HJ 700-2014	0.09μg/L

No.	Monitoring factors	Test method	Test basis	Testing limit
		coupled plasma-mass spectrometry		
30	Petroleum	Water quality - Determination of petroleum - Ultraviolet spectrophotometry (Trial)	HJ 970-2018	0.01mg/L

4.4.6.4 Evaluation standard and methods

The groundwater quality status is evaluated according to the Class III standard of *Standard for Groundwater Quality* (GB/T14848-2017). For detailed standards, see the following table.

Table 4.4-20 Groundwater quality evaluation criteria

No.	Monitoring items	Unit	Standard value	Standard source
1	pH	/	6.5-8.5	(GB/T14848-2017) Class III standard
2	Total hardness	mg/L	≤450	
3	Total dissolved solids	mg/L	≤1000	
4	Sulfate	mg/L	≤250	
5	Chloride	mg/L	≤250	
6	Iron	mg/L	≤0.3	
7	Oxygen consumption	mg/L	≤3.0	
8	Ammonia Nitrogen	mg/L	≤0.5	
9	Cyanide	mg/L	≤0.05	
10	Fluoride	mg/L	≤1.0	
11	Mercury	mg/L	≤0.001	
12	Arsenic	mg/L	≤0.01	
13	Cadmium	mg/L	≤0.005	
14	Chromium (hexavalent)	mg/L	≤0.05	
15	Lead	mg/L	≤0.01	
16	Volatile phenolics	mg/L	≤0.002	
17	Nitrate	mg/L	≤20	
18	Nitrite	mg/L	≤1.0	
19	Manganese	mg/L	≤0.10	
20	Total coliform group	(MPNb/100mL or CFUe/100mL)	≤3.0	
21	Total number of colonies	(CFU/mL)	≤100	
22	Potassium Ion	mg/L	/	
23	Sodium Ion	mg/L	200	
24	Calcium Ion	mg/L	/	
25	Magnesium Ion	mg/L	/	
26	Carbonate radical	mg/L	/	
27	HCO	mg/L	/	
28	Chloride ion	mg/L	≤250	
29	Sulphate Ion	mg/L	≤250	
30	Petroleum	mg/L	≤0.05	GB 3838-2002 (Class III standard)

4.4.6.5 Evaluation method

According to the statistical analysis results of groundwater quality status monitoring data, the single factor pollution index method is adopted to evaluate the current groundwater environment quality Designation number of water quality parameter >1, indicating that the water quality parameter exceeds the regulated water quality standard, and it cannot meet the use requirements.

4.4.6.6 Monitoring results statistics

① Monitoring results of water quality

The monitoring results of groundwater quality status are shown in the following table.

Table 4.4-21(1) Statistical results of groundwater quality monitoring

Monitoring factors	Unit	Standard limit	Liugujian Village			Xihanwang Village			Wulibao Village			Yanhe Village		
			Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)
pH value	Dimensionless	6.5-8.5	7.3	0.2	0	7.3	0.2	0	6.8	0.4	0	7.9	0.6	0
Total hardness	mg/L	450	261	0.58	0	288	0.64	0	406	0.902	0	421	0.94	0
Total dissolved solids	mg/L	1000	357	0.357	0	424	0.424	0	474	0.474	0	667	0.67	0
Oxygen consumption	mg/L	3.0	0.87	0.29	0	0.69	0.23	0	0.66	0.22	0	0.78	0.26	0
Carbonas	mg/L	/	0	/	/	0	/	/	0	/	/	0	/	/
Bicarbonate	mg/L	/	236	/	/	267	/	/	318	/	/	277	/	/
Nitrate (calculated by N)	mg/L	20	4.64	0.232	0	2.80	0.14	0	4.33	0.2165	0	4.61	0.23	0
Nitrite (calculated by N)	mg/L	1.0	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Sulfate	mg/L	250	48.2	0.1928	0	50.6	0.2024	0	50.4	0.2016	0	145	0.58	0
Chloride	mg/L	250	6.02	0.02408	0	30.3	0.1212	0	20.0	0.08	0	63.7	0.25	0
Fluoride	mg/L	1.0	0.140	0.14	0	0.295	0.295	0	0.311	0.311	0	0.267	0.27	0
Ammonia Nitrogen	mg/L	0.5	Not detected	/	0	Not detected	/	0	Not detected	/	0	0.035	0.07	0
Volatile phenol	mg/L	0.002	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Cyanide	mg/L	0.05	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Total coliform group	mg/L	3.0	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Total bacterial	mg/L	100	19	0.19	0	31	0.31	0	26	0.26	0	15	0.15	0

count														
Petroleum	mg/L	0.05	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Hexavalent chromium	mg/L	0.05	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Arsenic	mg/L	0.01	4×10-4	0.04	0	5×10-4	0.05	0	5×10-4	0.05	0	5×10-4	0.05	0
Mercury	MPN/100mL	0.001	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Sodium	CFU/mL	200	7.92	0.0396	0	12.6	0.063	0	18.5	0.0925	0	27.2	0.14	0
Magnesium	mg/L	/	19.4	/	/	26.1	/	/	30.5	/	/	33.8	/	/
Calcium	mg/L	/	55.0	/	/	65.3	/	/	67.2	/	/	99.1	/	/
Potassium	mg/L	/	7.11	/	/	1.18	/	/	0.688	/	/	1.30	/	/
Lead	mg/L	0.01	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Cadmium	mg/L	0.005	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Iron	mg/L	0.3	0.0921	0.307	0	0.0926	0.309	0	0.0887	0.296	0	0.114	0.38	0
Manganese	mg/L	0.10	6×10-4	0.006	0	3.4×10-4	0.0034	0	1.11×10-3	0.0111	0	Not detected	/	0
Cl-	mg/L	250	6.02	0.02408	0	30.3	0.1212	0	20.0	0.08	0	63.7	0.25	0
SO_4^{2-}	mg/L	250	48.2	0.1928	0	50.6	0.2024	0	50.4	0.2016	0	145	0.58	0

Table 4.4-21(2) Statistical results of groundwater quality monitoring

Monitoring factors	Unit	Standard limit	Jiaozuo Coal Senior Technical School			Qiuhuazhuang Village			Xinzhuang Village			Encun Village		
			Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)
pH value	Dimensionless	6.5-8.5	7.8	0.53	0	7.8	0.53	0	7.6	0.4	0	7.9	0.6	0
Total hardness	mg/L	450	401	0.89	0	296	0.66	0	408	0.91	0	397	0.88	0
Total dissolved solids	mg/L	1000	927	0.93	0	596	0.60	0	894	0.89	0	870	0.87	0
Oxygen consumption	mg/L	3.0	1.20	0.40	0	0.82	0.27	0	0.91	0.30	0	0.92	0.31	0
Carbon as	mg/L	/	0	/	/	0	/	/	0	/	/	0	/	/
Bicarbonate	mg/L	/	491	/	/	360	/	/	404	/	/	498	/	/
Nitrate	mg/L	20	15.7	0.79	0	0.604	0.03	0	17.9	0.9	0	15.1	0.76	0

Monitoring factors	Unit	Standard limit	Jiaozuo Coal Senior Technical School			Qiuhuazhuang Village			Xinzhuang Village			Encun Village		
			Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)
(calculated by N)														
Nitrite (calculated by N)	mg/L	1.0	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Sulfate	mg/L	250	65.6	0.26	0	146	0.58	0	122	0.49	0.49	61.2	0.24	0
Chloride	mg/L	250	48.9	0.20	0	51.2	0.20	0	87.5	0.35	0.35	46.9	0.19	0
Fluoride	mg/L	1.0	0.103	0.10	0	0.608	0.61	0	0.364	0.36	0.36	0.110	0.11	0
Ammonia Nitrogen	mg/L	0.5	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Volatile phenol	mg/L	0.002	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Cyanide	mg/L	0.05	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Total coliform group	mg/L	3.0	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Total bacterial count	mg/L	100	19	0.19	0	19	0.19	0	21	0.21	0	18	0.18	0
Petroleum	mg/L	0.05	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Hexavalent chromium	mg/L	0.05	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Arsenic	mg/L	0.01	2.5×10-3	0.25	0	1.6×10-3	0.16	0	5×10-4	0.05	0	4×10-4	0.04	0
Mercury	MPN/100 mL	0.001	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Sodium	CFU/mL	200	50.7	0.25	0	64.2	0.32	0	50.4	0.25	0	53.7	0.27	0
Magnesium	mg/L	/	51.8	/	/	30.6	/	/	52.4	/	/	54.9	/	/
Calcium	mg/L	/	150	/	/	27.8	/	/	123	/	/	159	/	/
Potassium	mg/L	/	0.832	/	/	0.278	/	/	0.842	/	/	0.584	/	/
Lead	mg/L	0.01	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Cadmium	mg/L	0.005	Not detected	/	0	Not detected	/	0	Not detected	/	0	Not detected	/	0
Iron	mg/L	0.3	0.119	0.40	0	0.230	0.77	0	0.0801	0.27	0	0.105	0.35	0
Manganese	mg/L	0.10	7.9×10-4	0.0079	0	5.60×10-3	0.06	0	Not detected	/	0	4.1×10-4	0.0041	0

Monitoring factors	Unit	Standard limit	Jiaozuo Coal Senior Technical School			Qiuhuazhuang Village			Xinzhuang Village			Encun Village		
			Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)	Monitoring value	Standard index	Excess ratio (%)
Cl^-	mg/L	250	48.9	0.20	0	146	0.58	0	87.5	0.35	0	46.9	0.19	0
SO_4^{2-}	mg/L	250	65.6	0.26	0	51.2	0.20	0	122	0.49	0	61.2	0.24	0

② Monitoring results of water level

The monitoring results of groundwater level are shown in the following table.

Table 4.4-22 Statistical table of groundwater level survey results

No.	Location	Water temperature (℃)	Well depth (m)	Water level (m)
1	Liugujian Village	24.2	320	270
2	Xihanwang Village	23.3	180	40
3	Wulibao Village	19.1	150	40
4	Shandi Village	18.5	430	180
5	Jinzuo Village	20.6	30	8
6	Dongkongzhuang Village	22.7	30	6
7	Yanhe Village	21.5	100	36
8	Jiaozuo Coal Senior Technical School	18.7	100	31
9	Qiuhuazhuang Village	20.6	40	4
10	Xinzhuang Village	18.2	60	9
11	Encun Village	17.8	70	12
12	Qunying Xincun Village	21	130	45
13	Wukong Bridge Park	20.6	60	10
14	Dongyu Village	18.2	50	6
15	Fengzhuang Village	17.8	80	20
16	Xiaobai Village	18.1	100	30

From the above table, it can be seen that the monitoring value of pH, ammonia nitrogen, nitrate, nitrite, volatile phenol, cyanide, arsenic, mercury, chromium (hexavalent), total hardness, lead, fluoride, cadmium, iron, manganese, total soluble solids, oxygen consumption, sulfate, chloride, total coliform group and total bacterial count of the groundwater environment can meet the requirements of Class III water quality standards of the *Standard for Groundwater Quality* (GB/T14848-2017). It indicates that the regional groundwater environment condition is good based on the monitoring data.

5 ESIA and Mitigation Measures

5.1 Protected E&S targets

According to the construction characteristics and site investigation, the residential areas and schoolswithin 200 meters of the construction area, Dasha River, Shanmen River, Shanmen River, main canal of the Middle Route of the South-to-North Water Transfer Project, Tianjian Ditch, Qunying River and Wengjian River are taken as the environmental protection objects, which is shown in the following table in details.

Table 5.1-1 Summary of protected E&S targets

Category	Component	No.	Protection object	Azimuth	Distance/m	Number of persons	Environmental quality standards
Atmospheric environment and noise environment	JZTJ101 Dasha River Restoration	1	Hekou Village	Left bank	89	95 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
				Right bank	15	33 persons	
		2	Xiaoshang Village	Left bank	15	3,440 persons	
		3	Gengzuo Village	Left bank	180	726 persons	
		4	Qintun Village	Left bank	63	1,164 persons	
		5	Tiejiangzhuang Village	Right bank	24	385 persons	
	JZTJ102 Dasha River Restoration in Xiuwu County	6	Licun Village	Right bank	120	1,790 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the Environmental Quality Standards for Noise (GB3096-2008)
		7	Liegangying Village	Left bank	100	1,800 persons	
	JZTJ103 Shanmen River Restoration in Xiuwu County	8	Wulibao Village	Right bank	15	1,355 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		9	Zhanggongpu Village	Right bank	120	1,870 persons	
	JZTJ104 Shanmen River Restoration in Macun District	10	Xunfan Village	Right bank	198	730 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		11	East campus of Macun Village Industrial Primary School	Right bank	150	1,600 persons	
		12	Liyuan Community	Right bank	125	6,400 persons	
		13	Baizhuang Cuiyuan Community	Right bank	30	2,100 persons	
		14	Baizhuang Village	Right bank	25	2,500 persons	
		15	Affiliated Kindergarten of Macun District Experimental School	Right bank	10	630 persons	
		16	Scattered household on the southeast side of Baizhuang Village	Right bank	130	11,000 persons	

Category	Component	No.	Protection object	Azimuth	Distance/m	Number of persons	Environmental quality standards
		17	Daiwang Village	Right bank	15		
		18	Wulibao Village	Right bank	100	1,500 persons	
	JZTJ105 - Wengjian River Restoration	19	Shanshuiyuan Community	Right bank	15	530 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		20	Qunying Xincun Village	Left bank	22	192 persons	
		21	North Family Courtyard	Right bank	27	1,200 persons	
		22	North Wengjian Village	Left bank	34	1,050 persons	
		23	Boyuan Lantingxu Community	Right bank	36	160 persons	
		24	Qunying West Courtyard of Qunying Xincun Community	Right bank	37	1,264 persons	
		25	Zhongzhou Shiji Community	Right bank	39	756 persons	
		26	Family Courtyard of Steel Mill	Right bank	52	489 persons	
		27	Jiaozuo No. 17 Middle School	Right bank	58	2,168 persons	
		28	Shengye Qinghua Garden	Right bank	60	800 persons	
		30	Sunshine Community	Right bank	80	10 persons	
		31	Dongfeng Garden Community	Left bank	90	1,650 persons	
		32	Family Courtyard of No. IV Steel Mill	Left bank	95	530 persons	
		33	Zhouzhuang Jianhong Community	Right bank	100	721 persons	
		34	Taihang Mansion Community	Left bank	116	2,300 persons	
		35	Taoyuan Community	Left bank	131	131 persons	
		36	No.1 Primary School, Jiefang East Road, Shanyang District, Jiaozuo City	Right bank	140	1,762 persons	
		37	Wanjihua Mansion Community	Right bank	150	130 persons	
		38	Sanhe Community (Shanyang Road)	Left bank	177	177 persons	
		39	Jiaozuo Shanyang Hospital of Traditional Chinese Medicine	Right bank	183	1,200 persons	
	JZTJ106 - Qunying River Restoration	40	Jiaozuo Coal Senior Technical School	Left bank	5	650 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for*
		41	Family courtyard of Industrial and	Left bank	10	230 persons	

Category	Component	No.	Protection object	Azimuth	Distance/m	Number of persons	Environmental quality standards
			Commercial Bureau				*Noise* (GB3096-2008)
		42	Family Dormitory Building of electric service depot	Right bank	12	98 persons	
		43	The Parkway	Right bank	14	2,300 persons	
		44	Courtyard of Jiaozuo Agricultural Bank of China	Right bank	15	231 persons	
		45	Petroleum courtyard of Zhanqian Road	Right bank	16	127 persons	
		46	Yanhe Village	Right bank	20	5,500 persons	
		47	Yard 10, North Minzhu Road	Right bank	20	50 persons	
		48	Yaxiya Community	Right bank	20	458 persons	
		49	Longhu Jingyuan Community	Right bank	20	2,083 persons	
		50	Taijiyuan Community	Left bank	20	3,154 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 1 in the Environmental Quality Standards for Noise (GB3096-2008)
		51	Central Pavilion Community	Right bank	22	1,300 persons	
		52	Four-Season City of Flower	Right bank	26	4,600 persons	
		53	Zone A of Jinhuayuan Community	Right bank	28	520 persons	
		54	Jinhua Nanyuan Community of Dongyu Village	Right bank	32	1,661 persons	
		55	Huabao Zhongxin Municipal Family Courtyard	Left bank	32	145 persons	
		56	Family East Courtyard of Hydrological Team	Right bank	33	2,400 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		57	Family Courtyard of the First Construction Work of Shanyang District	Left bank	38	95 persons	
		58	Huiyuan Community	Left bank	38	195 persons	
		59	Family Courtyard of Pharmaceutical Company	Right bank	40	446 persons	
		60	Xinxin Homes	Left bank	40	850 persons	
		61	Taihang Retirement Apartment	Left bank	43	45 persons	
		62	Huarong International Waterfront	Left bank	47	5,590 persons	

Category	Component	No.	Protection object	Azimuth	Distance/m	Number of persons	Environmental quality standards
		63	Zhanqian Road Foreign Trade Bureau family building	Right bank	56	127 persons	
		64	Hongyun Huayuan Community	Right bank	64	555 persons	
		65	Longyuan Family Community	Left bank	72	2,238 persons	
		66	Family Courtyard of Shanyang District	Left bank	76	105 persons	
		67	Huabao Huayuan Community	Left bank	84	800 persons	
		68	No. 2 Huanbei Courtyard, Minbei Community	Right bank	103	300 persons	
		69	Dacheng Garden	Left bank	111	990 persons	
		70	Bellagio Cuisine	Right bank	125	2,448 persons	
		71	Tonghe Chuntian Community	Left bank	150	190 persons	
	JZTJ107 - Urban River Facility Restoration	72	Huiyuan Community	Left bank	6	85 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		73	Jinhua Nanyuan Community of Dongyu Village	Left bank	7	1,574 persons	
		74	Resettlement Community of Xiyu Village	Left bank	70	2,860 persons	
		75	Zhengyun Yuecheng Community	Right bank	115	1,650 persons	
	JZTJ109 - Urban Road Facility Restoration	76	Jiaozuo No. 19 Middle School	Southeast	60	1,430 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
	JZTJ110 - Upgrading and New Construction of Urban Flood Ditches	77	Enzhou Garden	Left bank	21	5,000 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		78	Qiangnan Village	Left bank	86	8,460 persons	
		79	Country Garden Emerald Bay Community	Left bank	105	135 persons	
		80	Guanlan International	Left bank	115	5,100 persons	
		81	Yijia Yunhe Shangjun Community	Left bank	127	1,600	
		82	Xinzhuang Village	Left bank	130	1,346 persons	
		83	Shilin Village	Left bank	133	2,060 persons	
		84	China Overseas Left Bank	Left bank	148	2,900 persons	

Category	Component	No.	Protection object	Azimuth	Distance/m	Number of persons	Environmental quality standards
		85	Shuanghe Bay Community	Left bank	150	2,000 persons	
		86	Wanlong Qingshui Bay Community	Left bank	156	1,500 persons	
		87	Jinshan City Garden	Left bank	160	0 (Temporarily not resided)	
		88	Dongyu Village	Left bank	169	20 persons	
		89	Xinxing Residence Community	Right bank	160	0 (Temporarily not resided)	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 1 in the Environmental Quality Standards for Noise (GB3096-2008)
	JZTJ111 - Flood Control Upgrading of Urban Rivers and Bridges	90	Jianye Shihe Mansion Comminity	East side of Wenhui Road	17	100 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
	JZTJ112-North Ring Road (Puji Road~Tabei Road) Restoration	91	Xincheng North Courtyard	North of road	15	700 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		92	Seashell Star Kindergarten	South of road	10	120 persons	
		93	Jiaozuo Jinkai Middle School	North of road	10	650 persons	
		94	Huasheng Community	South of road	14	510 persons	
	JZTJ113 - Shanyang Road (Taihang Road-Jianshe Road) Restoration	95	Dongfeng Garden Community	West of road	11	1,650 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		96	Main campus of Donghuan Primary School	East of road	17	2,200 persons	
		97	Zhonghong Mingdu City Phase 1	East of road	35	2,350 persons	
	JZTJ114 - Longyuan Road (Minzhu Road-Shanyang Road) Restoration	98	Yuhe Garden	North of road	58	2,279 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		99	Resettlement Community of Xiyu Village	North of road	50	2,860 persons	
		100	Jinhua Nanyuan Community of Dongyu Village	North of road	57	1,574 persons	
	JZTJ115- Fengshou Road Restoration	101	Wanlong Shanshui Shangyuan Community	North of road	44	198 persons	
	JZTJ116- Minzhu Road Restoration	102	Jiaozuo Foreign Language Middle School (South Campus)	West of road	15	1,100 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
	JZTJ117 - Industry Road Restoration	103	Scientific and Art Homeland	South of road	9	480 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class
		104	Tyre's family	North of	17	756 persons	

Category	Component	No.	Protection object	Azimuth	Distance/m	Number of persons	Environmental quality standards
			commercial and residential buildings	road			2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		105	North Campus of Jiaozuo University	South of road	45	1,650 persons	
	JZTJ118 - Jiaowu Road Restoration	106	Shilin Village	West of road	4	2,060 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
				East of road	6		
	JZTJ119 - Jianshe Road Restoration	107	No. 2 yard of Jiaozuo power plant	North of road	14	360 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		108	No. 1 yard of Jiaozuo power plant	South of road	20	780 persons	
		109	East Family Courtyard of Shanyang District Water Conservancy Bureau	North of road	18	156 persons	
		110	Kangle Community	South of road	13	470 persons	
	JZTJ120- Jiefang East Road Restoration	111	Shangshui Sunshine Community	North of road	34	1,180 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		112	Dongfang Jiayuan Community	North of road	28	1,400 persons	
	JZTJ121- Tianjian Ditch Management	113	XinLifeng Village	Right bank	10	1,000 persons	Level II of *Ambient Air Quality Standard* (GB3095-2012), Class 2 in the *Environmental Quality Standards for Noise* (GB3096-2008)
		114	Lifengsan Village	Left bank	10	400 persons	
		115	Jiaozuo Longfa Community	Left bank	10	800 persons	
		116	Zhengda Garden Comminuty	Left bank	10	760 persons	
		117	Xintazhang Village	Left bank	12	2,500 persons	
		118	Tianjianxin District	Right bank	15	4,300 persons	
		119	Ode to Joy Community	Right bank	15	40 persons	
		120	Tianjian Village	Left bank	20	1,800 persons	
		121	No. 2 Courtyard, Jianxi Street	Left bank	27	1,200 persons	
		122	Hengyu Community	Left bank	33	1,020 persons	
		123	Hengyu Garden	Right bank	40	320 persons	
		124	Tianjian Sunshine Community	Left bank	46	1,000 persons	
		125	Xiaozhuang Village	Left bank	50	2,300 persons	
		126	Yuanhua Mission	Right	50	580 persons	

Category	Component	No.	Protection object	Azimuth	Distance/m	Number of persons	Environmental quality standards
			Community	bank			
		127	Rongxiang Community	Right bank	55	1,700 persons	
		128	Heshun Community	Right bank	61	5,000 persons	
		129	Jiaozuo No. 4 Middle School	Right bank	113	850 persons	
		130	North Courtyard of Chemical Plant I	Left bank	116	230 persons	
		131	Jinmengyuan Community	Left bank	135	600 persons	
		132	Residential building of tannery	Left bank	149	110 persons	
		133	Family courtyard of branches of the Public Security Bureau	Right bank	162	140 persons	
		134	Tianjian Garden	Right bank	164	2,200 persons	
Groundwater	JZTJ106 - Qunying River Restoration	135	Fenglin Water Plant (No. 4 water plant) Yan River groundwater source	Right bank	Adjacency	-	Class III in the *Standard for Groundwater Quality* (GB/T14848-2017)
		136	Taihang Water Plant (No. 2 water plant) Zhouzhuang groundwater source	Left bank	Adjacency	-	
	JZTJ121- Tianjian Ditch Management	137	Zhongzhan Water Plant (No. 6 water plant) Lifeng underground water source	Left bank	60	-	
	JZTJ102 - Dasha River Restoration in Xiuwu County	138	Beixinzhuang underground well group of Happiness Water Plant in Xiuwu County	Left bank	Adjacency	-	
Surface water	Dasha River	/		/			Class IV in the *Environmental Quality Standard for Surface Water* (GB3838-2002)
	Shanmen River	/		/			
	Qunying River	/		/			
	Wengjian River	/		/			
	Heihe River	/		/			
	Xiaozhang River	/		/			
	Tianjian Ditch	/		/			
	Main canal of the Middle Route of the South-to-North Water Transfer Project	/		/			Class III in the *Environmental Quality Standard for Surface Water* (GB3838-2002)

5.2 EIA

5.2.1 Terrestrial Ecological Impact Analysis

5.2.1.1 Impacts on land use and mitigation measures

(1) Impacts on land use

The Subproject requires a total area of 1153.3718 mu permanently-occupied land, including 73.2258 mu collective land and 1080.146 mu state-owned land; The Subproject involves a total area of 905.11 mu temporarily-occupied land, including 862.11 mu of temporarily-occupied state-owned land (including 8.46 mu of villagers' self-reclaimed beach land in Xiuwu County, which has been included in the temporary land compensation). 43 mu of temporarily-occupied collective land

According to the field investigation, the Tianjian Ditch and Qunying River need to be widened due to flood control and drainage needs in the Subproject. The partial rerouting shall be implemented for the Shanmen River, which needs to expropriate collective land of 73.2258 mu for construction. After the construction of new embankment, einforced embankment and bank slope protection works is completed, the slope will be afforested with vegetation. In general, after the project is completed, the area of construction land increased a little, and the area of grassland and wetland is increased. From the ecological perspective, the permanent land area of the project has little impact on land use.

The temporary area of the project is 905.11 mu, including river green land, Waste grassland, unused construction land, idle plant and abandoned mine, among which the vegetation of the green land and waste grass land is relatively simple, centering on artificial green plants, wild weeds and bushes. When the waste soil is temporarily stored in the camp construction and temporary storage yard, the surface vegetation will be damaged or occupied. At the beginning of the construction, it shall focus on the protection of topsoil and vegetation. The topsoil of 0-30cm shall be scooped up and put in a centralized pile. After construction, construction waste shall be removed in time, topsoil recovery shall be carried out for forest land, waste grassland, unused construction land and spoil ground in accordance with the design, the vegetation restoration shall be implemented through vegetation, greening, implementation of water and soil conservation plan and other measures, and ecological restoration of abandoned plants shall not be conducted. The area of vegetation restoration is 834.91 mu, while the remaining 70.2 mu of temporary land is currently idle mining land and road pavement, and there is no need for vegetation restoration. See Table 5.2-1 and Table 5.2-2 for details.

Table 5.2-1 Vegetation restoration measures for temporary land occupation

Land occupation type		Restoration measures	Restoration goal
Construction camp	Cultivated land	1. 30cm topsoil layer shall be reserved, and land leveling+topsoil landfill+vegetation restoration shall be timely carried out after construction. 2. The main plant species such as wheat and corn planted locally shall be used to restore the farmland community.	Productivity reaches the level before land occupation
	Waste grassland	1. 30cm topsoil layer shall be reserved, and land leveling+topsoil landfill+vegetation restoration shall be timely carried out after construction. 2. Native species such as bermuda grass and Poa pratensis L. shall be sown	The coverage is more than 60%
Construction road	River land	1. 30cm topsoil layer shall be reserved, and land leveling+topsoil landfill+vegetation restoration shall be timely carried out after construction.	The coverage is more than 60%

Land occupation type		Restoration measures	Restoration goal
		2. Native species such as bermuda grass and Poa pratensis L. shall be sown	
Spoil ground	Unused land	After the engineering construction is completed, the land shall be leveled, the topsoil shall be backfilled, and native species such as bermuda grass and Poa pratensis L. shall be sown.	The coverage is more than 60%
	Waste grassland	1. 30cm topsoil layer shall be reserved, and land leveling + topsoil landfill + vegetation restoration shall be timely carried out after construction. 2. Native species such as bermuda grass and Poa pratensis L. shall be sown.	The coverage is more than 60%

Table 5.2-2 Ecological restoration measures for temporary land occupation by component

Component		Restoration area of construction camp (mu)	Restoration area of spoil ground (mu)	Restoration area of airing yard (mu)	Restoration area of road in the yard (mu)	Restoration measures
No.	Component					
JZTJ101	Dasha River Restoration	30	180	30	/	◆ Restoration measures for cultivated land: 1. 30cm topsoil layer shall be reserved, and land leveling + topsoil landfill + vegetation restoration shall be timely carried out after construction. 2. The main plant species such as wheat and corn planted locally shall be used to restore agricultural planting. ◆ Grassland restoration measures: After the engineering construction is completed, the land shall be leveled, the topsoil shall be backfilled, and native species such as bermuda grass and Poa pratensis L. shall be sown. ◆ Restoration measures for unused land: After the engineering construction is completed, the land shall be leveled, the topsoil shall be backfilled, and native species such as bermuda grass and Poa pratensis L. shall be sown.
JZTJ102	Dasha River Restoration in Xiuwu County	/	185.5	22.5	/	
JZTJ103	Shanmen River Restoration in Xiuwu County	/	64.4	/	7.5	
JZTJ104	Shanmen River Restoration in Macun District	12	155.49	/	31	
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	7.50	/	/	/	
JZTJ106	Qunying River Restoration	9.00	/	/	/	
JZTJ107	Urban River Facility Restoration	7.50	/	/	/	
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	6.00	14.29	/	72.23	
Total		72	599.68	52.5	110.73	

The impact of temporary land occupation on land use type mainly in the construction period, which is temporary and basically does not exist after the construction.

(2) Soil and water conservation measures

The permanent land acquisition of the engineering is used for river works, and the temporary land occupation is used for construction diversion, temporary stockyard, construction road, construction production and living area, spoil ground and other temporary works during the construction period.

Based on the characteristics of engineering construction, construction sequence, engineering layout and water and soil loss, the area of water and soil loss caused by engineering construction

is divided into five water and soil loss prevention areas, namely river engineering area, municipal road engineering area, production and living area, construction road area, spoil disposal area, etc. The general layout of water and soil conservation of the engineering is as follows:

① River engineering area

The water and soil loss of the engineering mainly occurs during the construction period, and the foundation excavation surface is scoured by rainwater during the construction period, resulting in water and soil loss. For no excavation disturbance during the engineering operating to damage the surface, the effect of water and soil loss tends to be weak. The protective measures of water and soil conservation are not considered in the design of the main works, so in this water and soil conservation design, topsoil stripping, vegetation measures and temporary protection during construction are supplemented. During the construction process, it is required to excavate on the basis of the design depth and slope ratio, and the humus shall be stripped and stacked in a centralized manner before excavation, with a cover thickness of 30cm. Temporary protective measures for centralized storage of humus are woven bags around soil and drainage ditches.

② Municipal road engineering area

◆ The scope of work and the routes for personnel and vehicles shall be strictly defined, and the scope of site and personnel activities shall not be arbitrarily exceeded. Signs such as placards and boundary tablets shall be set up to prevent damage to vegetation outside the construction production.

◆ The existing access road shall be used as far as possible for the transportation of subgrade filler to reduce land occupation. If there is a newly built access road, the new access road shall be sorted out to meet the standard after completion, and it shall be reserved for road maintenance and repair or the original filler shall be excavated to restore vegetation and original appearance.

◆ Vegetation along the road shall be protected to reduce vegetation damage and water and soil loss. The border trees on both sides of the road are reserved in this design. During construction, attention should be paid to strengthening their protection and reducing damage.

◆ According to the excavation and filling conditions, the highway engineering shall protect the subgrade slope, subgrade drainage system, subgrade compaction and greening works, so that the stability of subgrade can be protected.

③ Construction production and living area

In the urban area, existing local houses or prefabricated houses shall be rented for construction, production and living to the greatest extent, while the production and living areas for river works are all temporary land, and topsoil in the work area shall be stripped and temporarily stacked before construction, with a cover thickness of 30cm; After the construction, the occupied land shall be covered with soil to restore the original functions.

The construction production and living area includes sites for temporary stacking of construction machinery and construction materials and living quarters, and intercepting and drainage ditches shall be excavated around the area. After the construction, the attachments on the ground shall be cleaned, construction waste and hardened ground shall be removed, and the waste shall be transported to the spoil area near the highway for stacking. Next, the original type of land use will be restored after land leveling and covering in the temporarily land occupation area.

In order to prevent rainwater from washing the exposed ground in the area, grass seeds shall be sown on the vacant bare land in the living area for protection, and the grass seeds shall be bermuda grass, mixed with soil evenly, and covered with soil after sowing.

④ Construction road area

10cm thick mud-gravel macadam pavement is used for the temporary roads in the engineering site, with a width of 4m. Temporary drainage ditches shall be set on both sides of the road, which shall be connected to the sedimentation tank and leveled after construction; The solid and materials piled up during construction shall be blocked and covered to prevent water and soil loss.

⑤ Spoil ground

There are 10 spoil grounds, which are now quarries and river depressions. Before stacking the waste soil, the topsoil shall be stripped, woven bags shall be stacked at the slope toe, drainage ditches shall be built outside the woven bags, the stripped topsoil shall be covered after stacking, and grass seeds shall be scattered for greening or rehabilitation.

5.2.1.2 Impacts on plants

The Subprojects of road restoration in this engineering are all existing roads without new land occupation, and the impacts of engineering construction on plants mainly come from the river control subproject. Based on the field investigation, the planned land for the blue line of the river course is covered with vegetation, and the impacts on plants during the construction are mainly in the construction area within the planned river blue line.

According to the ecological status survey results of the river section under control, the plant types within the existing river construction scope mainly include herbs and arbors. Most of them are herbs that are mainly distributed within the existing river channel. The dominant herbaceous species include Artemisia lavandulaefolia, Bermuda grass, Gaura parviflora douglas, Artemisia annua, Roegneria kamoji and Conyza canadensis, with the associated plants such as Dandelion, Potentilla discolor, Artemisia carvifolia, Althaea rosa, Tamarix chinensis and Phragmites. The dominant specie of arbors is Populus simonii, with Cotinus coggygria, Sophora japonica and Broussonetia papyrifera sporadically distributed. There is a small vegetation coverage in the river channel. The terrestrial plants occupied by the Subproject construction are mainly artificial plants, with the damaged plants widely distributed in the surrounding areas, and there are no rare and endangered wild plants in the damaged natural vegetation.

During the construction period, it is strictly prohibited to cut down and destroy the vegetation in non-construction area at will, and the construction vehicles shall be driven along the planned construction roads to avoid rolling the vegetation around the construction area and reduce the impact of construction on the plants. In the subproject construction area, the relatively simple vegetation community structure, with common plant species, will not cause obvious adverse impact on the local ecological environment, and the subproject construction only reduces the biomass without affecting the plant diversity. Through the construction of supporting greening and ecological landscape engineering on both sides of the bank in the later period, the loss of biomass will be compensated to some extent, and its ecological service function will be increased compared with that before the construction.

5.2.1.3 Impacts on animals

During the construction period, the impact of the engineering on wild animals mainly includes the impact of the construction land occupation, construction noise and personnel activities, with a detailed analysis based on wild animal groups as follows.

(1) Impacts on birds

a. Impacts of land occupation

During the construction period, the area occupied by the engineering is mainly concentrated in the river course in the evaluated area, and the land occupied includes river water bodies and

mud flats, riverside forest land, grassland and cultivated land, among which the birds in the forest land include sparrow, magpie, Cyanopica cyana, Corvus macrorhynchos, Chinese bulbul, goldfinch, Streptopelia chinensis, Streptopelia orientalis, pheasant, Ashy Starling and Phoenicurus auroreus, while the birds in the wetland water area mainly include great egret, little egret, Ruddy Shelduck, Tachybaptus ruficollis, common moorhen and Common Coot, etc. The land occupation will directly destroy the habitat of birds in the occupied area. However, due to the wide distribution of similar habitats around the engineering area, the bird habitat can migrate to the surrounding areas after being damaged If there are young birds during construction, they should be sent to the forestry protection department for treatment, which will have little impact on birds.

b. Impacts of noise from construction

During the construction phase of the subproject, birds may be disturbed by the noise from construction machinery. However, as the engineering is the linear engineering and is constructed in sections, there are still some habitat areas such as river surface, pits or ponds, and forest land in the upstream and downstream of the construction area for bird activities. The noise impact during construction is temporary, and the impact on birds will disappear after construction.

(2) Impacts on beasts

Human activities are frequent in the evaluated area, and there are few animal species, mainly including hedgehogs, Lepus capensis and a variety of rodents. During construction, the land occupation will encroach on its habitat. In view of the wide-range suitable habitats around the engineering area and the strong migration capacity of mammals, they will quickly migrate to new habitats after being affected. Therefore, the impact of the engineering on them is very limited, temporary and recoverable.

(3) Impacts on amphibians and reptiles

Amphibians in the engineering area are mainly common frogs and toads, and the survival of their larvae generally depends on adequate water sources. During the construction, they may be affected, but after being frightened, they will be far away from the construction area, so the impact is not significant.

Reptiles in the engineering area mainly include Trionychiaceae, Lacertian and Colubridae, which mainly inhabit grasslands and waters. The construction roads and land occupation may have certain restrictions on the migration and foraging activities of these animals, but they will not be greatly affected by the construction due to the wide-range reptile habitats and strong migration capacity.

During the construction period, the engineering should set up a strict scope of construction activities, strengthen the environmental protection education for construction personnel, reasonably arrange the operation mode of construction machinery, and reduce the disturbance to animals. It is strictly forbidden for construction personnel to hunt and kill wild animals at will during the construction. According to the living habits of birds, the construction time shall be standardized, and the construction at night shall be minimized to reduce the impact of light and noise on animals.

5.2.2 Aquatic Ecological Impact Analysis

5.2.2.1 Impact analysis on aquatic ecological environment during construction

According to the feasibility study, the wading construction works mainly include river channel dredging, bank slope protection, river sluice removal and reconstruction, and bridge works.

(1) Impacts of river channel dredging on the aquatic ecosystem

① Impact on zooplankton and phytoplankton

According to the preliminary engineering design, the river channels to be dredged are seasonal rivers, among which the Dasha River, the upper reaches of Shanmen River, Tianjian Ditch and Qunying River (section within the scope of works) are dry in non-flood seasons, and the construction period of this work is non-flood season, so there is no impact on water ecological environment during construction.

There is a certain runoff in the lower reaches of Dasha River and Shanmen River. As the current river channel is narrow and does not meet the conditions for half construction, wet dredging (with the volume of 10,600m^3) is adopted in the preliminary design of the works. For earthwork excavation of the main river channel, excavators shall be used to excavate the soil far from the river channel, and the part close to the main river channel shall be excavated finally. When working with water, amphibious excavators are used for earth excavation. The river dredging and wading operation will disturb the riverbed at the bottom of the river, increase the suspended solids and the turbidity of local river water, reduce the light transmittance, adversely affect the growth conditions of phytoplankton, and reduce photosynthesis; moreover, due to the sedimentation of sediment, some phytoplankton will be carried together for sedimentation, resulting in the decrease of phytoplankton both in species and quantity during construction. However, such impact is limited to the vicinity of the wading construction site, with a small scope. After the completion, the water depth will become relatively shallow and the transparency of the water body will increase, which is beneficial to the photosynthesis of phytoplankton and can promote the propagation of algae, so that the quantity of algae in the affected river reach can quickly recover to the original level.

River channel dredging will increase the suspended solids in local water, which leads to a certain impact on the growth rate, survival rate, feeding rate, abundance and community structure of zooplankton. The filter feeding zooplankton that migrate vertically depending on the intensity of light can only distinguish the particle size. As long as the particle size is appropriate, it can be ingested into the body, so animals may die of hunger if sediment is taken in. Zooplankton will escape from the site when stimulated by suspended solids, as a consequence, the species and quantity of zooplankton in the nearby waters will be reduced. Suspended solids can adhere to the surface of animals and interfere with their sensory kinetic energy. With the completion of construction, the water flow after regulation tends to be gentle, so the reduction of sediment content and the increase of water transparency are beneficial to the reproduction of protozoa, rotifers and planktonic crustaceans to some extent. After regulation, the quantity of zooplankton in the reach will increase, but the population structure will not change much.

② Impact on zoobenthos

Dredging works will damage the living environment of zoobenthos, thus affecting their species, quantity and distribution. The zoobenthos may live between the sandstone and bottom mud about 20cm in the bottom soil layer of the river, including aquatic insects, and be attached to various algae and organic detritus on the gravel. The river dredging will excavate the zoobenthos and the living soil together, which will damage the river bottom, remove zoobenthos and its living environment, and damage the river bottom ecosystem. The turbidity of the water body caused by the construction will increase the light absorption value of the water body and the water temperature, which is not conducive to the development and respiration of insects, mollusks and other animals, and the zoobenthos will be reduced during the dredging.

Based on literature research data, for zoobenthos, the risk of bottom mud dredging in winter is the smallest. In the Subproject, the downstream dredging of Dasha River and Shanmen River is carried out in dry season (from November to April) and winter to keep away from the production

and breeding period of the larvae of zoobenthos (most are the highest temperature periods) and minimize the impacts on zoobenthos.

According to the survey data analysis of zoobenthos in similar rivers after dredging, one year later, the zoobenthos community has recovered obviously, the standing stock and diversity have reached the level before dredging, the species composition is similar to that before dredging, and the number of dominant species is more than that before. After dredging, the improvement of the sediment environment and water quality, and the removal of contaminated bottom sediment will be conducive to the reconstruction of the aquatic ecological environment, speeding up the restoration of zoobenthos, and improving its diversity.

For the situation that the benthic ecosystem needs to be restored as soon as possible due to the loss of zoobenthos caused by river dredging, it can be arranged in the form of strip fields in the specific construction design, separated from each other, and a special protective belt is reserved to prevent dredging, which is used as the base reservoir for species. After dredging, based on the species pool in the protective belt, the species in the dredging area shall be recovered and developed in a short time by means of natural forces to multiply and expand.

③ Impacts on aquatic plants

During the river dredging construction, for slurry separation due to temporary stockpiling of sediment generated by dredging works in the soil drying yard within the construction scope, the discharge of muddy water into the river will damage the original ecological environment on the bank and have a certain impact on the aquatic vascular plants within the construction reach. At the same time, the evaluation suggests that a sedimentation tank should be set up in the soil drying yard to collect muddy water, which will be discharged into the river after settling for 8 hours in the sedimentation tank.

Due to the disturbance of the engineering construction on river bottom sediment, the exposure of some sediment at the bottom of the river has a certain adverse effect on the growth of aquatic plants. The aquatic plants will gradually recover after the construction, and the restoration of aquatic plants on both banks of the river can also be accelerated by planting aquatic plants manually after the construction.

④ Impacts on fishery resources

The construction of dredging works increases the suspended solids in local water bodies, and the impact of suspended solids on fish can be divided into three categories, namely lethal effect, sublethal effect and behavioral impact. The test shows that adult fish will make avoidance reaction in turbid waters and quickly escape from the construction area. Therefore, the impact of increased suspended solid concentration on fish is mainly reflected in fish roe, fish fry and juvenile fish. Meanwhile, due to the construction, the reduction of spawning and feeding places of fish and the reduction of the abundance of their bait organisms and predatory efficiency will also have a certain impact on the fish roe, fish fry and juvenile fish, and the construction period of the Subproject, which is mainly from October to April, has avoided the spawning and larval stage of river fish, so it has little impact on the juvenile fish. Moreover, according to the status survey, the fishes in the river reach mainly include carp, crucian, grass carp, silver carp and mud fish, which are common fish in small and medium-sized rivers, with low economic value. No national protected fishes and rare fishes are found. As a result, during river dredging, fish will be affected to some extent.

In order to reduce the impact of engineering construction on fishery resources, it is recommended to drive away fish in the construction area before construction. With the completion of construction, the water quality will quickly recover and gradually improve, and the common

small fish with strong adaptability to the environment will gradually recover to the original level, so the impact on the fish is reversible.

(2) Impact of bank slope protection works on aquatic ecosystem

The bank slope (dangerous section) protection works account for a small proportion of the channel length and are constructed in sections, so the diversion shall be carried out before the construction, and the bank slope protection works shall not be constructed directly by wading. Gabion is used for banket in the protection works, and the structure of gabion with the good water permeability is beneficial to the growth of natural plants. The ecological embankment connects the vegetation in the waterfront area with the vegetation in the embankment to form a complete river ecosystem, which is a transitional area between water and land. The slope vegetation of the ecological embankment can provide a place for fish and amphibians to feed and inhabit, which plays a certain role in maintaining biodiversity, and the embankment with sufficient vegetation coverage is the guarantee of biodiversity in the riparian zone. Therefore, the ecological embankment works have little adverse impacts on the river water ecological environment.

(3) Impacts of dam and sluice construction on aquatic ecosystem

The Subproject will repair the existing 4 hydraulic lifting dams and 1 rubber dam on Dasha River, maintain and reinforce the existing 3 rubber dams on Qunying River, as well as 1 rubber dam on Wengjian River, with the dam height unchanged. Among them, the existing 5 dams on Dasha River are all used for landscape water storage, with the height of 3.25-4.55 meters and the storage capacity of 1.30-23 million cubic meters. 4 dams on Qunying River and Wengjian River are all used for urban flood control, with a barrage height of 2-3 meters and a water storage capacity of less than 10,000 cubic meters, which do not involve dam construction. Also, in the Subproject, the existing 1 check gate in Dasha River and 1 check gate in Heihe River in the urban area will be rebuilt after demolition in the original site and scale.

The sluice and dam are arranged in the main river channel. During gate dam construction, the upstream and downstream cofferdams are filled, the open diversion channels are excavated and the diversion culvert pipes are buried. As part of the river channel area will be occupied during the construction of diversion and cofferdam wading, there will be a certain adverse impact on the aquatic habitat in the river channel, mainly reflected in the impact of land occupation on local aquatic habitats. During the construction, the proportion of river habitat occupied by the works is small, with a short occupation period, so the impact of engineering construction on river habitat can be ignored. With the balance of riverbed erosion and deposition and the stability of the bottom bed, the aquatic habitat will gradually recover its original appearance after cofferdam removal. The river sluice will be rebuilt at the original site after removal, with unchanged functions, dispatching management, water system connectivity, and the flow of important sections in the downstream of the river basically unchanged, which has little impact on spawning and feeding grounds of fish in the lower reaches of the river, and has no significant impact on fish reproduction and habitat.

(4) Impacts of bridge works on the aquatic ecosystem

The Subproject involves 17 bridge works, including 5 Dasha River bridges to be demolished and rebuilt, 1 submersible bridge to be rebuilt, 4 Shanmen River bridges to be demolished and rebuilt, all of which belong to substandard roads and bridges, 6 municipal road bridges to be demolished and rebuilt in urban areas, and 1 bridge deck to be widened, all of which are municipal roads and bridges. See the following table for the construction contents of bridge works of the Subproject.

Table 5.2-3 Summary of bridge works

Component	No.	River channel stake No.	Bridge length	Bridge width	Bridge type	Bridge grade	Type of Construction	Construction location	New permanent land occupation
JZTJ101- Dasha River Restoration	1	K16+570	400	20	Beam bridge	Substandard road and bridge	Reconstruction of existing overflow road	Construction of existing overflow road	None
JZTJ102-Dasha River Restoration in Xiuwu County	2	K6+070	44.04	7	Beam bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
	3	K8+499.4	44.04	7	Beam bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
	4	10+721.5	44.04	7	Beam bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
	5	K12+124.5	44.04	7	Beam bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
	6	K17+167.3	44.04	7	Beam bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
JZTJ103-Shanmen River Restoration in Xiuwu County	7	K1+860	19.5	6	Box culvert bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
	8	K2+330	19.5	6	Box culvert bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
	9	K3+900	24	6	Box culvert bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
	10	K4+260	24	6	Box culvert bridge	Substandard road and bridge	Demolition and reconstruction	Reconstruction on the former address	None
JZTJ111-Flood Control Upgrading of Urban Rivers and Bridges	11	Fengshou Road Bridge of Wengjian River	30	67	Box culvert bridge	Municipal bridge	Demolition and reconstruction	Reconstruction on the former address	None
JZTJ112-North Ring Road (Puji Road~Tabei Road) Restoration	12	Qunying River Bridge Site of North Ring Road	32	32	Box culvert bridge	Municipal bridge	Bridge deck widening	Bridge foundation unchanged	None
JZTJ121- Tianjian Ditch Management	13	K1+889	16	40	Box culvert bridge	Municipal bridge	Demolition and reconstruction	Reconstruction on the former address	None
	14	K3+125	16	40	Box culvert bridge	Municipal bridge	Demolition and reconstruction	Reconstruction on the former address	None
	15	K3+356	16	40	Box culvert bridge	Municipal bridge	Demolition and reconstruction	Reconstruction on the former address	None
	16	K4+283	16	40	Box culvert bridge	Municipal bridge	Demolition and reconstruction	Reconstruction on the former address	None
	17	K5+886	16	40	Box culvert	Municipal bridge	Demolition and reconstruction	Reconstruction on the former	None

					bridge			address	

The bridge with pile foundation is constructed by filling the construction platform in the river channel. Filling the construction platform in the water will directly bury benthos, causing local benthos to disappear in the platform area. At the same time, the platform will reduce the flow section of the water body in the waters, increase the flow velocity in local areas, increase the suspended solids in the water due to the scouring of the river bed and platform slope by the current, and reduce the water transparency, which will adversely affect local plankton. With the aquatic vegetation destroyed by the bridge construction, the disappearance of aquatic vascular plants in the area where the bridge foundation is located will affect the reproduction of fish that produce sticky eggs. According to the status survey, the river reach of the engineering is scattered with water plants, and does not have the conditions for large-scale spawning grounds, so the bridge work will not have a significant impact on fish reproduction.

Another important impact of bridge construction on aquatic ecosystem is noise, which mainly comes from pier construction on the water. In addition to mechanical noise, construction vibration will also cause certain interference to aquatic organisms such as fish. The construction period of the Subproject, which is mainly from October to April, has avoided the spawning and larval stage of river fish. Thus, the bridge construction will not have a significant impact on fish.

The impact of the engineering construction on the aquatic ecosystem mainly comes from the river control subproject, in which river channel dredging, bank slope protection, river sluice removal and reconstruction, bridge works and other construction have certain adverse effects on the aquatic ecosystem. In order to protect the aquatic ecological environment, maintain the diversity of aquatic organisms and reduce the adverse impacts on aquatic ecological environment, the evaluation proposes mitigation measures from the aspect of optimizing the construction scheme:

① Increasing publicity and education for construction personnel, and strengthening and improving their awareness of ecological environment protection.

② Reasonably arranging the pre-construction planning, strengthening the health management of construction personnel (such as feces and domestic wastewater), and preventing fish habitat pollution in the lower reaches of the river.

③ It is strictly forbidden for construction personnel to engage in illegal fishing operations or go fishing, angling and other activities in the river.

④ During the construction of temporary wading works, fish shall be driven before construction to minimize the damage to fish caused by the engineering.

⑤ Reasonably arranging the construction organization and construction machinery, and operating in strict accordance with the construction specifications. The construction unit must select construction machinery and transportation tools conforming to national standards, install noise control devices for strong noise sources, reduce the noise impacts on aquatic organisms, and control the traffic noise impacts on aquatic organisms during construction and transportation. It is forbidden for construction vehicles to whistle loudly in the construction area.

⑥ During the construction period, it is strictly forbidden to stack construction waste at random on the river beach. Garbage and waste should be collected and treated regularly by specially assigned persons, and shall not pollute the beach vegetation and soil.

⑦ Strengthening construction management. Construction operations must be carried out in strict accordance with the relevant provisions in the approved design to ensure the implementation of investments in environmental protection and environmental protection

measures.

⑧ Strengthening environmental monitoring and supervision during the construction period.

⑨ After completing construction, in order to make up for the impact on the protected area caused by river construction, especially for the amount of losses caused, a feasible fish enhancement and releasing plans shall be formulated on the basis of the fish conditions and water resources in different waters. Enhancement and releasing requirements: native fish species such as silver carp, crucian and grass carp shall be selected, and the specification of releasing fry shall be more than 7cm/tail, with the releasing time in June every year; the releasing fish species include silver carp 100~400g/tail and grass carp 15~20cm/tail, with the releasing time in March and December every year. Windless, sunny, cloudy or overcast days shall be selected for releasing. The fry shall be manually placed as close to the water surface as possible (no more than 1m from the water surface) and slowly put into the releasing water area downwind, and the ship speed shall be less than 0.5 m/s during releasing.

The releasing range and area shall be expanded as much as possible to reduce excessive fry clusters.

5.2.2.2 Impact analysis on aquatic ecological environment during operation period

The hydrological regime changes of river management during the operation period are mainly shown as follows: the widening of the whole water storage surface of the river channel during the flood period will cause the average water level and flow velocity to decrease. The river surface of the main channel is widened, expanding the effective living space for aquatic organisms, which is conducive to the growth and reproduction of aquatic organisms.

(1) Impacts on phytoplankton

The phytoplankton in the river mainly includes various algae such as diatoms and green algae, and the species number and abundance of phytoplankton in the river channel will be reduced in a certain period after governance compared with that in the construction period. However, two banks of the river are mainly farmland and farm villages, with frequent human activities, and the rainy season is convenient for the accumulation of organic matters in the river water, so the species and abundance of phytoplankton in the water body will increase after the river runs, especially some nitrophilous algae in Chlorophyta and Bacillariophyta suitable for river ecological habitat conditions reproduce rapidly.

(2) Impacts on zooplankton

During the engineering operating, with the continuous increase of phytoplankton biomass, the abundance of zooplankton will gradually recover. In particular, the number of protozoa will increase significantly, and the species of rotifers, cladocerans and copepods will also increase. As the population structure of zooplankton gradually changes into river type, the species will also change seasonally. Zooplankton will gradually recover to the original community characteristics after river runs, and the species and quantity of zooplankton will return to the original level, with more diversified species composition and increase current loving species.

(3) Impacts on river zoobenthos

After river control, the water velocity will increase, and relatively large water flow disturbance will reduce the abundance of filter feeders, such as the caddisfly larva. However, the increased water velocity will increase the water transparency, promote the growth of aquatic plants, and provide more habitat for zoobenthos, so as to increase the diversity and quantity of zoobenthos, especially the species and quantity of gastropods. However, the place with many water plants is not conducive to the life and reproduction of bivalves, with its number decreased.

(4) Impacts on river vascular plants

The river channel will be widened after the completion of construction, and the sediment in the water will be reduced and the transparency will be increased after stable operation. With the inflow of nutrients on both sides of the river bank, the growth of aquatic vascular plants along the bank will be promoted

(5) Impact on river fish resources

After river control, the water storage capacity will increase, and a certain water level can also be guaranteed in the dry season. With the decreased turbidity of the water body and the increased transparency, nutrients and water temperature, a better condition is formed for fish breeding, feeding and overwintering. At the same time, some small trash fish and Gobioninae fish a better development opportunity, so that larger carnivorous fish such as Erythroculter ilishaeformis will be developed. At the same time, the widening of the river and the deepening of the water body also provide a good basis for the growth and development of large fish.

As a result, the impact on fish is generally favorable during the operating period, and some fish can benefit from the changed environment, while others lose the environment suitable for survival. However, the mobility and certain adaptability to environmental changes can enable fish to find a new environment suitable for survival. After a certain time, the river aquatic ecosystem will regain a state of balance.

5.2.3 Impact Analysis of Hydrological Regime

5.2.3.1 Impact analysis of hydrological regime during construction

According to the construction organization design, the impact of hydrological regime of the engineering during the construction period is mainly caused by the construction diversion and cofferdam, and the main construction contents include embankment works, dredging works, bridge works, gate dam works, etc.

(1) Channel dredging

In the Subproject, the upper reaches of Tianjian Ditch, Shanmen River and Dasha River are seasonal rivers, which are dry all year round except in flood season, with flows onlyin the lower reaches of Shanmen River and Dasha River. Due to the "7.20" rainstorm in Dasha River and Shanmen River, lots of water conservancy facilities in Jiaozuo were damaged, the river channel silted up seriously, and the flood discharge section was insufficient. The whole section of the Subproject is designed to be dredged and excavated, including 6.596km of Tianjian Ditch, 13.45km of Shanmen River and 45.925km of Dasha River, with a total dredging volume of 1,114,730 m^3. In terms of river channel dredging works, 6.596km Tianjian Ditch, 8.15km upstream of Shanmen River and the river bed of the Upstream Dasha River Exit - South-to-North Inverted Siphon Section will be dry in non-flood season, and the construction will be completed within one non-flood season (from November to April); for 5.3km downstream of Shanmen River and the South-to-North Inverted Siphon - Jiaozuo Exit Section of Downstream Dasha River, firstly, the excavator shall be used to excavate the 2m^3 soil from the beach far away from the main river channel, then gradually advance to the main river channel, and the main river channel shall be excavated finally. Construction diversion and cofferdam shall be set during the excavation of the main river channel. During the construction period, the stream flow and water level will be affected to a certain extent, and the impact can be eliminated after the construction.

(2) Bank slope protection and restoration

During the construction of revetment works, the construction cofferdam shall be arranged to protect the foundation pit. The U-shaped cofferdam shall be filled in the river channel for diversion, the outer side of the U-shaped cofferdam overflows, and the inner side is drained before

construction on dry land. The construction cofferdam narrows the main channel, reduces the flow area and increases the flow velocity. The bank slope protection works shall be completed in a non-flood season, with short construction time and little impact on the hydrological regime.

Through the analysis of construction mode, diversion mode and diversion period, the impact of the hydrological regime during the engineering construction is mainly caused by the construction diversion and cofferdam, and the construction diversion will have a certain impact on the hydrological regime of the river channel, which is local, temporary and reversible, with the small overall impacts, and the impact can be eliminated after construction.

(3) Restoration of sluice and dam and bridge

In the Subproject, 11 dams and sluice gates will be repaired and 17 bridges will be widened and rebuilt, all of which will be completed in two non-flood seasons. The full-section cofferdam is used to block the main channel, open channel diversion on the beach or culvert pipe diversion for the repair of sluice and dam and bridge in the Subproject. During the construction period, the hydrological regime of the river course has changed greatly, and the diversion standard is designed according to the flood return period of 5 to 10 years, with a high safety factor; the water flow in the main channel is cut off, and the river flows downstream through the open diversion channel; the flow direction follows the direction of the open diversion channel and is partially offset from the main channel; the river flow in the original channel is basically zero. Diversion is a temporary construction measure, the diversion period of the works is from November to April of the next year, and the impact can be restored to the situation before the diversion after execution of works. Therefore, the impact of construction diversion is mainly reflected in the construction period and can be removed after the construction.

5.2.3.2 Impact analysis of hydrological regime during operation period

The implementation of the river channel restoration subproject mainly includes river channel dredging, bank slope protection and restoration, dam and sluice and bridge reconstruction. The dam, sluice and bridge works shall only repair the dam, sluice and submersible bridge destroyed by water without changing their structural specifications, and the river discharge, water level and flow velocity will not change greatly due to the construction of dam and bridge works, so the bridge works have little impact on the hydrological regime.

Before and after the project implementation, the flow direction and the total supply water quantity of the river remain unchanged, so the river flow has basically not changed. With the dredging of the river channel in the project area, the water-holding capacity and the water surface area will increase, the flow velocity will slow down, the configuration of the shoreline will change, and the hydrological regime of the reach will change to some extent. Overall, the flood carrying capacity of this reach in flood season is improved, and the water-holding capacity in normal years is enhanced.

5.2.4 Surface Water Impact Analysis

During the engineering operating, there is no sewage pollution source and waste water will not be produced. The evaluation only analyzes the impact of sewage generated during the construction period on the water environment.

5.2.4.1 Foundation pit drainage

The foundation pit drainage is divided into initial drainage and regular drainage. Among them, the initial drainage mainly includes the original river water, subsurface filtration and precipitation, with relatively low SS concentration; while regular drainage mainly comes from the water for the foundation pit concrete curing, grouting, cofferdam seepage and rainwater, and the main pollutant is SS.

Based on the experience of hydraulic engineering, the initial drainage volume of the foundation pit is relatively large, and the water quality is basically the same as that of the river, which will not increase the pollution to the water quality of the river. According to the survey, the regional groundwater quality meets the water quality target requirements of the groundwater function area, and the corresponding index value of the groundwater quality in the construction area is better than the water quality of the Dasha River and Shanmen River in each engineering area, that is, the seepage of the building foundation pit will not affect the surface water environmental quality of the corresponding river channel. However, after the foundation pit seepage, rainwater and building concrete curing wastewater are collected, the SS concentration and pH value of construction foundation pit drainage will be increased, and the concentration of suspended solids in regular drainage is about 2,000mg/L through analogy with the monitoring results of similar works. Based on the experience of similar domestic subprojects in the treatment of foundation pit wastewater, a sedimentation tank is generally arranged in the foundation pit, and the SS concentration of the construction foundation pit drainage is ≤ 70mg/L and pumped to the river for drainage after 8-h static settlement, so that the impact on surface water environment is small. In addition, the water quality of foundation pit drainage shall be monitored regularly during the construction period, and the hydraulic sedimentation time shall be adjusted timely on the basis of the monitoring results to ensure that the water quality of foundation pit drainage meets the requirements.

5.2.4.2 Mechanical flushing wastewater

The automatic vehicle cleaning device equipped at the entrance and exit of each construction area of the Subproject will produce a small amount of construction machinery and vehicle flushing wastewater, with suspended solids as main contaminants. According to the survey on the construction of similar works, the concentration of suspended solids in the mechanical flushing wastewater at the entrance and exit of the construction area is about 2,000mg/L. According to the engineering composition and scale, it is estimated that there are about 870 (sets) construction machineries and transport vehicles to be cleaned regularly during the peak period of the engineering construction, and the average amount of wastewater from washing each transport vehicle and mechanical equipment is about 0.2m^3, with the total amount of daily wastewater generated about 174m^3, while the random discharge of mechanical flushing wastewater will have adverse effects on surface water bodies and surrounding soil. Therefore, it is required to build an oil separation sedimentation tank at the entrance and exit of each construction area for the treatment of mechanical flushing wastewater. The treated wastewater can be recycled for the washing construction vehicles after meeting the standard requirements in *The Reuse of Urban Recycling Water-Water Quality Standard for Urban Miscellaneous Use* (GB/T18920-2020), and the redundancy can be used as water for watering and dust suppression on the construction site without discharge, which has little impact on the surface water environment.

5.2.4.3 Seepage of soil drying yard

The earthwork excavated during the river channel dredging of the Subproject shall be dried in the soil drying yard on the flood land first, and a small amount of seepage water is produced during the drying process due to the high moisture content of excavated soil aggregate, with SS as the main pollutant. If discharged directly, the SS concentration in the water body of lower reaches will increase to a certain extent. The evaluation suggests that the seepage water collected in the drying yard should be settled for 8 hours in the sedimentation tank before being discharged into the river, which has little impact on the surface water environment.

5.2.4.4 Domestic wastewater

The domestic wastewater mainly refers to the domestic sewage, bathing sewage, canteen wastewater and fecal sewage generated by construction personnel when living in the construction camp, which is discharged intermittently. There are 31 construction camps in this project, including 18 municipal subprojects. Located in the built-up area of Jiaozuo City, the municipal subprojects do not set up living camps, but only set up production camps, so the construction unit shall rent the surrounding residential buildings for the construction personnel's living. There are 13 water conservancy subprojects, and the construction camp includes production and living areas. According to the survey of the construction site and the local actual situation, centralized water closets will be built in the construction camp, and the construction domestic sewage is mainly the kitchen sewage and bathing sewage discharged by the construction personnel in the daily life, with COD, SS, ammonia nitrogen, animal and vegetable oils as main pollutants. The water quality parameter concentration of domestic sewage is determined according to the domestic sewage of villages and towns, with COD about 350mg/L, 200mg/L for SS, 25mg/L for ammonia nitrogen and 20mg/L for animal and vegetable oil.

Based on the optimization results of the construction camp living area layout, a total of 13 construction camps shall be arranged as living areas in this project. According to the water quota index of Henan Province, the water consumption index during the construction period is 60~99L/(person · d) in consideration of the characteristics of the camp project area, which is calculated by the drainage coefficient of 80%. See Table 5.2-4 below for the specific domestic wastewater discharge of each construction camp.

Table 5.2-4 Summary of domestic wastewater discharges of construction camps

Component	Construction area	Construction period/month	Maximum construction personnel/person	Domestic water/m^3/d	Domestic wastewater/m^3/d	Drainage direction
JZTJ101Dasha River Restoration	1# Camp	16	200	16	12.8	Greening or dust suppression
	2# Camp	16	200	16	12.8	Greening or dust suppression
	3# Camp	16	200	16	12.8	Greening or dust suppression
	4# Camp	16	200	16	12.8	Greening or dust suppression
	5# Camp	16	200	16	12.8	Greening or dust suppression
JZTJ102 Dasha River Restoration in Xiuwu County	1# Camp	16	400	24	19.5	Greening or dust suppression
	2# Camp	16	400	24	19.5	Greening or dust suppression
	3# Camp	16	400	24	19.5	Greening or dust suppression
JZTJ103 Shanmen River Restoration in Xiuwu County	1# Camp	9	300	18	14.4	Greening or dust suppression
	2# Camp	9	300	18	14.4	Greening or dust suppression
JZTJ104 Shanmen River Restoration in Macun District	1# Camp	8	417	41.26	33	Greening or dust suppression
	2# Camp	8	417	41.26	33	Greening or dust suppression
	3# Camp	8	417	41.26	33	Greening or dust suppression

According to the above table, the minimum and maximum domestic sewage discharge of each construction camp during the construction peak period is 12.8m^3/d and 33m^3/d respectively. The construction area of the engineering is linear, and the construction camps are distributed dispersedly. The evaluation suggests that septic tank+integrated sewage treatment facilities and other measures should be taken for the domestic sewage in the construction camp in combination with the local environmental characteristics, the treated wastewater can be reused for the wconstruction production or sprinkled in the site to reduce dust after meeting the building construction water quality standards in *The Reuse of Urban Recycling Water-Water Quality Standard for Urban Miscellaneous Use* (GB/T18920-2020), instead of being discharged outside. The impact of domestic sewage on the surface water environment will disappear with the completion of construction activities, which is a short-term impact. After the implementation of recycling measures, the domestic sewage during the construction period will not affect the environment of the project area.

5.2.4.5 Summary of wastewater treatment measures

See the Table below for wastewater treatment measures of each component.

Table 5.2-5 Summary of wastewater management measures by component

Component		Oil separation sedimentation tank (set)	Oil separator (set)	Septic tank (set)	Integrated treatment facilities (set)
No.	Component				
JZTJ101	Dasha River Restoration	5	5	5	5
JZTJ102	Dasha River Restoration in Xiuwu County	3	3	3	3
JZTJ103	Shanmen River Restoration in Xiuwu County	3	2	2	2
JZTJ104	Shanmen River Restoration in Macun District	3	3	3	3
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	2	/	/	/
JZTJ106	Qunying River Restoration	4	/	/	/
JZTJ107	Urban River Facility Restoration	3	/	/	/
JZTJ110	Upgrading and Construction of Urban Flood Ditches	4	/	/	/
JZTJ112- JZTJ120	Urban Municipal Road Restoration	9	/	/	/
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	4	/	/	/

The oil separation sedimentation tank shall be constructed at the vehicle entrance and exit of the construction area, and the septic tank, oil separator and integrated treatment facilities shall be constructed in the construction camps. During the construction, the construction unit shall strictly implement and maintain the stable operation of the wastewater treatment plant, and the environmental protection department and the construction unit shall supervise it.

5.2.5 Environmental air impact analysis

Air pollution caused by the construction mainly comes from the fugitive dust from earthwork excavation and filling, the construction machinery and transport vehicle exhaust, road dust, bottom mud stench, fume of asphalt pavement, and so on, with TSP, carbon monoxide, nitrogen

dioxide and asphalt fume as main pollutants.

5.2.5.1 Dust from earthwork

Dust generated from earthwork excavation, filling and spoil stacking during construction will have an impact on the local environment near the construction area.

There are two main sources of fugitive dust on the construction site: the first is dust generated from earthwork excavation and filling, and the second is dust generated during concrete mixing. The concrete of the works is purchased commercial concrete, so that dust pollution caused by the concrete mixing can be avoided.

The dust generated from earthwork excavation and filling is related to wind speed and moisture content of dust particles. At the initial stage, the amount of dust generated from earthwork excavation and filling is large in a short time, and the amount of dust in local air will increase; With the increase of earthwork excavation depth, the moisture content of excavated soil is high, the dust volume of earthwork will be greatly reduced after the initial soil is covered up, and the adverse impact on the construction personnel on the site and the nearby residential areas will be reduced.

Refer to the survey and measurement results of dust pollution at construction sites of other municipal projects (at the wind speed of 2.4m/s). The survey and measurement results are shown below.

Table 5.2-6 Construction dust pollution

Construction site	Enclosure condition	TSP concentration at different distances at downwind direction (mg/m^3)					
		20m	50 m	100 m	150 m	200 m	250 m
1#	None	1.54	0.981	0.635	0.611	0.504	0.401
2#	None	1.467	0.836	0.568	0.570	0.519	0.411
3#	Metal coaming	0.943	0.577	0.416	0.421	0.417	0.420
4#	Striped cloth coaming	1.105	0.674	0.453	0.420	0.421	0.417

By comparing the similar projects according to the above table, the construction dust pollution occurs mainly within 200m downwind of the construction site. After taking metal fencing measures, the construction dust downwind is dramatically reduced to make it lower than the TSP concentration at 20m downwind (1.0mg/m^3) as specified in the *Integrated Emission Standard of Air Pollutants* (GB16297-1996).

The construction work of the project locates mainly in the two sides of the construction area, so it may influence the sensitive points in the near distance. The ambient air pollution in the construction period features close influence distance in a small influence area, without any cumulative pollution impact as it stops at the end of the construction period. Therefore, the enclosure should be set up around the construction site, meeting the requirements of no less than 2.5m in height and spraying sprinkler nozzles every 4m at the top of the enclosure. Moreover, the number of dust sprinkling should be increased to reduce the impact of construction dust.

See the following table for dust control measures of each component.

Table 5.2-7 Summary of dust control measures by component

Component		Sprinkling truck (set)	Dust and fog remover (piece)	Automatic vehicle cleaning device (set)
No.	Component			

JZTJ101	Dasha River Restoration	5	5	5
JZTJ102	Dasha River Restoration in Xiuwu County	3	3	3
JZTJ103	Shanmen River Restoration in Xiuwu County	2	2	4
JZTJ104	Shanmen River Restoration in Macun District	3	3	3
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	1	1	2
JZTJ106	Qunying River Restoration	1	1	4
JZTJ107	Urban River Facility Restoration	1	1	3
JZTJ108	Urban Sewer Network Inspection and Restoration (Phase 1)	1	1	1
JZTJ109	Urban Road Facility Restoration Project	1	1	1
JZTJ110	Upgrading and Construction of Urban Flood Ditches	1	1	4
JZTJ111	Flood Control Upgrading of Urban Rivers and Bridges	1	1	1
JZTJ112	North Ring Road (Puji Road-Tabei Road) Restoration	1	1	1
JZTJ113	Shanyang Road (Taihang Road-Jianshe Road) Restoration	1	1	1
JZTJ114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration	1	1	1
JZTJ115	Fengshou Road Restoration	1	1	1
JZTJ116	Minzhu Road Restoration	1	1	1
JZTJ117	Industry Road Restoration	1	1	1
JZTJ118	Jiaowu Road Restoration	1	1	1
JZTJ119	Jianshe Road Restoration	1	1	1
JZTJ120	Jiefang East Road Restoration	1	1	1
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	2	2	4

Construction enclosure and sprinkler

Sprayer

Cover with dust screen

On-site monitoring and monitoring system

Automatic vehicle cleaning device

Slag truck (fully-enclosed)

Based on the feasibility study design data, about 10,177.83t of diesel fuel and 142.87t of gasoline are required for construction machinery and transportation vehicles. With reference to the *Technical Guideline for the Preparation of Air Pollutant Emission Inventory for Non-road Mobile Sources (Trial)*, the average emission coefficients of non-road mobile construction machinery are as follows: 2.09g/kg fuel for particulate matter, 3.39g/kg fuel for HC, 32.79g/kg fuel for NOx, 10.72g/kg fuel for CO kg fuel, 0.01g/kg fuel for sulfur content in gasoline and 0.35g/kg fuel for diesel. The total amount of particulate matter, HC, NOx, CO and SO_2 pollutants that may be generated are 21.57t, 34.99t, 338.41t, 110.64t and 7.13t respectively.

Construction machinery or transport vehicles are mostly large and medium-sized machines with large emission coefficients per vehicle. However, the constructed machinery is decentralized in the scattered construction area, resulting in relatively disperse pollutant emissions. Moreover, the exhaust pollution sources are mostly mobile and intermittent sources during the construction period, with small contribution values to the local air environment. On the basis of monitoring data of similar projects, the 1-hour average concentrations of carbon monoxide and nitrogen dioxide at a distance of 50m from the construction site are 0.2mg/m^3 and 0.13mg/m^3 respectively, and the daily average concentrations are 0.13mg/m^3 and 0.062mg/m^3 respectively. Therefore, they can meet the requirements of the secondary standards in the *Ambient Air Quality Standards* (GB3095-2012).

It is recommended that the construction unit should strengthen the selection of fuel machinery and equipment, adopt the emission standards of National V and above for transportation vehicles and National III and above for construction machinery. Furthermore, the

construction unit should strengthen the daily maintenance of transportation vehicles and construction machinery to ensure that the exhaust emission meets the national standards for reducing fuel exhaust emission.

Construction machinery and transportation vehicles will produce a certain amount of exhaust gas during construction, including CO, NOx, HC and other air pollutants. For reducing the impact of fuel machinery and vehicle exhaust on the environment, the specific mitigating measures are as follows:

(1) During the construction process, it should select construction machinery and vehicles with low energy consumption and low pollution emissions as far as possible, and implement the *Limits and Measurement Methods for Exhaust Pollutants from Diesel Engines of Non-road Mobile Machinery (China Stage III and IV)* (GB20891-2014), the emission control requirements in the Stage V from the *Limits and Measurement Methods for Exhaust Pollutants from Compression Ignition and Gas Fuelled Positive Ignition Engines of Vehicles (III, IV, V)* (GB17691-2005), and *Emission Standard of Air Pollutant for Gasoline Transport* (GB20951-2007).

(2) Strengthen the management and maintenance of the fuel machinery and vehicle and reduce the air pollution due to bad condition of machine and vehicle.

(3) Under the *The Implementation Plan for the 2022 Air Pollution Prevention and Control in Henan Province*: "positively promote the elimination of old cars, steadily conduct the phase-out of diesel trains with emission standards of national four and below, and complete the eliminating task of diesel trucks with emission standards of national three and below; It should speed up the promotion and application of new energy vehicles, and complete the renewal or new sanitation operation vehicles, dump trucks, cement tankers, etc by the end of 2022, except that some reserved emergency vehicles and new energy vehicles cannot meet the use demand. Therefore, this project requires diesel vehicles with emission standards of National V. It is recommended that sanitation trucks, dump trucks and cement tankers be new energy trams.

(4) It should formulate a construction site management system for non-road mobile machinery, develop a management ledger for non-road mobile machinery entering the construction site: Construction units, general contractors and supervisory units (referred to as "three parties participating in the construction") should perform the verification and acceptance duties of non-road mobile machinery mobilization, complete the verification and acceptance form of non-road mobile machinery mobilization, verify the non-road mobile machinery environmental inspection and registration card to achieve the requirement of" a machine has one table and one card. Mobilization verification and acceptance form and related information should be kept on the construction site for inspection.

(5) It should supervise the owners of non-road mobile machinery to carry out regular maintenance of machinery to the surrounding vehicle maintenance institutions (no maintenance center set up for this project), making sure that the exhaust emissions of non-road mobile machinery comply with the emission standards in their use.

(6) It should supervise the owner or user (unit or individual, hereinafter the same) to purchase non-road mobile machinery oil from regular channels, keeping the proof of purchase and a ledger.

(7) The non-road mobile machinery in this project is regularly inspected for pollutant emissions and oil sources, and those non-road mobile machinery that do not meet the emission standards and oil use do not meet the standards are decommissioned.

Following the above measures, it shall ensure the mobilized machinery and equipment can effectively reduce the impact of construction machinery itself on the environment in terms of

equipment itself, oil products, daily maintenance and other measures. Since it is relatively vast in the construction area with relatively small exhaust emissions from construction machinery and transportation vehicles, it is conducive to the dilution and diffusion of pollutants from the exhaust of construction machinery and transportation vehicles at the larger wind speed. Therefore, the pollution from construction machinery and transportation vehicles will have little impact on the air quality of the evaluated area after natural diffusion and dilution in the air.

5.2.5.2 Road dust

In terms of road dust, it mainly comes from two aspects: dust generated by cars driving and increased dust content in the air, caused by improper protection when loading earth materials and other dusty materials for transportation, on both sides of the access road.

The Subproject has 4,869,700 m^3 of earth excavation, 1,544,600 m^3 of soil, 2,973,000 m^3 of concrete and 255,851,000 m^3 of construction waste. The concrete, soil and construction waste are transported through the construction road inside the foot of the embankment in the field connecting to the city municipal road, county road and provincial road. This project has a large volume of earth and concrete transportation. The dust pollution from road transportation will be an important factor to pollute the ambient air, especially in the dry and windy time. Under the law of car road dust diffusion, the amount of road dust caused by car driving is proportional to the car speed at the ground wind speed lower than 4m/s in the dry air, proportional to the car mass and the road surface dust amount. The empirical formula for prediction of car dust amount is as follows:

$$Q = 0.123 \times \frac{V}{5} \times \left(\frac{W}{6.8}\right)^{0.85} \times \left(\frac{P}{0.5}\right)^{0.72}$$

Where:

Q — Dust generated from vehicle driving, kg/km•vehicle;

V — Vehicle speed, km/h;

W — Vehicle dead weight capacity, t;

P — Dust capacity on road surface, kg/m^2.

In the following table, it shows the amount of dust generated by the truck driving under different speed and road cleanliness when carrying 15t through a section of road of 1km in length.

Table 5.2-8 Vehicle dust amounts at different driving speeds and pavement cleanliness levels (unit: kg/km per vehicle)

Vehicle speed (km/h)	P=0.1	P=0.2	P=0.3	P=0.4	P=0.5	P=1.0
5	0.076	0.125	0.167	0.205	0.241	0.397
10	0.107	0.177	0.236	0.291	0.341	0.562
15	0.227	0.374	0.500	0.616	0.723	1.191
20	0.303	0.498	0.667	0.821	0.964	1.588

Table 5.2-3 indicates that, under the same road surface conditions, as the vehicle's speed becomes faster, there is more flying dust. Under the same vehicle speed, as the road surface is more dirty, there is more flying dust.

Based on the experimental results of sprinkling dust reduction in similar projects (see Table

5.2-4 for details), the influencing distance is between 50 and 100 m from the roadside without sprinkling water on the site, whereas the influencing distance is about 35-40m with sprinkling water. Substantially reduce the dust pollution level and influence range of the construction road, the dust reduction by road sprinkling can ensure that the TSP concentration is lower than the TSP concentration at 50m downwind (1.0mg/m^3) as specified in the *Comprehensive Emission Standards Atmospheric Pollutants* (GB16297-1996), and can basically meet the requirements of the *Ambient Air Quality Standards* (GB3095-2012) secondary standard (0.3mg/m^3) at 200m downwind.

Table 5.2-9 Experimental results of dust suppression by sprinkling during construction

Distance (m)		0	20	30	50	100	200
Average concentration in TSP hour (mg/m^3)	No sprinkling water	11.03	2.89	2.10	1.15	0.86	0.56
	Street sprinkler	2.11	1.40	1.05	0.68	0.60	0.29
Dust suppression rate		81%	52%	50%	42%	30%	48%

In this project, the construction roads are mainly the traffic network connecting the river construction area with the existing village and urban trunk roads. The road traffic dust will have certain influence on the sensitive points within 200m along the road, so it is necessary to take dust reduction measures. The evaluation requires that the project transportation vehicles should adopt roof covering or sealing measures as required by Jiaozuo City to avoid spilling on the road. The vehicles should not be faster than 15km/h when passing through the villages, and sprinkling water is regularly applied to the road surface along the road to reduce dust. It can effectively reduce the impact of road dust on the residents on both sides when taking the above measures.

5.2.5.3 Fume of asphalt pavement

The middle asphalt concrete pavement structure is used for urban roads and levee crown flood prevention roads, where asphalt fumes are mainly generated in the process of asphalt boiling, mixing and laying. No asphalt mixing plant is set up in this project, and all the asphalt required is purchased from outside. The project only produces asphalt fumes in the asphalt paving process, with the main pollutants of asphalt fumes and TVOC.

Based on the feasibility of the project, asphalt concrete roads are paved on urban roads and levee crown flood prevention roads. Upon looking up relevant information, the influencing distance of asphalt smoke generated during asphalt paving is generally within 60m. It is required by the evaluation that asphalt pavement should not be operated in the early morning, evening and other relatively poor atmospheric dispersion conditions, so as to reduce the impact of asphalt fumes on sensitive points along the pavement; The asphalt paver shall have good leakproofness and dust removal equipment. Maximum acceptable emission concentration and rate can meet requirements of Comprehensive Emission Standards Atmospheric Pollutants (GB16297-1996). Production equipment shall not have obviously unorganized emissions.

5.2.5.4 Bottom Mud stench

The Subproject dredges Dasha River and Shanmen River and treats Tianjian Ditch, an urban river. Organic matter in the river bottom mud is fermented and decomposed in an anaerobic environment for a long time, forming malodorous gases such as ammonia and hydrogen sulfide. When the project dredging, the bottom mud is disturbed or directly exposed to the air to emit these

malodorous gases to the surrounding environment, forming local malodorous pollution. Sludge malodor has complex components, which is significantly affected by local stacking and dredging season. By comparing similar projects, the bottom mud malodor has a range of influence within 80m, as shown in the following table for the stench intensity.

Table 5.2-10 Impact intensities of bottom mud odor

Distance	Odor intensity	Level
Stacking area	With obvious stench	Level 3
Stacking area 30m	Slight	Level 2
Stacking area 50m	Tiny	Level 1
Beyond 80m	None	Level 0

The dredging volume of Tianjian ditch management project is 17,130 m^3. As Tianjian ditch is located in the urban area of Jiaozuo city, it is recommended that Tianjian ditch remediation project is forbidden to dry in the urban section. During the dredging process, self-dumping trucks are parked nearby to cooperate with the digging machine for operation, so that the dredged bottom mud can be transported to the disposal site at any time for reducing the stacking time of the bottom mud.

In the Subproject, the dredged bottom mud of Shanmen River and Dasha River lower reaches is 1,097,600 m^3, and the dredged bottom mud is transported in a sealed way through the existing levee crown flood prevention road to the sludge drying field for drying. There is no sensitive point distribution in the 80m range of silt drying area after the field investigation. After the sediment layer is dried to a moisture content <60%, it will be transported to the spoil ground through the existing urban roads by fully enclosed trucks. Moreover, the dredging work will be arranged during the non-flood period by scheduling the construction time reasonably. The transportation route of the bottom mud is reasonably planned, without crossing villages, communities and other sensitive targets. After taking the above measures, the impact of stench on sensitive points is relatively small.

Table 5.2-11 Summary of dredging activities

Component No.	Component	Dredging length/km	Dredging volume/10,000 m^3
JZTJ101	Dasha River Restoration	27.9	99.7
JZTJ102	Dasha River Restoration in Xiuwu County	18.025	9
JZTJ103	Shanmen River Restoration in Xiuwu County	5.3	1.06
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	6.596	1.713
Total		57.821	111.473

Sludge drying yard 1

Sludge drying yard 2

Figure 5.2- 1　Mud drying yard of JZTJ101-Dasha River Restoration

Figure 5.2- 2 Mud drying yard of JZTJ103-Shanmen River Restoration in Xiuwu County

Sludge drying yard 1 of Dasha River Restoration in Xiuwu County

Sludge drying yard 2 of Dasha River Restoration in Xiuwu County

Figure 5.2- 3 Mud drying yard of JZTJ102-Dasha River Restoration in Xiuwu County

5.2.5.5 Camp canteen fumes

The Subproject is installed with living service facilities only in 13 construction camps of water conservancy sub-projects, with living canteens. In the peak period of each construction camp, there are 200-400 workers. According to the analogous calculation, the consumption coefficient of edible oil is 5kg/100 people-d, and the maximum consumption of edible oil in construction camps is 20kg/d. After the analogous survey, the volatile amount of oil in different frying conditions in the cafeteria is different, accounting for 2%-4% of the total oil consumption on average. For this evaluation, the amount of oil consumption is 4%, and the amount generated is 0.8kg/d. After the canteen oil smoke is treated by high-efficiency electrostatic oil smoke purifier, the purification efficiency is not less than 90%, then the concentration of oil smoke emitted from the canteen is 0.8mg/m^3. It can meet the standard of Table 1 of *Emission Standard Fume Pollutants from Catering Industry* (DB41/1604-2018). Moreover, it is discharged through the flue higher than the roof of the building, with less impact on the surrounding environment.

5.2.6 Noise impact analysis

During the construction period of this project, the noise mainly is generated from two aspects: the noise generated by the machinery and equipment running in construction and the noise generated by the motor vehicles. According to the Construction machinery and equipment.Noise limits (JG/T 5079.1-1996) and the Earth-moving machinery - Noise limits (GB 16710-2010), the noise sources of construction machinery are listed below.

Table 5.2-12 Summary of noise sources of construction machinery

No.	Construction machinery type	Model and specification	Maximum sound level Lmax(dB)	Characteristics of sound source
1	Single bucket excavator	1m3/2m3	85	Mobile source under unstable state
2	Bulldozer	59kw/74kw/88kw	92	Mobile source under unstable state
3	Crawler tractor	55kw	88	Mobile source under unstable state
4	Road roller	Internal combustion 6-8t	87	Mobile source under unstable state
5	Frog rammer	2.8kw	88	Mobile source under unstable state
6	Vibratory roller	14t	85	Mobile source under unstable state
7	Crane	20t	86	Mobile source under unstable state
8	Dump truck	8t/15t	86	Mobile source under unstable state
9	Diesel dumper	1t	80	Mobile source under unstable state
10	Winch	Double cylinder slow speed 5t	80	Stationary source under unstable state
11	Reinforcement processing system	Φ6-40	80	Stationary source under unstable state
12	Sprinkler	5t	80	Mobile source under unstable state

5.2.6.1 The construction machinery noise

The polluting influence of construction machinery possesses the characteristics of localization, mobility and short duration. Construction noise can be treated roughly as a point source. In accordance with the noise attenuation model of the point source, the noise values at different distances from the source are estimated, with the predicted model as follows.

$$L_2 = L_1 - 20\lg(r_2/r_1) - \Delta L$$

r_1

r_2

Where: L_1, L_2 -- noise value at the distance from the sound source r_1, r_2 (dB);

r_1-- distance from point acoustic source to sound receiving point 1 (m);

r_2-- distance from point acoustic source to sound receiving point 2 (m);

ΔL --the attenuation amount caused by barriers, air absorption, etc. during noise propagation.

Based on the noise prediction model, the noise impact prediction results of the main construction machinery running at full load at different distances during the construction period can be calculated and shown in the following table.

Table 5.2-13 Noise levels of main construction machinery at different distances (dB(A))

Stage	Type of machine	Distance from construction point (m)									
		5	10	20	30	40	50	75	100	150	200
Construction stage	Single bucket excavator	79	73	67	63	61	59	55	53	49	47
	Bulldozer	86	80	74	70	68	66	62	60	56	54
	Crawler tractor	82	76	70	66	64	62	58	56	52	50
	Road roller	81	75	69	65	63	61	57	55	51	49
	Frog rammer	82	76	70	66	64	62	58	56	52	50
	Vibratory roller	79	73	67	63	61	59	55	53	49	47
	Crane	80	74	68	64	62	60	56	54	50	48
	Dump truck	80	74	68	64	62	60	56	54	50	48
	Diesel dumper	74	68	62	58	56	54	50	48	44	42
	Winch	74	68	62	58	56	54	50	48	44	42
	Reinforcement processing system	74	68	62	58	56	54	50	48	44	42
	Sprinkler	74	68	62	58	56	54	50	48	44	42
Standard limit (day/night)		70/55									

In light of the above table results, it can be concluded that the construction machinery can reach the standard limit value at 40m away from the construction site during daytime and 200m away from the site during nighttime, in combination with the requirements of *Emission standard of Environment Noise for Boundary of Construction Site* (GB12523-2011). The project is mainly constructed during daytime (from 6:00 to 22:00), and it mainly affects the sensitive targets within 50m of the project boundary during the construction period, including 64 sensitive points of sound environment, such as Shilin Village, Jiaozhu Coal Senior Technical School, Huiyuan District, Jinhua South Court of Dongyu Village, Jiaozhu Information Technology School, Keyi Home, Family House of the Industrial and Commercial Bureau, New Lifeng Village, Lifengsan Village, Jiaozhu Longfa District, Zhengda Huahe Court, etc. (see Table 5.1-1 for details). To mitigate the impact of construction equipment on the quality of the surrounding acoustic environment, it is required that

(1) Control noise source

Low noise machinery and equipment should be used as far as possible, the machinery not in line with national standards should be prohibited from its mobilization into construction; Machinery and equipment with high vibration should be equipped with shock absorbing seat to reduce noise. There should also be frequent maintenance of equipment during construction to prevent the increased noise as a result of deterioration of equipment performance.

(2) Adjust the construction schedule reasonably

With a short-term construction noise impact, the night construction will disturb the residents

along the line nearby. Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.

(3) Lay out the construction reasonably

Determine reasonable construction site boundaries for the reasonable layout of the construction site according to the *Emission standard of Environment Noise for Boundary of Construction Site*. For instance, the fixed vibration sources at the construction site are relatively concentrated and kept away from the environmentally sensitive points as far as possible to minimize the impact; The fixed mechanical equipment such as air compressors and generators are placed in temporary rooms at the construction site, where sound insulation panels are installed to reduce the noise.

5.2.6.2 Traffic and transportation noise

Construction transportation noise is a mobile sound source, which is related to traffic flow, vehicle type, speed, road condition, etc. The Subproject is divided into the central city subproject and the suburban river road subproject. The former is transported through the existing municipal road network, while the main transport road of the latter is set up along the inner side of the embankment. According to the project feasibility study, the total transport volume during the construction period is 5,897,200t/year, and the traffic density is 45 vehicles/one-way per hour, the speed is controlled within 30km/h during the day and 15km/h at night, and medium-sized trucks (15t) are mainly used. According to the *Technical Guidelines for Noise Impact Assessment* (HJ2.4-2021) Appendix B, the following prediction model is selected for this traffic noise.

$$L_{eq}(h)_i = \left(\overline{L_{oE}}\right)_i + 10\lg\left(\frac{N_i}{V_i T}\right) + 15\lg\left(\frac{7.5}{r}\right) + \log\left(\frac{\psi_1 + \psi_2}{\pi}\right) + \Delta L - 16$$

Where: $L_{eq}(h)_i$ —hourly equivalent sound level of vehicle type I, dB (A);

$\left(\overline{L_{oE}}\right)_i$ —The vehicle type I has an average energy sound level A at the speed of Vi (km/h) and the horizontal distance of 7.5m, with daytime $\left(\overline{L_{oE}}\right)_i$ =74.3dB (A) and nighttime $\left(\overline{L_{oE}}\right)_i$ =62.8dB (A);

N_i —Average hourly traffic flow of vehicle type I passing through a prediction point day and night, vehicle/h;

r —distance from center line of the lane to the prediction point, m; $r >$ 7.5m;

V_i —average speed of vehicle type I, km/h;

T —equivalent sound level time for calculation, 1h;

ψ_1, ψ_2 —field angle and radian from prediction point to two ends of section of limited length;

ΔL -allowance caused by other factors, dB (A),

$\Delta L = \Delta L_1 - \Delta L_2 + \Delta L_3$

$\Delta L_1 = \Delta L_{\text{Inclination}} + \Delta L_{\text{Highway}}$

ΔL_2 =Aatm+Agr+Abar+Amisc

Where: ΔL_1—allowance caused by factors of line, dB(A);

ΔL Inclination-allowance of longitudinal slope in the highway, dB(A);
ΔL Highway-allowance caused by highway pavement materials, dB(A);

ΔL_2 —attenuation caused by sound wave propagation path, dB(A);

ΔL_3 —allowance caused by reflection, dB (A).

According to the survey, a perfect urban road network has been built in the area where the project is located, with provincial highways S306 and S308 running east-west and S234 and S233 running north-south under good transportation conditions. During the construction period, bulk materials, abandoned earth and rock, construction waste and machinery and equipment are mainly transported in the east-west direction on S306 and S308, and in the north-south direction on provincial road S234 and S233, in addition to county and village roads, village roads or temporary construction roads. Provincial and city roads have a large traffic flow, and this project has limited impact on their traffic noise. The noise impact of transportation vehicles during the construction period covers mainly the county and township roads, village roads and temporary construction access roads connecting provincial and city roads in the construction area.

JZTJ108-JZTJ120 is transported on the existing municipal roads, without new temporary roads. The rest of the subprojects are built with temporary construction roads, as shown in the following table.

Table 5.2-14 Summary of temporary roads

Component No.	Component	Temporary construction road length	Location	Construction schedule	Remarks
JZTJ101	Dasha River Restoration	27.9km	Along both banks of the river	16 months	Make use of existing levee crown flood prevention road
JZTJ102	Dasha River Restoration in Xiuwu County	18.025km	Right bank of Dasha River in Xiuwu County	16 months	Make use of existing levee crown flood prevention road
JZTJ103	Shanmen River Restoration in Xiuwu County	5.3km	Right bank of Shanmen River in Xiuwu County	9 months	Build newly the top of the levee crown flood prevention roads in 4.9km, utilizing the existing levee crown flood prevention roads in 0.4km
JZTJ104	Shanmen River Restoration in Macun District	5.17km	Along both banks of the river	8 months	New roads: Cemented gravel pavement structure, at the width of 4m
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	2.525km	River bottom and along the river bank	9 months	New roads: Cemented gravel pavement structure, at the width of 4.5m
JZTJ106	Qunying River Restoration	5.578km	River bottom and along the river bank	12 months	New roads: Cemented gravel pavement structure, at the width of 4.5m
JZTJ107	Urban River Facility	0.784km	River bottom and along the river	6 months	New roads: Cemented gravel pavement structure, at the

Component No.	Component	Temporary construction road length	Location	Construction schedule	Remarks
	Restoration		bank		width of 4.5m
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	8.03km	Arranged along both banks of the river	9 months	New roads: Bulldozed and compacted by bulldozers, at the width of 6m

Comparing with similar river management projects, ΔL=6 dB (A), ψ1+ψ2=Π. The predicted results of traffic noise on the sensitive impact along the transport road are shown below.

Table 5.2-15 Summary of noise forecast results of transport noise (dB(A))

Distance / Sound level value	Distance from the road centerline (m)										
	10	20	25	30	40	50	60	80	120	160	200
Predicted value (daytime)	65.5	61.0	59.5	58.3	56.5	55.0	53.8	51.9	49.3	47.4	46.0
Predicted value (nighttime)	57.6	53.1	51.6	50.4	48.6	47.1	45.9	44.1	41.4	39.5	38.1
Area of class 1 (daytime/nighttime)	55/45										
Area of class 2 (daytime/nighttime)	60/50										

As shown in the above table, it can meet the daytime standard for Class 2 and Class 1 of *Environmental Quality Standards for Noise* (GB3096-2008) from 50 meters and 25 meters away along the construction transportation route; It can meet the nighttime standard for Class 2 and Class 1 of *Environmental Quality Standards for Noise* (GB3096-2008) from 80 meters and 40 meters away along the construction transportation route. Since the noise impact of construction transportation is too great at night, it should be reasonably arranged to prohibit nighttime transportation. Within 50m of the construction transport route, there are 52 sound sensitive points including Yanhe Village, Jiaozhu Coal Senior Technical School, Huabao Zhongxin Municipal Family Yard, New Lifeng Village, New Tazhang Village, Tianjian New District, Hengyu Community, Lifengsan Village, Tianjian Village, etc. (see Table 5.1-1 for details). To minimize the impact on these sensitive points, it is recommended that the construction unit take the following noise prevention and control measures.

(1) Noise source control

The vehicles used must comply with the *Limits of Noise Emitted by Stationary Road Vehicles* (GB16170-1996) and *Allowable Noise Limits for Motor Vehicle* (GB1495-79); It shall strengthen road maintenance and vehicle maintenance to reduce noise sources; It shall prohibit vehicles from overloading transportation to reduce the noise level.

(2) Arrange transport routes and transport time reasonably

With the reasonable selection of transport routes, it should be as far away as possible from villages, towns, schools, etc. The transport route of the river subproject shall not cross villages, and the vehicle shall be slowed down (speed 15km/h) and banned from sounding the horn when going through villages if it cannot be detoured. Depending on the construction progress, arrange the transportation time reasonably and prohibit night transportation vehicles.

5.2.7 Solid waste

5.2.7.1 Domestic Wastes

According to the statistical data, the daily production of domestic garbage for construction personnel is 0.5kg per capita, and the amount of domestic garbage generated is 2105.5kg/d during the peak construction period of the project. The amount of domestic waste generated in each construction area is shown below.

Table 5.2-16 Summary of domestic waste generated by construction camps

Component	Construction area	Construction period/month	Maximum construction personnel/person	Domestic waste /kg/d	Domestic Wastes /t	Whereabouts after disposal
JZTJ101 Dasha River Restoration	1# Camp	16	200	100	48	Collected by environmental sanitation department and sent to Jiaozuo Landfill for sanitary landfill
	2# Camp	16	200	100	48	
	3# Camp	16	200	100	48	
	4# Camp	16	200	100	48	
	5# Camp	16	200	100	48	
JZTJ102 Dasha River Restoration in Xiuwu County	1# Camp	16	400	200	96	
	2# Camp	16	400	200	96	
	3# Camp	16	400	200	96	
JZTJ103 Shanmen River Restoration in Xiuwu County	1# Camp	9	300	150	40.5	
	2# Camp	9	300	150	40.5	
JZTJ104 Shanmen River Restoration in Macun District	1# Camp	8	417	208.5	50.04	
	2# Camp	8	417	208.5	50.04	
	3# Camp	8	417	208.5	50.04	
Total		/	/	2025.5	759.12	

As shown in the above table, the domestic waste in the construction area will be collected by the environmental sanitation department and sent to Jiaozuo Landfill for sanitary landfill, so there will be no environmental impact from the disposal of domestic waste.

By investigation, the *Environmental Impact Report of Jiaozuo Municipal Domestic Waste Treatment Project (970t/d) Project*, EIA report of Jiaozuo Landfill, was approved by Henan Province Ecology Department in 2006 with the YHS No. [2006] 198 for approval, and Jiaozuo Landfill has been put into operation with the treatment capacity of 970t/d.

5.2.7.2 Disposal of rocks and soils

Under the balance of soil and rock in the project feasibility study, the total amount of soil disposal (including the amount of dredged bottom mud) is about 3,452,653,000 m^3, commissioned to Jiaozuo Bencheng Construction Engineering Co., Ltd. and Xiuwu County Ningyi Environmental Sanitation Service Co., Ltd. to transport to the spoil ground. The spoil ground can accommodate all the dumped soil of the project, and the dumped soil will be re-farmed according to the requirements after backfilling.

The abandoned stone generated from this project is about 37,800 m3 in total, commissioned

to Jiaozuo Bencheng Construction Engineering Co., Ltd. to be delivered to Jiaozuo Qianye New Materials Co., Ltd. for disposal. By investigation, Jiaozuo Qianye New Materials Co., Ltd. is located in the north of Shandi Village and west of Ximiaoqian Village, within the jurisdiction of the street office of Anyangcheng, Macun District, Jiaozuo City. At the south of Qianye Cement Mine, it is mainly utilized limestone, lump stone, sand and other raw materials for the production of fine aggregates and commercial concrete, requiring about 7,274,100 m^3/a of limestone material and lump stone material at a production scale of 2,500tph of fine aggregates and 800,000 m^3/a of commercial concrete. The project's EIA report was approved by the Ecological Environment Bureau of Macun District in January 2019 (MHS No. [2019] 7) and was completed and accepted in July 2020. Therefore, Jiaozuo Qianye New Materials Co., Ltd. is able to accommodate all the discarded rocks of this project for disposal.

In the Subproject, the waste soil and slag will be transported to the spoil ground by Jiaozuo Bencheng Construction Engineering Co., Ltd. and Xiuwu County Ningyi Environmental Sanitation Service Co., Ltd. Based on the field investigation and communication, there are 10 spoil grounds set up in this project. The proposed spoil grounds can accommodate all the soil discarded in this project, and the vegetation will be restored as required after backfilling. See Table 5.2-15 for details of the spoil grounds.

Table 5.2-17 Summary of spoil transport agencies and destinations

Component No.	Component	Quantity of the abandoned earth 0,000 m^3	Transportation agencies	Destination	Spoil ground Location	Land Area of Spoil Ground Area (mu)	Distance
JZTJ101	Dasha River Restoration	135.47	Jiaozuo Bencheng Construction Engineering Co., Ltd.	Renmin Road spoil ground	Pit at the northeast corner of the intersection of Renmin Road and Dasha River	180	≤4km
JZTJ102	Dasha River Restoration in Xiuwu County	41.55	Xiuwu County Ningyi Environmental Sanitation Service Co., Ltd.	Beiqiao spoil ground	Pit at 530m north of the Beiqiao	30	≤0.1km
				Changqiao spoil ground	Pit at 670m northwest of Changqiao	15	≤0.3km
				Wa Village spoil ground	Spoil ground at 770m north of Wa Village	140.5	≤0.2km
JZTJ103	Shanmen River Restoration in Xiuwu County	10.42	Xiuwu County Ningyi Environmental Sanitation Service Co., Ltd.	Hebei Xinzhuang spoil ground	Pit at 290m north of Hebei Xinzhuang	7.5	≤1km
				Wa Village spoil ground	Spoil ground at 770m north of Wa Village	56.9	≤1.5km
JZTJ104	Shanmen River Restoration in Macun District	82.97	Jiaozuo Bencheng Construction Engineering Co., Ltd.	Spoil ground at the curved straightening of the upper reaches of	Pit at 650m northwest of Shandi Village	37.49	≤1km

				river channel			
				Spoil ground 1 in the north of Majie Village	Quarry at 680m northwest of Majie Village	38	≤10km
				Spoil ground 2 in the north of Majie Village	Quarry at 260m northwest of Majie Village	80	≤10km
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	1.23	Jiaozuo Bencheng Construction Engineering Co., Ltd.	Beishan spoil ground (Houyugou)	Quarry at 560m north of Jiao Po	Designated disposal site by Jiaozuo Municipal Government	≤7km
JZTJ106	Qunying River Restoration	13.22					≤10km
JZTJ107	Urban River Facility Restoration	0.59					≤10km
JZTJ110	Upgrading and Construction of Urban Flood Ditches	11.67					≤10km
JZTJ111-JZTJ120	Urban Municipal Road Restoration	5.4053					≤10km
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	42.74					≤15km

In this project, the spoil ground in the north of Majie Village and four spoil grounds including the Beishan spoil ground (Houyugou) are located within the protected area of the North Mountain area. In accordance with the *Master Plan for Ecological Environmental Protection and Utilization of North Mountain of Jiaozuo City (2017-2035)*, it's listed as follows.

(1) Planning scope

The planning scope of Jiaozuo City Beishan: To the eastern boundary of Jiaozuo City in the east, to the western boundary of Jiaozuo City in the west, to the northern boundary of Jiaozuo City in the north, to Jiaohui Road, Nanshan Road, Yingshi Road, Jiaoque Road and Jiaoliu Railway in the south. The total area is 823.4km^2, of which the mountain area to the north of the foot line is 724.35km^2 and the plain area to the south is 99.05km^2.

(2) Ecological protection zone

Protection Zone I: It is mainly situated in the deep mountain area of Beishan in an area of 70.35km^2, accounting for 8.54% of the total land area of Beishan. It includes the core and buffer areas of Taihang Mountains Macaque National Nature Reserve, water source protection areas (Qunying Reservoir, Danhe Water, Qingtianhe Reservoir, Maanshi Reservoir, Qinglongdong Reservoir and Shanwangzhuang Reservoir), special protection areas of Yuntai Mountain, Qingtian River and Shennong Mountain Scenic Spot, forest land with protection level I and important areas of ecological functions in ecological evaluation.

Protection Zone II: It is mainly located in the peripheral areas and low-mountain zones of the protection zone I in an area of 169.39km^2, accounting for 20.57% of the total land area of Beishan.

It includes the experimental area of Henan Taihang Mountains Macaque National Nature Reserve, the first-class protected area of Yuntai Mountain Scenic Spot, national and provincial forest parks (Yuntai Mountain National Forest Park, Jiaozuo Provincial Forest Park, Longxiang Provincial Forest Park, Jinjialing Provincial Forest Park), Yuntai Mountain World Geological Park, state-owned forest farms (state-owned Xiuwu Forest Farm, state-owned Jiaozuo Forest Farm, state-owned Boai Forest Farm, state-owned Shuangtai Forest Farm) and national and provincial cultural relics protection units.

Protection Zone III: The area within the Beishan area, excluding other areas of protection zone I and II, covers 583.66km^2, accounting for 70.89% of the total land area of Beishan.

(3) Protection and control measures

① Protection Zone I:

◆ All development and construction as well as production and business activities, irrelevant to ecological environment, are prohibited in the Protection Zone I.

◆ The tourist visitors are not allowed to enter the nature reserves (Taihang Mountains Macaque National Nature Reserve) and scenic spots (Yuntai Mountain, Qingtian River, Shennong Mountain) in the first category of protected areas, except for the approved scientific research and management personnel to carry out protection and scientific research activities.

◆ Should it be necessary for the original residents in the core and buffer zones of the nature reserve (Taihang Mountains Macaque National Nature Reserve) to move out, the local government where the nature reserve (Taihang Mountains Macaque National Nature Reserve) is located shall properly resettle them.

◆ Such infrastructure as communications and power grids should be built prudently if possible. If it must be built through them, it should conform to the planning of the nature reserve (Taihang Mountains Macaque National Nature Reserve), and conduct a thematic evaluation of the impact of the reserve for approval in accordance with the law. New roads, railroads and other infrastructure should not pass through the core area of the nature reserve (Taihang Mountains Macaque National Nature Reserve), while avoiding the buffer zone as far as possible.

② Protection Zone II

◆ It is forbidden to cut into the mountains, quarry, mine, open up the land, build the graves to erect monuments and other activities that damage the topography, vegetation and landscape, as well as to build projects and facilities that are incompatible with its carrying capacity of the ecological environment in Protection Zone II.

◆ In the Protection Zone II, existing roads and related facilities, in compliance with the planning of the nature reserve (Taihang Mountains Macaque National Nature Reserve) and scenic area planning and the thematic evaluation of the impact of the protected area, can be retained and continue to be used.

◆ It is only appropriate to carry out ecological sightseeing activities in the scenic spots located in the Class II protected areas (Yuntai Mountain, Qingtian River, Shennong Mountain), whose visitor capacity should be strictly controlled. Except for the placement of necessary pedestrian roads, resource protection, ecological restoration, scenic rest, ecological toilets, visitor safety and other facilities, it is strictly forbidden to build structures that are not related to landscape protection and appreciation. It is not allowed to set up lodging beds, while those already built should be gradually evacuated. The natural resources must be preserved in their original form, including natural topography, mountains, water bodies, rocks, soil, plants, animals, etc. Necessary protection facilities and maintenance measures can be set up for human resources as appropriate, and visitor capacity is strictly controlled.

◆ The forest land of forest parks (Yuntai Mountain National Forest Park, Jiaozuo City Provincial Forest Park, Longxiang Provincial Forest Park, Jinjialing Provincial Forest Park) in the protection zone II can be subject to occupation, expropriation, requisition for development and construction projects when necessary. However, it is necessary to handle the occupation, expropriation, requisition or transfer procedures in accordance with the *Law of the People's Republic of China on Forest* and its implementation rules and other relevant provisions, report it to the government for approval according to the statutory approval authority, and pay the relevant fees.

◆ The forest land of state-owned forestry in the protection zone II (state-owned Xiuwu Forestry, state-owned Jiaozuo Forestry, state-owned Boai Forestry, state-owned Shuangtai Forestry) can be occupied for development and construction projects in accordance with the law if necessary, but it requires a feasibility assessment work of state-owned forestry management agencies of forestry departments above the provincial level to participate in project establishment.

③ Protection Zone III

◆ It should give priority to increasing the greening area and moderately developing ecological tourism in the Protection Zone III, and can carry out necessary village and town construction and development and construction conforming to the requirements of environmental protection, etc.

◆ The construction projects in the scenic spots of the three types of protected areas are required to comply with the plan. It is necessary to submit and approve in strict accordance with the prescribed procedures, and those with incomplete procedures shall not be organized and implemented. It is strictly forbidden to cut into the mountains, deforestation, mining and blasting activities.

◆ Quarry (sand) field and borrow yard supporting linear engineering, such as highway, railroad, communication, electric power, oil and gas pipeline, and water conservancy, hydropower and waterway projects shall not be used on forest land in the state forest land of protected forest land Class II in accordance with the main construction project.

Located in the North Mountain Protected Area, some of the spoil grounds in this subproject are of the Protection Zone III, all of which are quarriess and gullies as they are. The abandoned soil generated by the subproject is transported to the spoil ground and backfilled for ecological restoration; It can fulfill the requirements of the *Master Plan for Ecological Environmental Protection and Utilization of North Mountain of Jiaozuo City (2017-2035)*. Meanwhile, it will strictly implement the pollution prevention measures proposed in the EIA during the construction period to reduce the impact on the northern mountain area.

Located in the North Mountain Protected Area, some of the spoil grounds in this subproject are of the Protection Zone III, all of which are quarriess as they are. The abandoned soil generated by the subproject is transported to the spoil ground and backfilled for ecological restoration; It can fulfill the requirements of the *Master Plan for Ecological Environmental Protection and Utilization of North Mountain of Jiaozuo City (2017-2035).* Meanwhile, it will strictly implement the pollution prevention measures proposed in the EIA during the construction period to reduce the impact on the northern mountain area.

5.2.7.3 Construction waste

In the subproject, the construction waste mainly includes the abandoned slurry masonry removed from the river restoration project, concrete of hydraulic structures, concrete roadbed material from the broken road surface of the urban water-damaged road restoration project. The demolition of slurry masonry is carried out manually with steel brazing. Any quality of slurry

masonry that meets the requirements during the demolition process is reused, while the rest that does not meet the quality requirements and the abandoned concrete are disposed of as construction waste.

In the preliminary design of the subproject, the construction waste generated by the project is 255,851,000 m^3, proposed to entrust to Jiaozuo Bencheng Construction Engineering Co., Ltd. and Xiuwu County Ningyi Environmental Sanitation Service Co., Ltd. to transport them to Boao New Building Materials Factory in Xiuwu County, Jiaozuo Haoda Building Materials Co., Ltd. and Jiaozuo Weitai Environmental Protection Building Materials Co., Ltd. for comprehensive utilization. The construction waste will not cause any environmental impact.

Table 5.2-18 Summary of construction waste transport agencies and destinations

Component No.	Component	construction waste 10000 m^3	Transportation agencies	Destination		Distance
				Name	Location	
JZTJ102	Dasha River Restoration in Xiuwu County	0.08	Xiuwu County Ningyi Environmental Sanitation Service Co., Ltd.	Boao New Building Materials Factory in Xiuwu County	South of Jiaozhuang Village, Sianfeng Town, Xiuwu County	≤7km
				Jiaozuo Weitai Environmental Protection Building Materials Co., Ltd. for comprehensive utilization	North of Ligu Village, Wuliyuan Township, Xiuwu County	≤6km
JZTJ103	Shanmen River Restoration in Xiuwu County	0.04		Boao New Building Materials Factory in Xiuwu County	South of Jiaozhuang Village, Sianfeng Town, Xiuwu County	≤8km
				Jiaozuo Weitai Environmental Protection Building Materials Co., Ltd. for comprehensive utilization	North of Ligu Village, Wuliyuan Township, Xiuwu County	≤12km
JZTJ101	Dasha River Restoration	7.54	Jiaozuo Bencheng Construction Engineering Co., Ltd.	Jiaozuo Weitai Environmental Protection Building Materials Co., Ltd. for comprehensive utilization	Xiaoyangzhuang Village, Wenchang Sub-district Office, Jiaozuo New Area	≤21km
JZTJ104	Shanmen River Restoration in Macun District	0.4				≤20km
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	0.93				≤7km
JZTJ106	Qunying River Restoration	0.41				≤12km
JZTJ107	Urban River Facility Restoration	0.09				≤10km
JZTJ108	Urban Sewer Network Inspection and Restoration (Phase 1)	0.086				≤10km
JZTJ109	Urban Road Facility	0.27				≤10km

Component No.	Component	construction waste 10000 m^3	Transportation agencies	Destination		Distance
				Name	Location	
	Restoration					
JZTJ110	Upgrading and Construction of Urban Flood Ditches	0.46				≤14km
JZTJ111	Flood Control Upgrading of Urban Rivers and Bridges	0.726				≤10km
JZTJ112	North Ring Road (Puji Road-Tabei Road) Restoration	1.151				≤8km
JZTJ113	Shanyang Road (Taihang Road-Jianshe Road) Restoration	0.897				≤6km
JZTJ114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration	1.799				≤12km
JZTJ115	Fengshou Road Restoration	1.9791				≤13km
JZTJ116	Minzhu Road Restoration	1.919				≤10km
JZTJ117	Industry Road Restoration	3.499				≤10km
JZTJ118	Jiaowu Road Restoration	0.001				≤12km
JZTJ119	Jianshe Road Restoration	0.671				≤12km
JZTJ120	Jiefang East Road Restoration	0.897				≤6km
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	1.74				≤12km

By investigation, Jiaozuo Weitai Environmental Protection Building Materials Co., Ltd. covers an area of 160 mu with an annual construction waste treatment capacity of 1.2 million m^3. It has been put into operation, whose main treatment technologies are to make hollow brick, roadside stone, colorful ground brick, slope protection stone, roadside stone and other products after crushing, sorting, iron removal, feeding, mixing and prefabrication to meet the construction waste treatment requirements of the subproject.

Boao New Building Materials Factory in Xiuwu County and Jiaozuo Haoda Building Materials Co., Ltd. focus on the production of recycled aggregates made from construction waste, with an annual processing capacity of 900,000 m^3 of construction waste. It has been completed and put into operation. The main treatment techniques are to produce recycled aggregates from construction waste by jaw breaking, iron removal, coarse breaking, screening, fine breaking, mixing and other processes, and it can meet the requirements of construction waste treatment for the subproject.

5.2.7.4 Sludge from the pipe network

(1) Generation and disposal

Based on the engineering feasibility study, the Urban Sewer Network Inspection and Restoration of the Subproject is 1379.6m^3 (85% water content). Among them, the pipes are dredged and desilted by joint dredging and sewage tank trucks, while the drainage culverts, covered drains, rainwater outlets and inspection wells are dredged by manual and mechanical dredging. The sludge generated from dredging shall be screened and dehydrated to 60% moisture content by a mobile sewage dehydration vehicle, the waste water shall be discharged into the urban sewage system, other screened large-particle gravels and wastes shall be delivered to the urban waste treatment plant for treatment, and the disposal of sludge from the pipe network will not influence the environment.

According to the accounting, the dehydrated sludge of the Urban Sewer Network Inspection and Restoration is about 517.3m^3 (calculated based on 60% water content) in total, then the mud cakes are delivered to the sludge disposal center for disposal, and the waste water is discharged into the urban sewage system for treatment and recycling.

(2) Treatment operation of the sludge treatment center

Located in the southwest of Yanma Village, Macun District, Jiaozuo City, the sludge treatment center breeds earthworms with the sludge produced from the domestic sewage plant as main raw material and livestock and poultry breeding feces as batching and accessories. The earthworms are sold as high-quality protein feeds, medicinal materials or fish baits, and the produced wormcast can be sold for comprehensive utilization as a soil improvement fertilizer.

At present, the sludge disposal center can use Level 2 earthworms to treat domestic sludge directly, and after treatment, the contents of nitrogen, phosphorus and potassium increase significantly, making the alkaline soil close to neutral, which is beneficial to the growth of crops and vital activities of propagation of beneficial microorganisms in the soil. The enzymes produced from the growth of earthworms can convert soil nutrients and organic matters into organic compound fertilizers and high proteins, and the earthworm cast can provide the soil with rich beneficial microbial populations to reduce crop pests, and provide necessary amino acid, protein, phosphorus, calcium and other nutrient elements for the growth of crops to greatly increase the soil fertility.

Current situation of the sludge disposal center

Growth situation of earthworms recently

(3) Measures for security risk prevention in the dredging process of urban drainage pipeline

The internal space of the urban drainage pipeline is small, in which the air flow is slow and there may be a lot of inflammable, explosive, poisonous and harmful gases. Therefore, attention shall be paid to the safety operation during the cleaning and dredging process of sewage pipelines, and in particular, when manual access to the pipeline is required, the safety rules shall be specially abided by. The sewage discharge pipeline dredging is a space-limited operation, which can be executed according to relevant provisions in the *Regulations on Safety Management for Space-limited Operation in Hebei Province* (issued in HBSGFL [2020] No. 4 Decree):

① Before implementing space-limited operations, isolation measures shall be taken around the operation site, striking warning signs shall be set, space-limited exits/entrances shall be maintained smooth, and the operation environment, equipment and facilities, personal protective equipment, tools and instruments as well as emergency rescue equipment and materials shall be inspected, to ensure that they comply with the requirements of relevant standards and operating specifications.

② Before and during the implementation of space-limited operations, ventilation measures shall be taken to ensure that the oxygen content in the limited space always meets the national standards. It is strictly prohibited to use pure oxygen for ventilation and air change.

③ Within 30 min before the operation, the concentration and other indicators of the oxygen content, poisonous and harmful gases as well as combustible gases, explosive dust and other flammable and explosive substances in the limited space shall be inspected according to the national standards or industrial standards. Different heights (depths) and locations in the limited space shall be selected for inspection to ensure the scientific and balanced sampling, and the inspection time, inspection site, gas type and inspection concentration shall be recorded faithfully. The inspection results shall be promptly notified or copied to the leader or the supervisory personnel of the operation site. If not inspected or inspection failed, no personnel is allowed to operate. If the operation is really necessary, external control, robot operation and other methods shall be adopted to replace manual operation.

④ Operating personnel shall wear safety belts, life ropes, as well as isolated respiratory protective equipment that meet the national standards or industrial standards during the operation to prevent unexpected dangers.

⑤ Smoking and any other open fires are strictly prohibited around the sewage pipes and sewage wells, to prevent flammable gas from burning and causing explosions. When operating in

the well, attention shall be paid to avoid sparks caused by friction or collision, and obvious no-smoking signs shall be set by the construction unit.

⑥ Before construction, it shall be recommended to print and issue the safety manual to clearly specify the operation scheme, the possible hazardous factors on the operation site and the prevention and control measures, ensuring everyone has a copy. The related training and safety warning education shall be regularly carried out for safety disclosure. Safety disclosure shall be made during the shift of the space-limited operation.

⑦ In the process of operation, if the operating personnel are in no condition, or the concentration of any poisonous and harmful gas exceeds the limit value, or other circumstances not suitable for continued operation appear, the operating personnel have the right to immediately evacuate and report to the person in charge of the site. The person in charge of the operation site shall decide to immediately stop the operation and evacuate the personnel.

5.2.8 Traffic impact

The traffic impact caused by the Subproject involves 17 bridges and 9 urban roads. According to the field investigation, the traffic conditions around the involved construction bridges and urban roads are convenient, and during the temporary closing of bridges and roads in the construction period, detour schemes can be adopted to relieve the traffic, as detailed in Figure 5.2-4.

In order to reduce the traffic interruption impact due to the construction period, the following field management measures are adopted under the premise of implementing traffic dispersion:

(1) Security isolation

Closed management shall be carried out for the construction area. Color plate separating walls shall be used to isolate the construction area and the traffic roads to avoid mutual interference between construction and traffic. Meanwhile, the construction unit shall reduce enclosures as far as possible if conditions permit, to reduce the impact of the construction on the urban traffic.

(2) Traffic guidance

Guideboards are set in front of the crossroads, change crossings, overhead passage openings, and temporarily occupied roads to inform the vehicles of the road conditions, lanes, speed limits, warnings and other information required to enter the construction site, and guide the vehicles to pass safely. In order to ensure the smooth road traffic of the construction section, the employer of each component shall be responsible for contacting the local traffic police departments to strengthen the traffic dispersion by increasing the police forces, extending the working hours and other means at the construction section, to ensure that no significant congestion occurs.

(3) Settings of traffic signs for construction roads

"Road word ahead, please slow down" safety (reflectorized paint) signs and warning signs shall be set on the right side of the vehicle direction of the motor vehicle lane at both ends of the construction site.

(4) Traffic coordination

The construction unit shall increase the coordination with the urban traffic department and add personnel for traffic guidance and dispersion at the main traffic intersections entering the construction area and in special working places. Mobile tool type enclosures and safety warning signs shall be set for parts requiring temporary enclosures, and isolation measures shall be taken for dangerous and important parts of the Subproject.

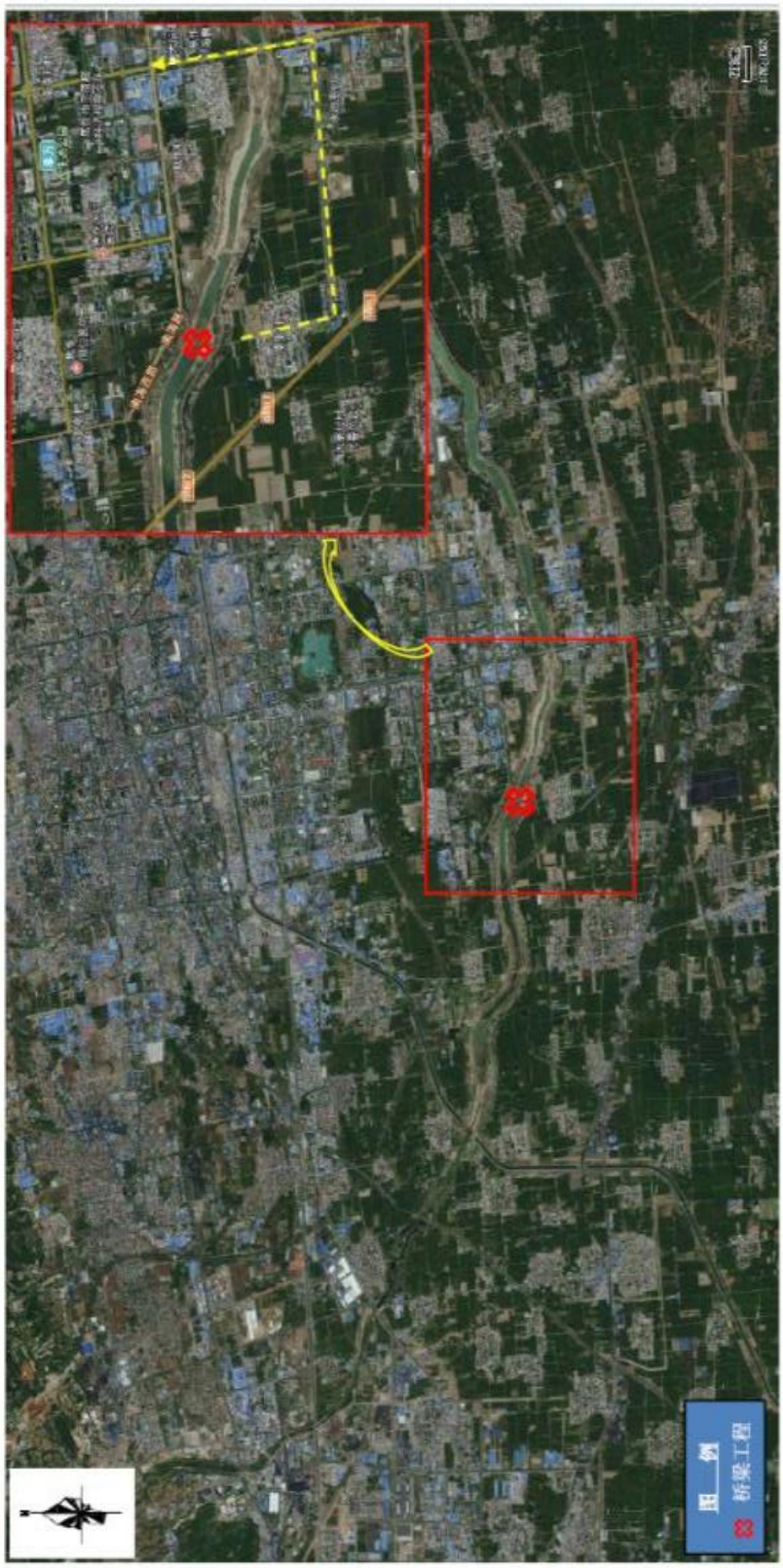


Figure 5.2-4.1 Distribution of bridge works in JZTJ101

Figure 5.2-4.2 Distribution of bridge works in JZTJ102

Figure 5.2-4.3 Distribution of bridge works in JZTJ103

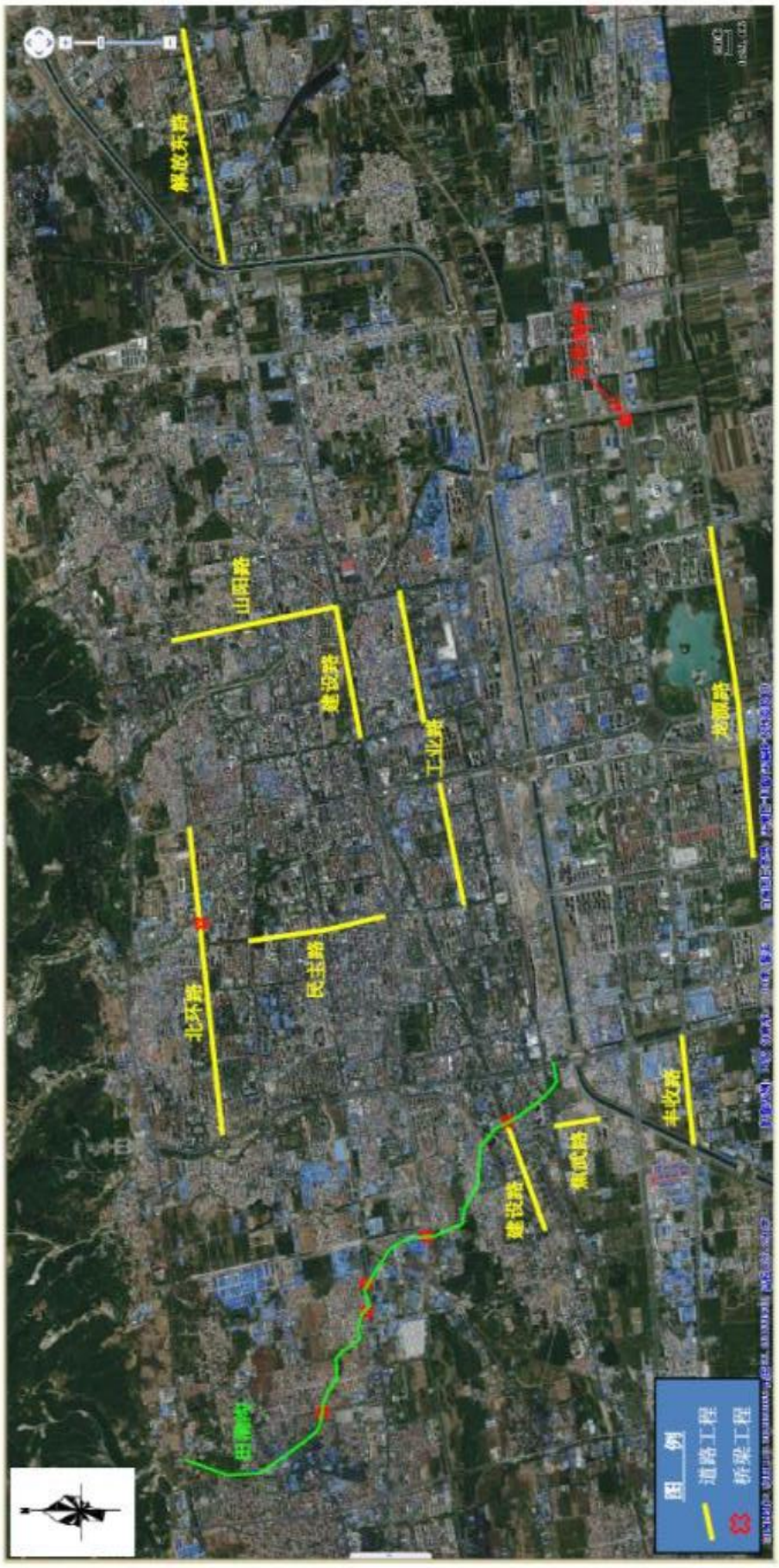


Figure 5.2-4.4 Distribution of road and bridge works in JZTJ111-JZTJ121

5.3 SIA tasks

According to AIIB's ESF and the ESMPF disclosed in November 2021, the purpose of the SIA is to avoid or minimize adverse E&S risks and impacts, and where such risks and impacts are inevitable, identify such risks and impacts, and develop and implement necessary mitigation measures according to the applicable PRC laws and AIIB's ESP, thereby protecting the basic rights and interests of all stakeholders, and promoting their equal participation in the Subproject. The main tasks of the SIA are:

1) Identifying the Subproject's primary stakeholders, and learning their needs through extensive participation;

2) Investigating the applicability of ESS3—Indigenous Peoples;

2) Learning the Subproject's potential positive and negative social impacts, and identifying potential social risks according to AIIB's ESF and the ESMPF disclosed in November 2021;

- Assessing impacts on communities, such as temporary traffic restrictions, and disturbances to traffic and other public facilities, as well as impacts on residential and commercial units;
- Analyzing OHS and labor influx impacts, and developing measures for community interactions;
- Analyzing community health and safety risks at the construction and operation stages

4) Identifying different stakeholders, describing key expectations, and analyzing impacts, issues and concerns of each stakeholder;

5) Learning attitudes of women, poor residents, etc. to the Subproject, and identifying the Subproject's impacts on them;

6) Assessing the Subproject's potential positive and negative social impacts on different stakeholders, and proposing measures to mitigate negative impacts and maximize positive impacts;

7) Strengthening public participation, proposing suggestions to optimize the subproject design, and establishing GRMs; and

8) Identifying the Subproject's potential risks and impacts, and developing mitigation measures to mitigate such risks and impacts, and promote the realization of the project objectives; using gender-segregated data, and improving the project design to promote equal opportunities, and women's economic and social empowerment, especially in terms of service rendering and employment

5.4 Subjects and scope of the SIA

5.4.1 Subjects of the SIA

Subjects of the SIA are primary and secondary stakeholders. Primary stakeholders are direct beneficiaries of the Subproject and those affected negatively by the Subproject, including residents, vulnerable groups and persons affected by LA in 43 sub-districts in the 5 affected counties / districts.

Secondary stakeholders include the Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), JLAO, natural resources bureau, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, affected sub-district offices, design agency, construction agency, supervising agency, etc.

5.4.2 Scope of the SIA

The scope of the SIA is the 44 townships / sub-districts in the 5 affected counties / districts in the subproject area.

5.4.3 Key Points of the SIA

The SIA is focused on the following:

1) Identifying primary stakeholders, and learning their attitudes to and needs for the Subproject, including:

2) Identifying the Subproject's potential social impacts, such as key sensitive sites, key concerns, potential LAR impacts, willingness of nearby residents for participation, community health and safety during COVID-19; identifying ethnic minorities, impacts of nonlocal workers, and the contractors' employment and OHS systems;

3) Analyzing the Subproject's impacts on poor residents, especially their needs for, and willingness and ability to participate in the Subproject;

4) Analyzing potential GBV issues in subproject implementation, the Subproject's impacts on women and their needs for the Subproject, and identifying any gender difference;

5) Conducting information disclosure and public participation, including the APs' awareness of, support for and participation in the Subproject;

6) Incorporating social factors into the subproject design, and proposing measures to avoid or mitigate negative impacts;

7) Developing an SMP so that local residents are further aware of and participate in the Subproject.

5.5 Stakeholder identification

Stakeholders are individuals or groups that can affect or are affected by the realization of the project objectives, and can be divided into primary and secondary stakeholders.

The Subproject's primary stakeholders have been identified, being direct beneficiaries and those negatively affected by the Subproject, including local residents, vulnerable groups, residents affected by LAR, etc. Secondary stakeholders include the owner, design agency, construction agency, supervising agency, government agencies concerned, etc.

5.5.1 Primary stakeholders

The Subproject's primary stakeholders include direct beneficiaries and those negatively affected by the Subproject.

1) Beneficiaries: The Subproject will benefit residents in 44 sub-districts in 5 counties / districts, with a total population of 492,000, including 245,754 females, accounting for 49.95%. See Table 5.5-1.

a) Local residents: Local residents are the most direct beneficiaries of the Subproject. The Subproject will benefit about 492,000 residents in 5 counties / districts, who suffered heavy losses in the 2021 rainstorm. The Subproject's main benefits for local residents are as follows (see Appendix 4 for a detailed analysis):

First, it will significantly improve the flood control capacity of local water facilities, mitigate water loss and soil erosion, and water pollution, and reduce the frequency and threat of floods.

Second, the Subproject will restore affected roads (pavement cracking, roadbed subsidence) and auxiliary facilities (streetlamps, monitoring devices), and eliminate potential safety risks.

Third, the Subproject will increase local land value, beautify the urban rivers, and enrich local residents' cultural life.

Finally, the Subproject will bring spiritual consolation to local residents, increase the city's commerce and tourism income, improve the city's influence, and generate job opportunities for

local residents.

Table 5.5-1 Summary of beneficiary population

City	County / district	Township / sub-district	Population	Female beneficiary population	Percent of females (%)
Jiaozuo	Jiefang District	Minzhu Sub-district	12356	5217	42.22
		Minsheng Sub-district	11320	5998	52.97
		Xinhua Sub-district	10675	5390	50.59
		Qibaijian Sub-district	9876	4009	40.59
		Jiaoxi Sub-district	8869	5310	59.87
		Jiaonan Sub-district	9432	4789	50.77
		Jiaobei Sub-district	10076	5999	59.54
		Shangbaizuo Sub-district	11234	6987	62.19
		Wangchu Sub-district	10975	5634	51.33
	Zhongshan District	Wangfeng Sub-district	8765	5643	64.38
		Licun Sub-district	9067	5710	62.98
		Zhucun Sub-district	6784	5764	84.96
		Yueshan Sub-district	8972	3567	39.76
		Fengfeng Sub-district	7775	3007	38.68
		Longdong Sub-district	8754	4093	46.75
		Danhe Sub-district	8905	4678	52.53
		Fucheng Sub-district	10002	6009	60.08
		Xuheng Sub-district	8976	3425	38.15
		Longxiang Sub-district	10289	8976	87.24
	Macun District	Macun Sub-district	10009	4457	44.52
		Fengying Sub-district	11000	5550	50.45
		Jiulishan Road Sub-district	9098	5678	62.41
		Daiwang Sub-district	9492	6578	69.3
		Anyangcheng Sub-district	12596	7798	61.9
		Yanma Sub-district	11441	6123	53.51
		Wuwang Sub-district	11011	4897	44.47
	Shanyang District	Baijianfang Sub-district	9075	5890	64.9
		Jiaodong Sub-district	9832	5998	61
		Yixin Sub-district	9546	6006	62.91
		Dongfanghong Sub-district	9976	4537	45.47
		Taihang Sub-district	9998	4430	44.3
		Guangya Sub-district	10013	5679	56.72
		Dinghe Sub-district	10001	5600	55.99
		Xincheng Sub-district	9096	4040	44.42
		Zhongxing Sub-district	9435	4569	48.43
	Xiuwu County	Wangtun Xiang	9084	4563	50.23
		Wuliyuan Xiang	10541	5770	54.12
		Xicun Xiang	11413	6889	43.65
		Chengguan Town	10053	4356	43.33
		Xunfeng Town	10012	5900	50.07
		Qixian Town	11440	5789	46.22
		Zhouzhuang Town	11223	6754	43.23
		Yuntaishan Town	11982	6008	41.34
	Total	44	492000	245754	49.95

Source: feasibility study report, and 2021 socioeconomic statistical reports of local townships / sub-districts

b) Vulnerable groups: Local vulnerable groups include MLS households, five-guarantee households, the disabled, women-headed households, poor residents, etc. (There is no vulnerable group in the 18 households with 70 persons affected by LA for the Subproject.) The Subproject will undoubtedly generate more job opportunities and make traffic more convenient. The unskilled jobs generated by the Subproject will be first made available to local vulnerable groups, such as security guard and cleaner, so that they can earn extra money while taking care

of families.

2) Those negatively affected by the Subproject: including residents affected by LAR, and also including local vulnerable groups, such as poor residents and women

The Subproject's LAR impacts arise from LA for the river management components mainly, affecting 18 households with 70 persons in Shanyang, Jiefang and Zhongzhan Districts. See the RAP.

5.5.2 Secondary stakeholders

Secondary stakeholders include the owner, design agency, construction agency, supervising agency, government agencies concerned, etc.

1) PMO: Since December 2021, the Jiaozuo Municipal Government has established the subproject leading group, and the Jiaozuo PMO thereunder is responsible for the organizational leadership, implementation and supervision of the Subproject, and liaison with AIIB. Subproject leading groups have been established in the affected counties / districts, responsible for subproject organization, coordination, management and implementation under the leadership of the Jiaozuo PMO.

2) Owner: The owner is responsible for coordinating relations of all parties concerned, and subproject construction, operation and maintenance.

3) Government agencies concerned: The government agencies concerned include JMURCB, the natural resources bureau, JLAO, development and reform commission, transport bureau, statistics bureau, labor and social security bureau, women's federation, civil affairs bureau, rural revitalization bureau, ecology and environment bureau, sub-district offices, etc. The successful implementation of the Subproject relies on their support.

In addition, the Subproject's secondary stakeholders also include the design agency, contractors, etc.

5.5.3 Stakeholder demand analysis

1) Urgent demand for river infrastructure restoration

The heavy rainstorm in July 2021 led to serious damages. Local residents highly support the Subproject, and urgently expect local roads and rivers to be restored.

①River facilities should be restored and upgraded to ensure convenient traffic and personal safety. The rainstorm has led to local embankment collapse, slope damage and water quality deterioration, and damaged riverside vegetation, streetlamps, roads and other facilities, posing safety risks. There is an urgent need for post-disaster restoration to restore river infrastructure and improve flood discharge capacity, thereby ensuring local residents' property and personal safety. In addition, urban river landscapes are low and close to river channels, and are likely to be inundated, and there are some dangerous structures beside some bridges, such as power distribution rooms and storerooms. Local residents expect to restore damaged embankments, and heighten and reinforce existing embankments while preserving landscapes for leisure purposes.

Interview 5-1: Ms. Zhang, etc., Jiaoxi Sub-district, Jiefang District (48 years)

"In the July 20 rainstorm, the sidewalks along the Dasha River were seriously inundated, but no damage occurred."

"There is no retaining wall along the Dasha River, so that persons are likely to fall into the river in strong winds. Guardrails should be added."

"The bridge openings are narrow, resulting in unsmooth water flow and difficult drainage."

"There are few low structures beside the bridge, such as power distribution rooms and storerooms. They must be removed to ensure nearby residents' property and personal safety."

Interview 5-2: Ms Jiang, etc., Wuliyuan Xiang, Xiuwu County (54 years)

"There is a large sightseeing platform beside the river, and we like to dance there. We expect it to be preserved during embankment upgrading for our recreational activities."

Interview 5-3: Mr. Li, etc., Zhouzhuang Town, Xiuwu County (52 years)

"The embankments of the Shanmen River cannot resist heavy floods and have seepage, and must be heightened."

"In last year's flood, the embankments reached their limit. They may collapse in rainstorms, and must be heightened and reinforced to ensure our safety."

②Road and bridge damage has resulted in inconvenient traffic. There are many residential and scenic areas (glass skywalk, Qixing Park, etc.) along the Dasha River, attracting many nearby residents and visitors. However, there are such problems as narrow roads, unregulated vehicle parking and unregulated peddling. In the July 20 rainstorm, 916,823 persons in 110 townships / sub-districts in 11 counties / districts in Jiaozuo City were affected, and in the urban area alone, 36 bridges and 89 river facilities were damaged, resulting in inconveniences to local residents' daily life and recreation. Local residents expect the damaged roads be restored, riverside landscapes beautified, and river and road management strengthened as soon as possible.

Interview 5-4: Ms Liu, etc., Dongfanghong Sub-district, Shanyang District (35 years)

"Peddlers often occupy roads along the Dasha River to sell drinks and snacks, resulting in traffic congestion. We expect that traffic signals and monitoring devices be provided during road restoration.

"The bridges on the Dasha River have heavy pedestrian traffic, and we mostly pass through it by electric bike. Its south part was damaged by flood last year. We expect the damaged bridges to be restored, and some pedestrian bridges be built to ensure traffic convenience."

Interview 5-5: Mr. Ma, etc., Zhouzhuang Sub-district, Xiuwu County (45 years)

"The roads and bridges along or on the Dasha River need to be upgraded badly. In last year's flood, the bridges collapsed due to sludge from the river."

③Conduct river dredging to ensure flood safety. The 2021 rainstorm led to serious river channel scouring and silting. Currently, some river segments have insufficient flood discharge capacity. Local residents expect to restore intercepting pipes and auxiliary facilities through the Subproject to improve the flood discharge capacity of rivers and lakes, and the urban emergency management system, thereby ensuring urban flood safety.

Interview 5-6: Mr. Fu, etc., Licun Sub-district, Zhongzhan District (42 years)

"The riverbed is too seriously silted for over 1m."

"After the flood of last year, some water valves were damaged, so waterlogging is serious in the village, and the water from that flood was not fully drained until winter."

Interview 5-7: Mr. Hong, etc., Wuliyuan Xiang, Xiuwu County (56 years)

"Sludge in the flood ditches along the Shanmen River is 1m deep, and has not been cleaned up to date."

"The river channel is to be broadened urgently, otherwise it cannot resist heavy floods."

④Improve the ecological environment of rivers. After the rainstorm, river water quality is poor due to wastewater overflow, non-point-source pollution, etc., accompanied by odor and eutrophication. In addition, riverside green spaces and river facilities are poor in quality, with such problems as unstable slopes, aged revetments and improper pipe connection. Residents expect to solve these problems through the Subproject and improve the environmental quality of urban rivers.

Interview 5-8: Mr. Liu, Xincheng Sub-district, Shangyang District (30 years)

"The most important thing is to clean up river sludge to make water clearer. Without a healthy river, a beautiful landscape is meaningless."

Interview 5-9: Mr. Qi, Wangfeng Sub-district, Zhongzhan District (43 years)

"We expect the river have a good landscape and clear water. In summer, there are flocks of insects along the river, and there is strong odor."

"I think that the riverside landscape of the Dasha River should be integrated with the environment. There are many scenic spots here, so it is critical to improve the water environment and infrastructure."

2) Local residents urgently expect municipal infrastructure restoration due to traffic impacts.

The heavy flood in July 2021 damaged some urban roads, bridges and drainage facilities, affecting the traffic of nearby residents greatly. Since many affected roads (Minzhu Road, Jianshe Road, Jiefang West Road, etc.) are important trunk roads, with many malls, schools, hospitals and government agencies on them, their damage has resulted in inconvenient traffic, forcing local residents to take detours. Post-disaster road restoration is imperative.

Interview 5-10: Mr. Wang, etc., Shangbaizuo Sub-district, Jiefang District (43 years)

"Jianshe Road is in bad condition, and its drainage facilities need upgrading urgently. There is serious waterlogging, and wastewater is likely to overflow into residences. Despite of our repeated complaints, there has been no improvement to date."

"Streetlamps on Minzhu Road are unstable, and may pose electric shock risks on rainy days."

"The roadbed was damaged in the flood of last year, and wastewater would flow out whenever there is a rain."

①Improve the flood discharge capacity of urban flood ditches. In the July 20 rainstorm, flood ditches totaling about 10km in the urban area were damaged, and many rainwater discharge channels were unsmooth, affecting urban residents' daily traffic adversely. They expect to restore and improve the flood discharge capacity of urban flood ditches to ensure their normal traffic and

life in the rainy season.

Interview 5-11: Mr. Liu, etc., Shangbaizuo Sub-district, Jiefang District (55 years)

"At the junction of the Tianjian Ditch and Puji River, intercepting sewers are damaged, and wastewater overflow leads to river pollution."

"The drain ditch of Jianshe Road should be broadened to avoid inundation."

"The flood ditch is often silted, and some residences were immersed in rainwater last year."

"Since the Tianjian Ditch is winding, twigs and sludge would be flushed downstream into the residential community during a flood."

②Local residents expect the damaged intercepting sewers and other associated facilities of the Qunying, Xiaozhang and Wengjian Rivers be restored as soon as possible.

Interview 5-12: Mr. Zhang, etc., Xincheng Sub-district, Shangyang District (43 years)

"The Tianjian Ditch was scoured seriously last year, and domestic wastewater would flow into the Tianjian Ditch, resulting in strong odor in summer. We no longer go there for a walk."

"The underground drain ditches are often silted and damaged. This is a longstanding problem."

③Restore damaged urban roads and auxiliary facilities to ensure traffic safety. In the July 20 rainstorm, many national, provincial, county, township and village highways were damaged by collapse, landslides, mud-rock flows, etc., including cracking and waterlogging. In addition, urban roads need to be optimized in layout. Urban residents, especially middle-aged and elderly ones, expect urban roads to be restored at a time, and that roadside vegetation and recreational facilities be kept.

Interview 5-13: Mr. Wu, etc., Xincheng Sub-district, Shangyang District (66 years)

"There are many elders here. Road restoration began last year, but has been conducted repeatedly. We approve of road restoration, but recreational spaces should not be damaged."

3) Students of nearby schools and their parents expect road restoration be implemented as soon as possible to ensure convenient traffic. Due to the rainstorm, some urban roads have local waterlogging, and some streetlamps are damaged, which is adverse to students' traffic safety. In addition, some roads and bridges are closed during construction, so that students take detours, thereby increasing the burden of students and parents.

Interview 5-14: Ms Zhang, Minzhu Road Sub-district, Jiefang District (35 years)

"Jiefang West Road is under construction and impassable. I have to take a detour to take my child home in the evening. We have to spend a lot of time and effort for that."

4) Residents along the Dasha and Shanmen Rivers expect public toilets, waste bins, recreational facilities and other facilities be provided along rivers to maintain a good riverside environment.

Interview 5-15: Mr. Wu, Wangtun Xiang, Xiuwu County (50 years)

"Some public toilets and waste bins should be provided along the river. I can often find urine and feces when walking along the river."

"The riverside landscape should be improved in the Subproject, because the riverfront is an important recreational place for us."

5) Nearby residents expect to strengthen the management of the Dasha and Shanmen

Rivers to alleviate the environmental damage resulting from the July 20 flood. The two rivers are close to the urban center, and surrounded by many residential communities and urban parks, and are important places for recreational activities.

Interview 5-16: Ms Zhang, Xiaozhuang Sub-district, Macun District (75 years)

"We are retired, and would like to gather near the Dasha River to chat and play cards. We expect more vegetation, so that we can take shelter in all seasons."

5) 98.9% of local poor residents support the Subproject. If possible, they are willing to get employed during construction and operation to increase income while taking care of families.

Most MLS subjects and poor residents are willing to participate in the Subproject, because it is a good opportunity to increase their income. They can do unskilled jobs generated by the Subproject directly, or work outside using convenient traffic conditions created by the Subproject.

6) Women support the Subproject strongly, because it will improve local road conditions and river infrastructure, thereby saving their time spent on going to and from work, taking children to and from school, and shopping, and providing more recreational places to them.

Women expect the Subproject to be constructed as soon as possible to improve river infrastructure and traffic conditions.

The questionnaire survey on 182 local women shows that 96.5% of the respondents are willing to participate in the Subproject. See the table below.

Table 5.5-2 Willingness of local women to participate in the Subproject

Option \ Indicator		Frequency	Percent	Valid percent	Cumulative percent
Valid	Willing	176	96.5	96.5	96.5
	Unwilling	6	3.5	3.5	100.0
	Total	182	100.0	100.0	

7) Local residents expect to increase the awareness of the Subproject.

Through door-to-door publicity at the preparation stage, 77.78% of the respondents are aware of the Subproject. The main information sources are village / community committee notification (66.7%), government publicity (54.63%), and announcement (36.11%).

The awareness of the scope of construction of the Subproject among staff of government agencies concerned or local governments has increased to some extent. However, most local residents are still unclear about the scope of construction, so further publicity is needed.

5.6 Social impact analysis

With the support of the Jiaozuo PMO, JMURCB, JMWRB, Jiaozuo Municipal Emergency Management Bureau, XCWRB, MDARAB, JLAO, sub-district offices, village / community committees, etc., the taskforce conducted a questionnaire survey on 400 respondents in the 5 affected counties / districts in February and June 2022, covering different age groups, educational levels and occupations, including 218 males and 182 females. In addition, the taskforce held 13 FGDs with 453 men-times, including 134 men-times of females, accounting for 29.58%.

The beneficiary area of the Subproject is the 44 sub-districts / townships in the 5 affected counties / districts, and the area affected by construction is 200m around the construction sites.

5.6.1 Social benefits

The positive impacts of the Subproject perceived by the respondents are as follows: 1) 76.85% of the respondents think that the Subproject will alleviate flood impacts; 2) 72.22% think

that it will create a safer living environment; 3) 58.33% think that it will alleviate local traffic congestion; 4) 51.85% think that it will improve urban sewage facilities to avoid sewage siltation; 5) 51.85% think that it will alleviate water loss and soil erosion, and water pollution; 6) 44.44% think that it will beautify the riverside landscape and increasing tourism income; 7) 16.67% think that it will bring more job opportunities.

Table 5.6-1 Perceived positive impacts of the Subproject

Indicator / Option	Potential positive impact							
Perception	Alleviating flood impacts	Creating a safer living environment	Alleviating local traffic congestion	Improving urban sewage facilities to avoid sewage siltation	Alleviating water loss and soil erosion, and water pollution	Beautifying the riverside landscape and increasing tourism income	Bringing more job opportunities	Don't know
Sample size	307	289	233	207	207	178	67	15
Percent (%)	76.85	72.22	58.33	51.85	51.85	44.44	16.67	3.7

5.6.1.1 Improving the flood control standard of rivers to reduce flood impacts

The July 20 flood resulted in serious property losses and casualties, and adverse mental impacts. The taskforce finds that the existing flood control facilities of the urban rivers are substandard. When the Subproject is completed, the flood control standard of these rivers will be improved, thereby alleviating flood risks greatly. 72.22% of the respondents think that the Subproject will create a safer living environment, and 76.85% think that it will reduce floods, so the Subproject will be significant for stabilizing the river banks, improving flood control capacity and reducing floods, and enable nearby residents to live more safely.

1) The riverbed silting of the Dasha and Shanmen Rivers has affected their normal flood control, drainage, irrigation and water supply functions. River dredging will restore their normal functions, promote local economic development, and improve the living environment.

2) River dredging and broadening, and embankment restoration will improve the overall flood control capacity of the urban rivers.

3) The July 20 flood has caused great financial losses to Jiaozuo City, and threatened the personal safety of local residents, who highly recognize the importance and urgency of river management. According to interviews, they are very dissatisfied with the current situation of the Dasha and Shanmen Rivers, including their banks and bridges. The Subproject is highly expected by local residents.

Interview 5-17: Mr. Zhang, Macun Sub-district, Macun District (42 years)

"River management is highly expected by us. We expect it to create an enjoyable recreational environment for us."

5.6.1.2 Improving river and road facilities, and creating a safer living environment

77.78% of the respondents think that the Subproject will make their living environment safer. After the July 20 flood, some bridges and embankments of the Dasha, Shanmen and Qunying Rivers, and Tianjian Ditch have been damaged, making accidents likely to occur.

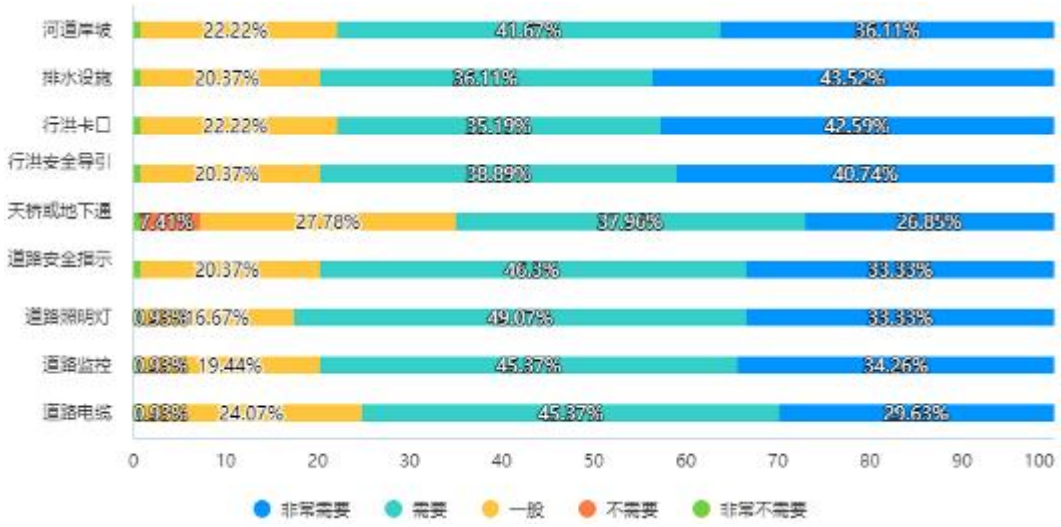


Figure 5.6-1 Needs of local residents for river infrastructure

Over 70% of the respondents expect the restoration of river and municipal infrastructure, including the restoration and upgrading of damaged river channels, roads, bridges and auxiliary facilities, thereby meeting flood control and traffic demand, and eliminating safety risks.

Interview 5-18: Mr. Zhang, Wangfeng Sub-district, Zhongzhan District (35 years)

"After the flood of last year, the underpass that we went through every day was damaged, and has not been restored yet. There is no guardrail along the river, posing great safety risks."

5.6.1.3 Restoring urban roads and auxiliary facilities to alleviate urban traffic congestion and realize more convenient traffic

58.33% of the respondents think that the Subproject will alleviate urban traffic congestion and realize more convenient traffic. Due to the flood, some roads (pavement cracking, roadbed subsidence) and auxiliary facilities (streetlamps, monitoring devices) are damaged. The Subproject will restore these roads and facilities to ensure safe and convenient traffic.

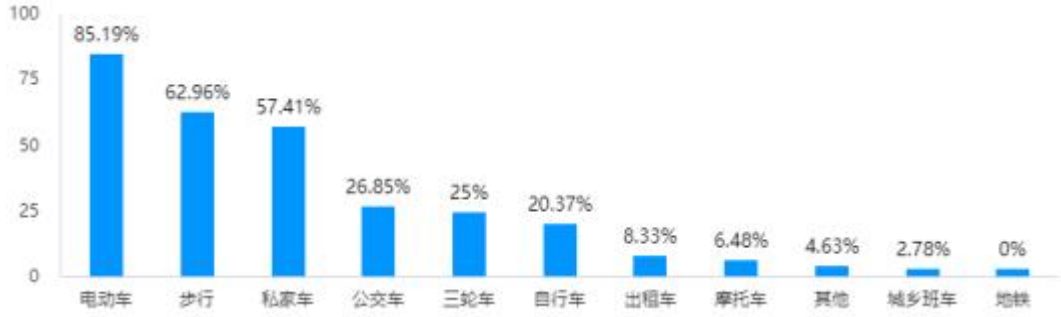


Figure 5.6-2 Traffic modes of local residents

Interview 5-19: Mr. Zhang, Wangfeng Sub-district, Zhongzhan District (35 years)

"The road condition from Jiaodong Road to Shanyang Road is very poor, with serious cracking and waterlogging. This high-traffic segment must be improved as soon as possible."

5.6.1.4 Improving local sewage facilities to realize smooth drainage, and safe and efficient traffic

51.85% of the respondents think that the Subproject will bring safer and more efficient traffic

by restoring or constructing sewage facilities (flood ditches, etc.). After its completion, the resistance of urban roads to natural disasters will be improved greatly, and the problems of road silting and rainwater overflow will be solved effectively.

Interview 5-20: Mr. Qi, Shangbaizuo Sub-district, Jiefang District (35 years)

"There would be a drainage problem here in the rainy reason, which has remained unsolved despite of repeated complaints. We expect urban drainage facilities to be restored soon."

5.6.1.5 Improving river water replenishing facilities to improve the water environment

51.85% of the respondents think that the Subproject will alleviate water loss and soil erosion, and water pollution, and further the local water environment. In the July 20 rainstorm, river intercepting pipes and associated facilities (shafts, covers, etc.) were damaged to some extent, and the reclaimed water pump stations on the Xiaozhang, Qunying and Hei Rivers, were damaged, so that nearby ecological wetlands were damaged. The Subproject will restore and improve river water replenishing and related facilities to improve the local water environment.

5.6.1.6 Improving the riverside landscape and surrounding natural environment, and increasing tourism income

44.44% of the respondents think that the Subproject will improve the riverside landscape and surrounding natural environment, and increase tourism income. Parks beside the urban rivers are preferred recreational places for local residents. Currently, these rivers have such problems as collapse and insufficient landscaping, making it possible to provide good recreational experiences. After the completion of the Subproject, the urban landscape will be further improved and more tourism resources will be available, thereby increasing tourism income.

Interview 5-21: Mr. Wang, Wuliyuan Xiang, Xiuwu County (45 years)

"The flood of last year was unexpected. We often walk along the river after dinner, but the river has dried out, its water is not clean, and there are less people here. We highly support the Subproject, and expect it to revitalize this place."

5.6.1.7 Promoting local development and creating more job opportunities

First, the Subproject will promote local economic development by improving local river and road infrastructure, and promoting development and investment along the urban rivers. In addition, local residents will also enjoy higher house rental income.

Interview 5-22: Ms Kong, Dongfanghong Sub-district, Shanyang District (55 years)

"There are many parks in our city, and many people would walk and recreate here. When the roads are restored, we will enjoy more convenient traffic and a better urban landscape."

Second, the Subproject will generate some unskilled jobs during construction and operation, such as building material transport and transfer, site cleaning, catering, daily patrol, cleaning, etc. The PMO will urge the contractors and competent authorities to make such jobs first available to local and nearby workers, especially vulnerable persons able to work, thereby increasing their income.

However, only 16.67% of the respondents think that the Subproject will create more job opportunities. It can be seen that local residents are prudent about the Subproject's economic driving effect. At FGDs, nearby residents say that they need long-term jobs mainly, and are unwilling to do short-term jobs, which are unsustainable for them.

5.6.2 Social risks

5.6.2.1 Potential LAR impacts

LAR for the Subproject will affect 18 households with 70 persons in Shanyang, Jiefang, Zhongzhan and Macun Districts, Jiaozuo City. The main resettlement impacts are as follows (see the RAP for details):

1) 73.2285 mu of collective land will be acquired for the Subproject, affecting 18 households with 70 persons in 11 villages in 6 sub-districts in Jiefang, Zhongzhan, Shanyang and Macun Districts, in which 31.4985 mu in 9 villages in 4 sub-districts in Jiefang and Zhongzhan Districts will be acquired for river dredging, bank protection and structure construction in Tianjian Ditch River Management, affecting 18 households with 70 persons; 5.14 mu of collective wasteland in Xiaozhuangxin Village, Dinghe Sub-district, Shanyang District will be acquired for Qunying River (Xinyue Railway-Xin'an Road) Integrated Management in Qunying River Restoration, affecting no one; and 36.59 mu of collective woodland in Shandi Village, Anyangcheng Sub-district will be acquired for river dredging, bank protection and drainage culvert construction in Shanmen River Restoration in Macun District, affecting no one.

2) 1,080.146 mu of state-owned land will be occupied for the Subproject, including 360.6 mu of state-owned construction land (transport and public infrastructure land, currently being roads and open spaces) and 719.546 mu of state-owned unused land (river surface, river flat and grassland). The occupied state-owned are within jurisdictions of construction agencies (urban road construction land and public infrastructure land belongs to JMURCB, and land within the range of river management belongs to the municipal / county water resources bureaus), not involving allocation, transfer, compensation and resettlement.

3) Temporary land occupation arises from construction camps, traffic, spoil grounds, etc. 905.11 mu of land will be occupied for the Subproject, including 862.11 mu of state-owned land (including 8.46 mu of river flat reclaimed by villagers in Xiuwu County, compensated for as temporarily occupied land) and 43 mu of collective land, affecting 7 households with 36 persons. The temporarily occupied state-owned land is mostly river flat, existing roads, and unused land along rivers and roads, all occupied without compensation; there are young crops on 8.46 mu of state-owned land, including 4.13 mu within the river flat occupied by JZTJ102-Dasha River Restoration in Xiuwu County, and 4.33 mu within the river flat occupied by JZTJ103-Shanmen River Restoration in Xiuwu County. Such land will be reclaimed by the contractors after compensation, in which 324.696 mu overlaps with the permanently occupied state-owned land, including 9 mu for JZTJ106-Qunying River (Xinyue Railway-Xin'an Road) Integrated Management, 15.996 mu for JZTJ121-Tianjian Ditch River Management, 1.8 mu for JZTJ111-Flood Control Upgrading of Urban Rivers and Bridges, 226 mu for JZTJ102-Dasha River Restoration in Xiuwu County and 71.9 mu for JZTJ103-Shanmen River Restoration in Xiuwu County.

The Subproject does not involve HD.

It is necessary to identify the LA impacts, disclose them to the APs in advance, grant full compensation to them, collect their opinions and suggestions timely, and establish an appropriate response mechanism for potential issues. See the RAP for details.

See Table 5.6-2.

Table 5.6-2 Summary of resettlement impacts

Component	County / district	LA					Works involving LA	State-owned land (mu)	Temporary land occupation (mu)				Remarks
		Township / sub-district	Village / community	Area (mu)	Affected				State-owned land	Collective land			
					AHs	APs				Area (mu)	Affected		
											AHs	APs	
JZTJ101-Dasha River Restoration	/	/	/	/	/	/	/	/	240	/	/	/	The other components involve neither additional LA nor HD.
JZTJ102-Dasha River Restoration in Xiuwu County	Xiuwu County	Chengguan Town Xunfeng Town Wuliyuan Xiang Zhouzhuang Town	/	/	/	/	/	877.9	226	/	/	/	
JZTJ103-Shanmen River Restoration in Xiuwu County	Xiuwu County	Chengguan Town Wuliyuan Xiang Zhouzhuang Town	/	/	/	/	/	100.07	71.9	/	/	/	
JZTJ104-Shanmen River Restoration in Macun District	Macun District	/	/	36.59	/	/	River dredging, bank protection, drainage culverts, etc.	/	155.49	43	7	36	
JZTJ105-Wengjian River Restoration	/	/	/	/	/	/	/	/	7.5	/	/	/	
JZTJ106-Qunying River (Xinyue Railway-Xin'an Road) Integrated Management	Shanyang District	Dinghe Sub-district	Xiaozhuangxin Village	5.14	/	/	River management	/	9	/	/	/	
	Jiefang District	/	/	/	/	/	/	16.8		/	/	/	
	Shanyang District	/	/	/	/	/	/	31.33		/	/	/	
JZTJ107-Urban River Facility Restoration	/	/	/	/	/	/	/	/	7.5	/	/	/	
JZTJ108-Urban Sewer Network Inspection and Restoration	/	/	/	/	/	/	/	/	7.5	/	/	/	
JZTJ109-Scattered Damaged Urban Road Restoration	/	/	/	/	/	/	/	/	2.25	/	/	/	
JZTJ110-Upgrading and Construction of	/	/	/	/	/	/	/	/	5.25	/	/	/	

Urban Flood Ditches													
JZTJ111-Flood Control Upgrading of Urban Rivers and Bridges	Shanyang District	/	/	/	/	/	/	38.05	1.8	/	/	/	
JZTJ112-North Ring Road (Puji Road-Tabei Road) Restoration	/	/	/	/	/	/	/	/	7.5	/	/	/	
JZTJ113-Shanyang Road (Taihang Road-Jianshe Road) Restoration	/	/	/	/	/	/	/	/	3.3	/	/	/	
JZTJ114-Longyuan Road (Minzhu Road-Shanyang Road) Restoration	/	/	/	/	/	/	/	/	3.75	/	/	/	
ZTJ115-Fengshou Road Restoration	/	/	/	/	/	/	/	/	3.75	/	/	/	
JZTJ116-Minzhu Road Restoration	/	/	/	/	/	/	/	/	2.25	/	/	/	
JZTJ117-Industry Road Restoration	/	/	/	/	/	/	/	/	5.4	/	/	/	
JZTJ118-Jiaowu Road Restoration	/	/	/	/	/	/	/	/	3	/	/	/	
JZTJ119-Jianshe Road Restoration	/	/	/	/	/	/	/	/	2.25	/	/	/	
JZTJ120-Jiefang East Road Restoration	/	/	/	/	/	/	/	/	4.2	/	/	/	
JZTJ121-Tianjian Ditch River Management	Jiefang District	Shangbaizuo Sub-district	Tianjian Village	0.57	2	8	River dredging, bank protection, structure construction	9.573	92.52	/	/	/	
			Chunlin Village	5.2275	2	9							
			Xiaozhuang Village	10.7715	4	15							
			Majian Village	0.075	1	4							
		Wangchu Sub-district	Shilin Village	2.25	1	3							
			Xiwangchu Village	11.082	4	13							
	Zhongzhan District	Licun Sub-district	Zijing Community	0.297	1	4		6.423					
		Xuheng Sub-district	Licun 3 Village	0.8145	2	9							
			Licun 1 Village	0.411	1	5							
Total				**73.2285**	**18**	**70**	**/**	**1080.146**	**862.11**	**43**	**7**	**36**	

Note: Such data is from the RAP.

5.6.2.2 .2 Potential E&S impacts during construction and operation

Noise, flying dust and waste gases generated by construction machinery and trucks, domestic wastewater and domestic waste generated during construction, and bottom mud drying may affect nearby residents, especially for residential communities and schools close to construction sites.

This can be verified from the questionnaire survey results. Such negative impacts include: ①87.96% of the respondents think that the Subproject will generate waste gas, wastewater, noise and solid waste pollution; ②72.22% think that the Subproject will lead to temporary traffic inconvenience; ③45.93% think that the Subproject will affect local residents' personal and property safety; ④27.78% think that the Subproject will lead to water loss and soil erosion, and water pollution; ⑤24.63% think that the Subproject will lead to LAR impacts. ⑥2.78% think that the Subproject will lead to AIDS and other infectious diseases. See Table 5.6-3.

Table 5.6-3 Perceived negatives impacts of the Subproject at the construction and operation stages

Indicator	Potential negative impact						
Perception	Waste gas, wastewater, noise and solid waste pollution	Temporary traffic inconvenience	Threat to local residents' personal and property safety	Water loss and soil erosion, and water pollution	LAR impacts	AIDS and other infectious diseases	Don't know
Sample size	352	289	184	111	99	11	30
Percent (%)	87.96	72.22	45.93	27.78	24.63	2.78	7.41

5.6.2.3 Community health and safety impacts of construction

1) There are many densely populated areas around the construction sites, including residential areas, schools and parks. During construction, more vehicles will pass through nearby villages, resulting in traffic convenience and safety risks, especially children and old people, who are more likely to encounter accidents. In addition, sludge and slag on vehicles may spill, thereby affecting local vehicles and pedestrians, and flying dust will be adverse to physical health.

2) During construction, noise, flying dust, waste gases, domestic wastewater and domestic waste may affect nearby residents' production and lives. Noise and dust isolation measures should be taken to minimize such impacts.

3) After the completion of the Subproject, local pedestrian and vehicular traffic will increase considerably, thereby threatening the personal safety of local residents. Safety education should be conducted.

5.7 Labor and working conditions

China's legal framework on labor protection is consistent with ESS1 of AIIB's ESF, and even more rigorous, such as the statutory age limit for child labor.

5.7.1 Labor and impacts

Specialized construction teams will participate in subproject construction, and may include nonlocal workers. It is expected 133 nonlocal workers (106 male and 27 female (20.3%)), and 372 local workers (299 male and 73 female (19.62%)) will be needed. Male workers will do skilled jobs mainly, and female ones will do unskilled jobs mainly. Particular attention should be paid to GBV and gender discrimination to protect female workers. The proportion of female workers should be increased appropriately.

Nonlocal workers will pose social and health risks, such as epidemics (including AIDS,

COVID-19, influenza, etc.), and violation of local customs (including religious, funeral, wedding, etc.).

Table 5.7-1 Summary of expected labor input and types of work

Indicator / Township	Nonlocal workers – female not less than 20%	Main types of work	Nonlocal workers – female not less than 20%	Main types of work	Total
Jiefang District	38	Project management, financial management, contract management, machinery operation, etc.	76	Construction, material transport, cooking, cleaning, etc.	114
Shanyang District	27	Project management, financial management, contract management, machinery operation, etc.	80	Earth transport, material transport, construction, cooking, cleaning, etc.	107
Zhongzhan District	25	Project management, financial management, contract management, machinery operation, etc.	78	Earth transport, material transport, construction, cooking, cleaning, etc.	103
Macun District	18	Project management, financial management, contract management, machinery operation, etc.	55	Earth transport, material transport, construction, cooking, cleaning, etc.	73
Xiuwu County	25	Project management, financial management, contract management, machinery operation, etc.	83	Earth transport, material transport, construction, cooking, cleaning, etc.	108
Total	133	/	372	/	505

5.7.2 Labor and GBV management

The PMO should ensure that project workers are treated fairly, and have a safe and healthy working environment. In this regard, a sound labor rights protection and regulation mechanism has been established in Jiaozuo City. First, an employer must have a lawful license, and recruit workers by lawful means. Second, all labor contracts and relationships should be registered. Third, regular and special inspections are conducted to see if an employer uses no child labor, protects female and underage workers, observes the working time and salary provisions, etc. Fourth, a signboard is set up at the workplace, notifying workers of their lawful rights and means of rights protection. Fifth, the duties of the government agencies concerned are defined. Publicity and social supervision are also strengthened.

In terms of GBV, Jiaozuo City takes extensive measures to protect female workers' lawful rights. According to the Special Regulations on the Labor Protection of Female Workers of Henan Province, an employer shall not impose restrictions on the lawful rights of female workers in labor contracts, and shall not reduce salaries and benefits, restrict their promotion opportunities, or dismiss them on the ground of marriage, pregnancy, etc., and shall take effective measures to prevent female workers from sexual harassment at the workplace. Employers should handle female workers' grievances about sexual harassment at the workplace, and protect their personal privacy. In addition, the Jiaozuo Municipal Women's Federation (hotline: 0391-3568268) should offer consulting services and conduct publicity on GBV to promote social civilization and harmony.

5.7.3 Measures and suggestions

The contractors should meet the following requirements:

1) Employ project workers equally and fairly without discriminating women, disabled

persons and migrant workers.

2) Take appropriate protective and supporting measures for certain groups.

3) Allow workers to establish and join worker organizations, and protect their collective bargaining right.

4) Set up toilets for women on construction sites, develop regulations against sexual harassment, and offer relevant training.

5) Establish a GRM and a labor protection supervision mechanism for workers. See Chapter 8.

5.8 Current situation of poverty

Through poverty alleviation efforts, there was no poor village or household in the 5 affected counties / districts in 2021. However, poverty may still exist. The poor population mentioned here is equivalent to the low-income population, mostly lifted out of poverty in 2020[1].

The affected population includes a poor population of 15,490, with a poverty incidence of 3.15%.

5.8.1 Current situation of local poverty

There was no poor village or household in the 5 affected counties / districts in 2021.

1) Jiefang District: At the end of 2021, the district's population was 347,400, including no formerly registered poor resident.

2) Shanyang District: At the end of 2021, the district's population was 303,200, including no formerly registered poor resident.

3) Zhongzhan District: At the end of 2021, the district's population was 122,000, including no formerly registered poor resident. After the July 20 flood, a living assistance program was developed, and subsidies granted to affected residents. Therefore, no resident has been impoverished again.

4) Macun District: At the end of 2021, the district's population was 120,600. After the July 20 flood, there were 193 monitored households with 714 persons, in which 57 households with 172 persons were distressed due to the disaster.

5) Xiuwu County: At the end of 2021, the county's population was 248,600, including 1,548 registered poor households with 4,857 persons. Currently, it has 269 households with 833 persons in 3 types, including 6 marginal households likely to be impoverished with 25 persons, 30 households unstably lifted out of poverty with 94 persons, and 233 households in extreme difficulty for sudden reasons with 714 persons (including 78 households with 220 persons affected by the flood). In 2022, 22 villages lifted out of poverty were affected by the flood, in which 1,099 households with 3,926 persons were affected.

Table 5.8- 1 Profile of local poor population

County / district	Formerly poor villages	Formerly registered poor households	Formerly registered poor residents	Poverty incidence	3 types of monitored households	3 types of monitored residents
Jiefang District	/	/	/	/	/	
Shanyang District	/	/	/	/	/	
Zhongzhan District	13	1278	4159	3.40%	102	284
Macun District	18	1702	6474	5.37%	193	714

[1]Poor population: At the end of 2021, there was no poor village in the subproject area. However, poverty may still exist.

Xiuwu County	34	1548	4857	1.95%	362	1135
Total	65	4628	15490	3.15%	657	2133

5.8.2 Livelihoods of poor residents

The local poor population deals with self-sufficient small-scale farming, including:

1) Their income is from traditional farming mainly. For 70.52% of the poor respondents, the main income source of cultivation and stockbreeding. Their average proportion of agricultural income to household income is 63.5%, showing that they rely highly on traditional farming.

2) The poor population still deals mainly with the cultivation of traditional food crops, and less with the cultivation of commercial crops. 83.35% of the poor respondents deal with wheat cultivation, 82.17% with corn cultivation, and only 12.29% with the cultivation of vegetables and other crops. On the other than, the poor population is generally poorly educated and elderly (over 50 for males and over 45 for females), and lacks skills and knowledge.

Table 5.8-2 Crops cultivated by poor population

Crop	Households	Percent (%)
Wheat	3857	83.35
Corn	3802	82.17
Beans	/	/
Vegetables and other crops	569	12.29
Total	4628	100

5.8.3 Poverty causes of poor residents

1) Due to historical and geographic factors, usable resources are limited, rural infrastructure is backward, and some places do not have basic conditions for cultivation.

2) Difficulty of employment: Most poor residents are elderly, poorly educated and unskilled, and cannot adapt to modern life. They can just do unskilled jobs, and are often employed.

3) The poor population still deals mainly with the cultivation of traditional food crops, and less with the cultivation of commercial crops. 83.35% of the poor respondents deal with wheat cultivation, 82.17% with corn cultivation, and only 12.29% with the cultivation of vegetables and other crops. On the other than, the poor population is generally poorly educated and elderly (over 50 for males and over 45 for females), and lacks skills and knowledge.

4) Some poor residents are disabled or sick, and unable to work. Some live on MLS subsidies, and some incur huge debts due to illness.

5) The July 20 flood has caused great property losses, further impoverishing poor residents.

6) Some poor residents rely highly on external assistance, and are not motivated to become rich.

Table 5.8-3 Causes of poverty of poor population (multiple choices)

Cause of poverty	Number of households	Percent (%)
Difficulty of employment	3636	78.56
Simple business pattern	2414	52.16
Illness	4126	89.17
Disaster	3680	83.41
No motivation	1107	23.89
Total	4406	/

5.8.4 Local supporting measures

In general, the local supporting measures include:

1) Strengthen industry development and develop the collective economy to offer jobs and promote poverty alleviation. For example, in Macun District, advantaged industries such as vegetables, fruits and medicines are developed by multiple stakeholders actively to build industry clusters.

2) Promote employment, and develop public welfare jobs, such as health quarantine and ruins cleanup. In Zhongzhan District, laborers are employed in various forms, such as working at local enterprises, placement to public welfare jobs, working at home and findings jobs themselves.

3) Strengthen post-disaster reconstruction to prevent re-impoverishment. In Jiaozuo City, 78 agricultural post-disaster reconstruction projects have been implemented, crops of 7,805 mu made up or replanted, and temporary subsidies totaling 65.38 million yuan granted.

4) Strengthen infrastructure investment. Village highways totaling 15.8km have been reconstructed, providing access to 100% of villages, 100% of drinking water is safe, and rural power grid upgrading, and rural living environment improvement have been implemented, improving the rural environment greatly.

5.8.5 Needs of poor residents for the Subproject

Poor residents' special needs should be met, and their sound suggestions taken into account to reduce the Subproject's potential negative impacts on them.

Poor residents usually have difficulty in getting employed, so they need jobs suitable for them. The Subproject will generate some unskilled jobs, such as cleaners, patrollers and security guards along the Dasha and Shanmen Rivers, which will be first made available to poor residents.

5.8.6 Impacts of the Subproject on poor residents

Since the Subproject involves LAR, relatively poor communities and residents are disadvantaged in utilizing compensation, receiving subproject benefits and adapting to the new situation, thereby potentially aggravating relative poverty.

However, the Subproject will not aggravate local poverty or create additional poverty, and will ensure that poor residents will benefit equally, including:

1) Offering direct and indirect job opportunities to increase income: The Subproject will create temporary or permanent jobs directly during construction and operation, in which unskilled jobs like sand and stone handling, and cooking, will be first made available to local poor residents, women and other vulnerable groups to increase their income. The Subproject will improve the local environment and attract more visitors, thereby generating job opportunities indirectly, such as catering, accommodation, sightseeing and cleaning.

2) Improving local infrastructure and making traffic more convenient: Bridge restoration will alleviate traffic congestion and reduce traffic accidents to some extent, and protect the personal safety of local residents, including poor residents. The Subproject will also reduce traffic costs of poor residents.

4) Promoting local economic development and creating more development opportunities: The Subproject will improve the local investment environment, and attract more investment to promote local economic development and create more job opportunities for local residents. The Subproject will also promote the tourism development of the 5 affected counties / districts, and the development of related industries, such as catering, accommodation and travel services, thereby increasing the income of local residents, including poor residents.

3) Promoting social fairness: The Subproject will improve the infrastructure and public service level of the 5 affected counties / districts practically, and provide poor residents with greater convenience and more development opportunities, such as nonagricultural employment and business startup.

5.9 Social gender analysis

5.9.1 Local women's demographics

At the end of 2021, Jiaozuo City had a resident population of 3.524 million, including 1.775 million males and 1.749 million females, with a gender ratio of 101:100, including 816,000 women of childbearing age, accounting for 23.17% of the city's resident population.

At the end of 2021, the 5 affected counties / districts had a total population of 1.1418 million, including 564,100 females, accounting for 49.4%. Among the 5 affected counties / districts, Shanyang District has the highest proportion of female population of 51.12%, and Zhongzhan District has the lowest proportion of 43.36%. Xiuwu County has the highest gender ratio of 106, and Shanyang District has the lowest ratio of 96. See Table 5.9-1.

Table 5.9-1 Basic information of local women

Division	Households (0,000)	Population (0,000)	Male (0,000)	Female (0,000)	Proportion of females	Gender ratio (female =100)
Jiaozuo City	102.9	352.4	177.5	174.9	49.63	101
Subproject area	32.64	114.18	56.3	56.41	49.40	100
Jiefang District	9.01	34.74	17.11	17.63	50.75	97
Shanyang District	9.58	30.32	14.82	15.5	51.12	96
Zhongzhan District	3.48	12.2	5.44	5.29	43.36	103
Macun District	3.56	12.06	6.16	5.9	48.12	104
Xiuwu County	7.01	24.86	12.77	12.09	48.63	106

Source: 2021 Social and Economic Development Bulletin of Jiaozuo City

5.9.2 Local women's current situation

To learn local women's current situation, the taskforce conducted a questionnaire survey and interviews with women. In the questionnaire survey, there are 182 female respondents, accounting for 45.5% of the sample.

5.9.2.1 Age structure

In the sample, males and females account for 54.5% and 45.5% respectively. Among the female respondents, those aged 45-54 years are the most (58.3%), followed by those aged 35-44 years (39.4%), and those aged 18-24 years or above are the least (12.7). See Figure 5.9-1.

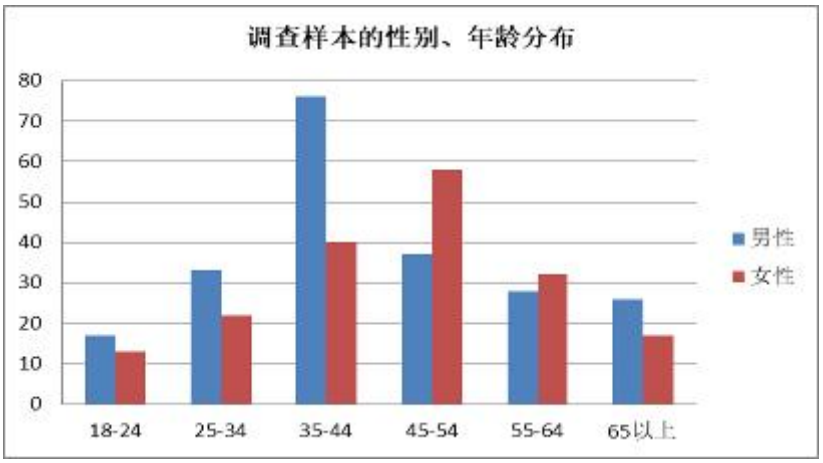


Figure 5.9-1 Gender and age distribution of the sample

5.9.2.2 Educational levels

The respondents have mostly received primary high school education (52.55% and 56.82% for males and females respectively). 18.57% of the female respondents have received senior high school / secondary technical school education, lower than that of the males (25.08%). 11.64% of the female respondents have received primary high school education, much higher than that of the males (3.26%). It can be seen that men and women are generally well educated. See Table 5.9-2.

Table 5.9-2 Educational levels of the sample

Educational level	Male		Female		Total	
	N	Percent	N	Percent	N	Percent
Junior college or above	40	18.17%	21	11.68%	61	15.25%
Senior high school / secondary technical school	55	25.08%	34	18.57%	89	22.25%
Junior high school	115	52.55%	103	56.82%	218	54.50%
Primary school or below	7	3.26%	21	11.64%	28	7.00%
Illiterate	2	0.94%	2	1.29%	4	1.00%
Total	218	100%	182	100%	400	100.00%

5.9.2.3 Occupations

Over 1/3 of the male and female respondents are civil servants, public institution workers or enterprise employees. The proportion of employment of the males is higher than that of the females, while the proportions of the females choosing “other” and “freelancer” are higher than those of the males. This shows that men and women are relatively balanced in employment.

Local women mostly stay at home and rarely work outside. There is a clear division of labor between the genders, where men are responsible mainly for external affairs and women mainly for internal affairs, such as farming and taking care of families. Therefore, men enjoy higher status, while women are mostly subordinate.

Table 5.9- 3 Occupations of the sample by gender

Occupation	**Male**		**Female**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
Civil servant	17	7.86%	10	5.39%	27	6.75%
Public institution worker	41	18.87%	23	12.77%	64	16.00%
Enterprise employee	37	16.98%	22	12.34%	59	14.75%
Self-employer	40	18.41%	26	14.11%	66	16.50%
Freelancer	34	15.58%	42	23.27%	76	19.00%
Student	8	3.46%	17	9.41%	25	6.25%
Retiree	12	5.35%	17	9.45%	29	7.25%
Farmer	14	6.57%	9	4.95%	23	5.75%
Other	15	6.92%	15	8.31%	30	7.50%
Total	218	100%	182	100%	400	100.00%

5.9.3 Women’s needs and expectations

At the preparation stage, the Jiaozuo PMO, IAs, design agency and taskforce collected local women’s needs and suggestions by means of FGD and interview. Their needs for the Subproject are as follows:

5.9.3.1 Road traffic

Women’s main trip modes are non-motorized vehicle (35.2%), motorized vehicle (30.0%) and

walk (23.8%). In daily life, local women travel by motorized vehicle, non-motorized vehicle and walk mainly. They expect to improve traffic efficiency and comfort. See Table 5.9-4.

Table 5.9-4 Traffic modes of the sample by gender

Indicator	Female			Male		
	Means of transport	Frequency	Percent	Means of transport	Frequency	Percent
No.1 traffic mode	Walk	64	35.2%	Walk	83	38.2%
	Non-motorized vehicle	55	30.0%	Non-motorized vehicle	48	22.2%
No.2 traffic mode	Non-motorized vehicle	50	27.4%	Non-motorized vehicle	64	29.2%
	Public transit	49	27.0%	Public transit	57	26.2%
No.3 traffic mode	Motorized vehicle	44	24.0%	Motorized vehicle	60	27.4%
	Subway	43	23.8%	Subway	63	28.8%

Note: The sample of the questionnaire survey includes 182 females and 218 males.

1) Women expect the damaged bridges and roads to be restored as soon as possible to ensure convenient traffic. Some roads, bridges and sidewalks are in poor condition, congested or waterlogged, increasing traffic pressure, especially on holidays. Women are responsible for taking children to and from school, and shopping, and have to go out often. Therefore, local women generally support the Subproject, and raise their expectations for traffic infrastructure.

2) Women think that urban river infrastructure is aged, and needs to be restored urgently. 54.7% of the female respondents think that riverside roads are very seriously damaged, and 45.2% think that they are seriously damaged; 35.6% think that vehicle lanes are very seriously damaged, and 31.2% think that they are seriously damaged; 42.3% think that the traffic capacity of the road network is very low, and 40.05% think that it is low; 36.7% think that traffic congestion is very serious, and 31.4% think that it is serious; 68.5% think that road drainage efficiency is very low, and 56.2% think that it is low.

3) Women expect to strengthen education and publicity on traffic safety, because women and elders are relatively short of traffic safety knowledge, and women, especially elderly women, are likely to be excluded from relevant activities due to low social status. In addition, women may have no time or effort to participate in such activities due to their heavy household burden.

In general, local women think that there are serious problems in urban road traffic, mainly including road damage, low traffic capacity of the road network, traffic congestion, aged bridges, incomplete infrastructure, and lack of education and publicity on traffic safety.

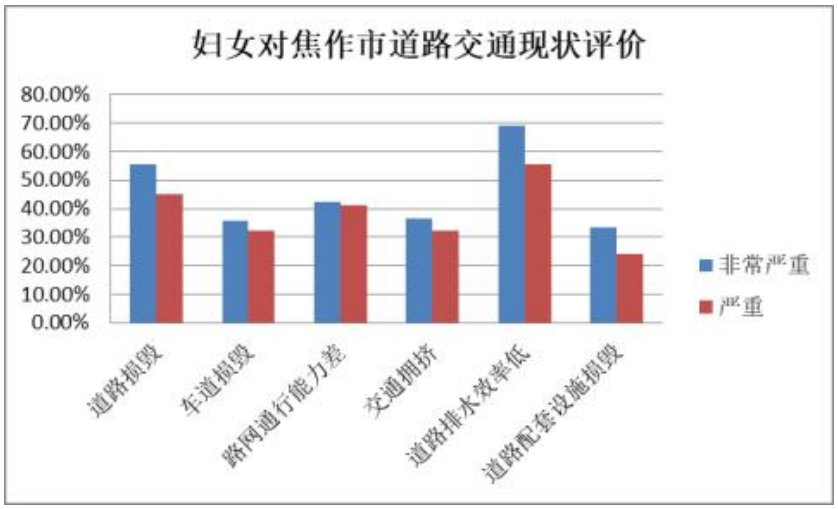


Figure 5.9-2 Women's comments on road traffic

5.9.3.2 Greater support for and confidence in the Subproject

In the question “Do you support the Subproject?”, 68.89% of the female respondents choose “strongly support”, much higher than that of the males (63.49%). Since road infrastructure improvement will bring great convenience to them in shopping, taking children to and from school, and housework, their support level is much higher. See Figure 5.9-3.

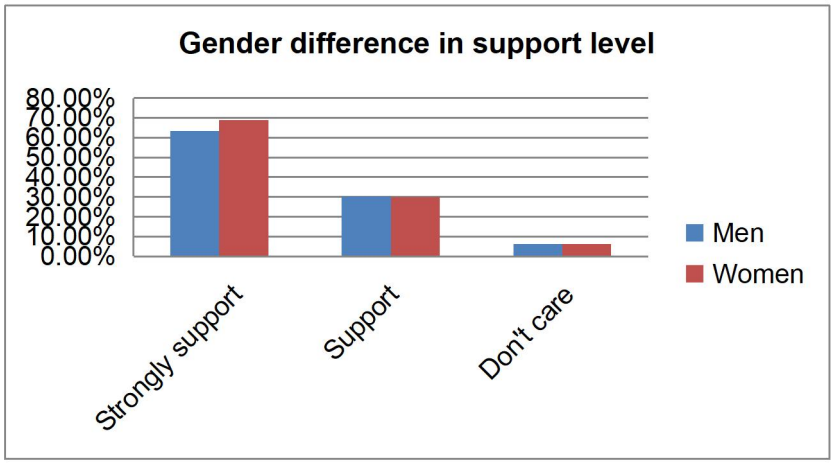


Figure 5.9-3 Support for the Subproject

5.9.3.3 Expectation for more job opportunities

The Subproject will generate some unskilled and service jobs, such as cleaning. Local women expect to take such jobs to increase income while taking care of families.

5.9.3.4 Strong demand for public participation

In recent years, through active efforts of the government, women’s federations and NPOs (including international organizations), local women have more opportunities to participate in public affairs and enjoy public services, making it possible for them to increase income and improve social status.

The traditional division of labor still exists in the subproject area, and women’s participation in certain activities is still inadequate, such as receiving LA compensation, major decisions, skills training and flood safety publicity, in which the participation rate of women is lower than that of men by 9.84%. See Figure 5.9-4.

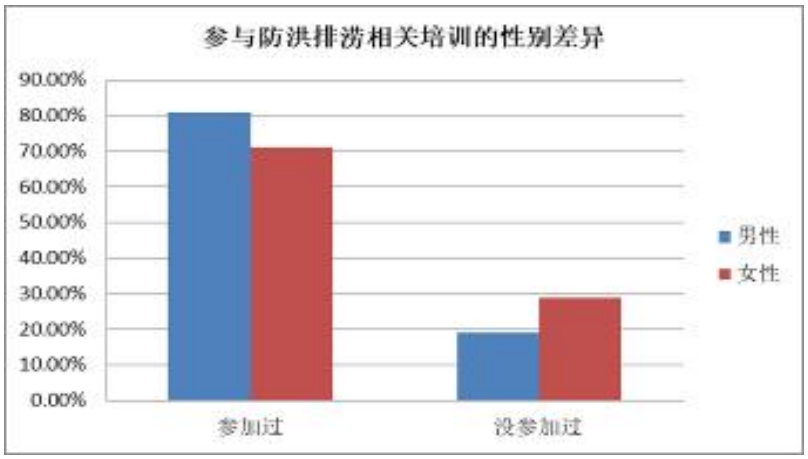


Figure 5.9-4 Have you been trained on flood control?

Local women are generally willing to participate in the above activities, and expect that particular attention should be paid to their needs and interests in future activities, especially middle-aged and elderly women.

Interview 5-23: Ms Liu, Anyangcheng Sub-district, Macun District (35 years)

"I take care of the child and do housework at home, and community meetings are mostly attended by my husband. In fact, some things can also be done by women, but there is no opportunity. I expect the government to offer more opportunities to us."

5.9.4 Subproject impacts on women

5.9.4.1 Positive impacts

1) Improving local traffic

There are many residential communities, commercial areas and recreational areas along the Dasha, Shanmen and Qunying Rivers, and are important passages for local residents' daily traffic and important flood discharge channels. The Subproject will improve the city's flood control capacity and traffic greatly.

2) Creating a safer and more convenient traffic environment for women

After road and bridge restoration, women will enjoy safer, more convenient and more comfortable traffic. Their saved time can be used for production or creation.

3) Providing nonagricultural job opportunities to women to increase their income

The Subproject will generate some temporary jobs during construction, such as unskilled labor, cleaning and cooking, which are available to local women and poor residents to increase their income. The Subproject will generate some unskilled jobs after completion, such as patrol, cleaning and security, which will be first made available to local women and poor residents.

4) Encouraging women to participate to promote their development

AIIB encourages women's participation and pays attention to the protection of their rights. During implementation, women will be encouraged to participate in public affairs through village committees, and an incentive mechanism established. In addition, special flood control training will be offered to women to improve their participation awareness and overall literacy, and promote their long-term development. The survey shows that the female respondents are highly willing to participate in public activities, so women will be an important target group for community participation in the Subproject.

5) Reducing floods to reduce financial losses

In the July 20 rainstorm, 916,823 persons were affected, with property losses amounting to 1,016,073,400 yuan. Women were affected more seriously than men, because they are weaker in physical fitness and emergency response, and do more housework. The Subproject will improve flood discharge and regulating capacity, and flood resistance, and create a favorable living environment. It will also reduce flood losses, and create a stable and safe production environment.

5.9.4.2 Negative impacts

The Subproject will benefit women. However, if there is a lack of gender sensitivity in the Subproject's design, implementation and management, and women's needs and suggestions are neglected, the Subproject's benefits will be reduced, and women will be exposed to risks. The social risks for women include:

1) Local women's public participation rate is low, and their needs are likely to be neglected.

Due to traditional culture, income, etc., women's social status is still lower than that of men. Most major family decisions are made by men, and most participants of public affairs are men.

Thus, women's needs and suggestions are likely to be neglected at the design, construction and operation stages. For example, in the question "Have you attended training on flood safety?", over half of the female respondents give a negative answer.

2) Inequality in receiving compensation and getting employed

During LA compensation distribution, some women cannot sign for receipt because they are not household heads, so they are likely to be passive in making use of such compensation. During construction and operation, female workers are likely to be treated unfairly, such as remuneration and labor protection.

Interview 5-24: Ms Liu, Chengguan Town, Xiuwu County (48 years)

"I usually take care of my grandson and do housework at home. I want to participate in public affairs, but most participants are men. I have been used to it."

3) Reducing the land-based income of some women

LA may affect the living standard of women, because land-based income is likely to be reduced after LA. If land-expropriated women are not properly employed or resettled, their income will be reduced, thereby increasing the financial burden of their families.

4) Increased traffic safety risks after traffic improvement

Local women are generally poorly educated, lack traffic safety awareness, and are likely to be neglected in traffic safety training. This is partly attributed to their heavy housework burden. As a result, women may be unable to utilize improve roads safely.

5) Potential GBV risks

GBV means acts that are against personal will and based on interpersonal gender differences, including acts that lead to physical, sexual and spiritual harms or pains, threats of such acts, coercion and other acts that deprive one of freedom. Such acts may occur publicly or privately. At the construction and operation stages, more male workers are employed than female ones, and the proportion of skilled male workers is higher. In case of improper management, GBV and SEA / SH may occur, thereby affecting female workers' physical and mental health negatively. The construction agency provides regular mental counseling and rights protection training to female laborers, and tell them that they may resort to the municipal women's federation (hotline: 0391-3568268). The construction agency should strengthen the regulation of construction sites to avoid SEA / SH and GBV, and establish a clear GRM. The construction agency should also establish a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.

The SMP has been developed through adequate consultation with the PMO, IAs, local women's federations and agencies concerned. See Tables 10.3-4 and 10.3-5 in Chapter 10 for details.

6 Scheme Comparison and Selection

The reconstruction and upgrading of the water infrastructures of the Subproject mainly aims at the restoration and upgrading of seriously damaged rivers of Dasha River and Shanmen River, and the main construction contents include river dredging and desilting and embankment works, bank slope regulation works, ecological restoration works, building works, bridge works, sluice gate works, flood control road works, etc.

The reconstruction and upgrading of municipal infrastructures in the Subproject mainly aims at the restoration and upgrading of water-damaged rivers, water-damaged urban roads, auxiliary facilities, bridges and drainage facilities, etc., in the urban area. The restoration of water-damaged rivers mainly includes river restoration, river dredging, restoration of auxiliary facilities along the river, etc.; the reconstruction of water-damaged urban roads and auxiliary facilities mainly includes road restoration, restoration of municipal drainage facilities and drainage pumping stations, transformation of local water points on the road, and restoration of street lamps; the restoration of water-blocking bridges mainly includes bridge detection, bridge reinforcement and repair, etc.; the transforming and upgrading project of drainage facilities mainly includes the restoration and upgrading of storm sewage pipe network and flood interception ditches, etc.

In the reconstruction and upgrading project of water infrastructures, the river dredging method is closely related to the environmental impact of the project implementation; and in the reconstruction and upgrading project of municipal infrastructures, the selection of the design schemes of the water-damaged urban road pavement structures is related to the road restoration effect and the environmental impact of project implementation. Therefore, the selection and comparison of the following technical schemes are mainly analyzed from the dredging methods of rivers and the design schemes of pavement structures.

6.1 Comparison and selection of technical schemes

6.1.1 Comparison and selection of dredging methods

The Dasha River, Shanmen River and Tianjian Ditch in the Subproject involve dredging works. Shanmen River and Tianjian Ditch are seasonal rivers, which have no water all year round in non-flood season. The construction period of the Subproject is arranged in the non-flood season, so, in combination with the practical situation of rivers, the Shanmen River and Tianjian Ditch adopt dry dredging with no more analysis. Comparison and selection analysis is mainly carried out for the dredging methods of Dasha River in Jiaozuo City and Dasha River in Xiuwu County.

6.1.1.1 Dredging methods

Common dredging technologies in the river dredging management process include underwater dredging method, draining dredging technology and environmental dredging technology. The draining dredging technology is dry dredging, while underwater dredging method and environmental dredging technology are wet dredging.

(1) Underwater dredging methods

Common underwater dredging methods include cutter-suction type, bucket-wheel type and grab type, etc. Due to the different dredging means, the actual situation of the corresponding river is also different. For example, the cutter-suction type is usually used for dredging of medium-sized rivers, but sludge rotation often occurs in the process of use; the grab type is often used for dredging of river areas with high concentration of barriers and large thickness of sludge layer, with high stability; and the bucket-wheel type is often used for dredging of medium-sized rivers with large engineering volume, with significant dredging effect.

(2) Draining dredging technology

There are two common operating methods of draining dredging technology, namely hydraulic excavation and dry excavation. The hydraulic excavation mainly uses the huge pressure generated by water torch to flush away the sludge at the river bottom, and uses the equipment for centralized collection of sludge and centralized transportation to the target location. The dry excavation uses excavators to carry out the riverbed excavation operation and transfer the sludge onto slag trucks for transport out of the river. Both the hydraulic excavation and dry excavation will not be affected by the river environmental factors, but greatly affected by the seasons, and dredging can only be carried out during the dry period of river.

(3) Environmental dredging technology

The environmental dredging technology has strict requirements on the turbidity of the water areas to be treated, and can achieve a good dredging effect, but the application cost of the environmental dredging technology is high. The environmental cutter-suction dredging technology can reduce the environmental impact during the dredging operation with the assistance of high positioning accuracy equipment. During the use, the technology can be combined with other equipment, such as positioning technology, mining vessels, etc. In the specific work, the relevant technical personnel shall make an accurate judgement of the excavation precision and track to avoid the incomplete dredging problem.

6.1.1.2 Comparison and selection analysis of dredging methods for Dasha River

The Dasha River section from the mountain outlet to the 1.1km upper reaches of the South-to-north Water Diversion is located at the upper reaches of Dasha River, and is a seasonal river, with a small water volume all year round and wide bottom width. The Dasha River section from 2km lower reaches of South-to-North Water Diversion to 2.5km lower reaches Jiugao Road is located at the lower reaches of Dasha River, with a bottom width of 68.94m-324.42m and a water depth of 2-5m, without merchant shipping. At present, the river is built with water retaining structures for flow control, and there is a divaricating channel on the right side of the river bottomland from the Zhongyuan Road section to the lower reaches terminal section. Dasha River flows lower reaches from Jiaozuo City into Xiuwu County. The Dasha River section in Xiuwu County has a small river channel, generally 20-45m, and about 2-4m deep in non-flood season. The incoming water of upper reaches is relatively stable and the amount of water is relatively large. At present, there are crops planted on the bottomland of the left bank of the Dasha River. Due to the rainstorm on July 20, 2021, the groundwater level of Dasha River in Xiuwu County was high. In July 2021, Jiaozuo City suffered from a rare continuous heavy rainfall weather and impact of mountain torrents of upper reaches in history, and the lower reaches section of the Dasha River had serious siltation.

According to the actual situation of the Dasha River, the upper reaches section of the Dasha River (from the mountain outlet to the South-to-North Water Diversion) has a small water volume in the river channel and is dredged with the dry dredging method. The Dasha River section in Jiaozuo City from 2km lower reaches of the South-to-North Water Diversion to 2.5km lower reaches of Jiugao Road features deep water depth and wide river channel. In addition, at present, the river is built with water retaining structures for flow control, and there is an old river channel on the right side of the river bottomland from the Zhongyuan Road section to the lower reaches terminal section, which can be used for temporary diversion during construction, and can guarantee the dry dredging conditions in the main channel to reduce the dredging cost. Dry dredging is adopted for this river section, and compared with wet dredging, dry dredging has the following advantages: smaller dredging volume, smaller occupied area for temporary stacking of sludge, shorter duration of noise impact on the surrounding environment by the required

transportation vehicles and construction equipment, less waste water produced by sludge dehydration, smaller disturbance of the dredging process to the water quality of the river, and smaller adverse impact on the surrounding environment. Therefore, the dry dredging method is adopted for the dredging of the Dasha River section from 2km lower reaches of South-to-North Water Diversion to 2.5km lower reaches Jiugao Road.

The lower reaches section of Dasha River in Xiuwu County has a small river channel and a narrow river width, with a water depth of about 2-4m. The incoming water of upper reaches is relatively stable and the amount of water is relatively large. At present, there are crops planted on the bottomland of the left bank of the Dasha River. If dry dredging is adopted, a diversion channel shall be excavated on the bottomland of the left bank of Dasha River, but the excavation process of the diversion channel involves a large area of temporary land occupation, and produces many earthworks and large earthwork development quantities; in addition, the groundwater level is high in Xiuwu County, resulting in a large water discharge in the diversion process; the farmers' acceptance level during the construction process is lower, and the construction coordination is more difficult. Both the excavation process and excavation earthworks of the open channel will have a certain impact on the environmental air; Excavation of open channels will damage the native vegetation on the bottomland and have a certain impact on the natural environment. The overall cost is high. If wet dredging is adopted, the dredging equipment are operated on the bottomland on both sides of the river channel, without increasing new land occupation and involving the compensation problems for people's livelihood, the farmers' acceptance level is higher, and the construction coordination is less difficult. During the process of wet dredging, the equipment directly performs sludge dredging and excavation at the water bottom, which greatly disturbs the water bodies, and the dredging process will cause an adverse effect on the lower reaches water quality of Dasha River, causing the deterioration of water quality in a short period; But the wet dredging almost has no influence to the bottomland and vegetation on both sides of the river channel. The earthwork excavation quantities are small, involving no occupation of embankment works, and the total investment is low. Therefore, the wet dredging method is adopted for the dredging of Dasha River section in Xiuwu County.

6.1.2 Comparison and selection of pavement structural design schemes

Since the reconstruction and upgrading of the municipal infrastructures of the Subproject involve the restoration of several municipal roads, the North Ring Road (Puji Road-Tabei Road) Restoration is selected as a representative for the selection and comparison analysis of the design schemes for pavement structures.

According to the water-damaged road investigation and evaluation of North Ring Road and in combination with the maintenance countermeasure table for bituminous pavement, the motor vehicle lanes of North Ring Road are mainly overhauled. In this study, the overhaul schemes for the motor vehicle lanes of North Ring Road mainly include milling and paving of asphalt surface courses and removal of the new asphalt pavement.

Scheme I: Milling and paving of asphalt surface courses

The milling of the existing asphalt surface course is to add a 2x18cm thick cement stabilized macadam layer, and the surface course adopts the 4cmAC-13C fine-grain asphalt mixture + 6cmAC-20C medium-grain asphalt mixture.

The advantages of this scheme include: the excavation volume of the base course is small, which can effectively reduce the old road wastes produced from excavation and is beneficial to saving the investment and speeding up the construction progress, and the project investment is less; The disadvantages include: After the motor vehicle lanes are paved with a base course, the

road elevation is increased, which is not conducive to the smooth connection between the North Ring Road and the intersecting roads on both sides. Moreover, the increased road elevation will cause rainwater intrusion to some shop front rooms along the street along the road, and the later maintenance quantity is big.

In order to promote the road capacity, realize rain and sewage diversion, and promote the drainage capacity, new storm sewage pipelines shall be built and roads shall be expanded in this project to optimize the section. If a base course is added, there will be more overlapping joints between the new and old subgrades, which is easy to cause a hidden danger of uneven settlement.

Scheme II: Removal of the new asphalt pavement

The existing motor vehicle lanes shall be removed to the subbase course of the original road structure, and a new asphalt pavement and base course shall be constructed. The advantages of this scheme include: The base course of the existing road is thoroughly removed, two layers of the cement-stabilized macadam base and cement-lime-stabilized soil base are paved, and the roadbed is treated. The overall strength of the pavement structure is improved to meet the sub-arterial road level and the traffic demand after the upgrading and transformation of the North Ring Road. The disadvantages of the scheme include: Compared with Scheme I, the old road excavation volume is bigger, the construction cost is bigger and the construction is more difficult. During the implementation of the project, reasonable stacking and utilization of old road wastes shall be considered, and the construction organization plan shall be arranged scientifically.

Considering the current situation of the pavement structure and the service life of the pavement structure, in line with the principle of once building for long-term use, and to avoid the later patch-type road repair and reduce the impact of later maintenance on the surrounding traffic and the adverse noise effect on the surrounding people, a design scheme of removing newly build pavement structure is adopted for the motor vehicle lanes of the North Ring Road in this design after comprehensive analysis in combination with the implementation effect and long-term environmental impact of the whole project.

6.2 No project alternative analysis

No project alternative means the project is not constructed.

The current state is maintained. The heavy rainfall during the flood season of 2021 greatly affected the economic society of Jiaozuo City, and there were many point locations with dangerous circumstance and dangerous section in the river. The collapse of production bridges and bank slopes caused great losses to the traffic, production and life as well as economy of the residents along the bank, some embankment sections were damaged by flood, causing incomplete flood banks along the river, and some river sections had leakage and other problems due to undercutting of main river channel and flood brushing, which affected the overall flood prevention of the river. The ability to withstand flood is poor, which cannot effectively constrain the flood and threat the life and property security of urban and rural residents along the bank; the flood has caused great damages to the river bank slope, waterfront ecological revetment protection and some ecological greening protection projects of Dasha River, and caused great influence to the excellent ecological environment of the original lake water systems. The silt brought down from the upper reaches is deposited seriously in the main channel of the lower reaches, especially in the upper reaches of the gate dam. The accumulation of wastes and silt and the instantaneous floods also cause certain damage to the gate dam projects, and it is difficult to form effective ecological water surface and ecological shoal, which greatly affects the original

habitats of river lake wetlands.

The project is not constructed. The heavy rainfall during the flood season of 2021 caused great losses to the urban area of Jiaozuo City, and the urban infrastructures were seriously damaged. Among them, about 80,000m^2 of roads and 50,000m^2 of sidewalks were damaged, and a total of 36 damaged bridges were found in the preliminary investigation and all bridged shall be comprehensively inspected. About 160km of the sewer network was clogged, 3,000 inspection wells and water wells, 89 river facilities, 260 street lamps and 28km of cable pipes were damaged, and the municipal road infrastructures were seriously damaged, which seriously affected the traffic. In addition, the drainage capacity of existing roads and their capacity to withstand the water damage risk were poor, which greatly affected the normal operation of the city and the safety traffic of the public, and significantly affected the normal traffic of residents along the river.

The Subproject aims to reconstruct the water-damaged rivers, roads and municipal auxiliary facilities in Jiaozuo City, consolidate or expand the urban water-blocking bridges, transform drainage facilities in seriously flood-washed area, eliminate the potential safety hazards after disasters, protect the life and property safety of the public and restore the normal production and life orders of the city, which are necessary to eliminate the influence of the heavy rain and restore the normal production and life of the masses along the river, perfect and promote the urban flood prevention system of Jiaozuo City, restore the ecological environment level of the river system and improve the ecological restoration ability of the lake water systems of Jiaozuo City, and realize the comprehensive benefit, coordination and unification of the society, economy and ecology.

7 Climate Change and Climate Response Capacity Analysis

7.1 Climate change

The climate is a long-term average state of atmospheric physical characteristics, and stable to some extent. According to the provisions of the World Meteorological Organization (WMO), the computing time of a standard climate is 30 years. The climate is measured with cold, warm, dry and wet characteristics, and is generally represented by the average value and deviation value of a period. Most of the engineering area is located in the planned and current built-up urban area of Jiaozuo City, at the edge of North China Plain and next to Taihang Mountains in the north. The possible climate problems mainly include: Rainstorm, gale, hail, low temperature freezing, drought, etc.

7.2 Climate response capacity analysis

7.2.1 Analysis of the climate change response capacity during the construction process

Climate change have adverse effects on the engineering construction, for example, the earthwork of the construction project cannot be implemented due to the increased rainfall, extended plum rain season or frequent occurrence of rainstorm and other extreme precipitations, which delays the construction period. Strong breeze, heavy precipitation, heavy snow and other extreme weathers will bring up security problems to the use of large equipment and construction machineries on the construction site, which is not conducive to the safety of construction personnel.

According to the project characteristics, priority shall be given to the response to the floods caused by gales and rainstorms during the construction period, and proper measures shall be taken to prevent high temperature and drought, hail, low temperature freezing and other disaster weather.

(1) Enhanced warning

In order to guarantee the safety of construction personnel during the construction process, it is necessary to timely understand the current and future weather, and the command and supervision departments shall take timely measures and make reasonable scheduling according to the meteorological information, to avoid disasters caused by meteorological disasters.

(2) Flood response during the construction period

① Flood response during the construction period of river projects

In the Subproject, it is required to take a full account of the flood discharge during the construction in the non-flood season, and during the construction, it needs to complete the water and soil conservation and environmental protection to reduce the impact on the surrounding vegetation and the ecological environment. Before the flood season, the management unit shall clear the dredged mud and sundries in the river channel to guarantee the flood discharge section. The spoil area, temporary facilities and equipment, and bridge works shall be comprehensively inspected, and corresponding scour prevention and drainage facilities shall be built to ensure that no water damage occurs during the construction.

② Flood prevention during the construction period of road and pipe duct projects

For the construction of road and pipe duct projects, flood prevention work during the construction period shall be well completed from the aspects of construction organization, engineering measures, material and equipment safeguard, etc.

1) Organizational measures

◆ Establish a safety flood control leading group at the engineering construction and

management office to be responsible for organizing and leading the work of flood control for projects under construction in the flood season. The safety flood control leading group shall obey the dispatch of the local flood control headquarters and actively cooperate with the local flood control work.

◆ Establish several motor emergency squads with the project manager of each bid section as the captain and 30-50 highly capable personnel as members based on the project departments of several bid sections under construction in the engineering section, which is dispatched by the municipal flood control headquarters and the superior flood control department.

2) Engineering measures

◆ Take full advantages of the municipal road drainage systems near the engineering for the drainage of stagnant water, and carry out construction diversion during the temporary blocking period of pipelines.

◆ Strengthen the implementation of measures such as channel and canal embankment slope protection, replaced canal slope protection, high fill canal section protection, channel influent and water accumulation prevention and elimination, and channel lining concrete protection in the flood season, to ensure the channel projects can be safely carried out in the flood season.

◆ Comprehensively inspect the water culverts of construction roads and the drainage systems around the construction area, and equip necessary water pumps to ensure safety construction in the flood season. Strengthen the road maintenance in the construction area to ensure the roads unobstructed.

◆ The spoil area, temporary facilities and equipment, and bridge works shall be comprehensively inspected, and corresponding scour prevention and drainage facilities shall be built according to the flood control schemes, to ensure that no water damage occurs during the construction.

3) Safeguard measures for materials and equipment

The Supervision Department shall inspect the material reserves and field facilities for flood control of each bid section, and in case of any insufficient or lack of flood control equipment and materials for any individual bid section, it shall order the construction unit of the bid section to make proper rectification within the specified time limit according to the flood control requirements. During the flood season, the transportation vehicles, excavators, bulldozers, generators and water pumps shall be ensured in full quantity and good standby state, to meet the requirements of scheduling and use at any time in case of emergency rainfall and flood situation.

(3) Gale response during the construction period

Gale refers to the wind with the wind force near the ground up to Beaufort scale of Level 8 (average wind speed of 17.2-20.7 m/s) or above. In the China Meteorological Observation service, it is specified that the wind with the instantaneous wind speed reaching or exceeding 17 m/s (or the visually estimated wind speed reaching or exceeding Level 8) is considered as gale. In the China Weather Forecast service, it is specified that the wind with Beaufort scale of Level 6 (average wind speed of 10.8--13.8 m/s) or above is regarded as gale. The gale will greatly damage the ground facilities and buildings, and is a disastrous weather.

The Subproject involves earthwork excavation and backfilling. Therefore, in the event of gale and other disastrous weathers, the outdoor operations shall be stopped, and dust reduction measures such as covering and watering shall be taken for the construction site and spoil ground, and the flying dust control shall be strengthened to reduce the impact on the surrounding environment. Construction vehicles shall not stopped under the high buildings and big trees to

prevent glasses and branches falling and damaging the vehicle bodies.

7.2.2 Analysis of the climate change response capacity during the operation process

The engineering restoration objects include rivers, roads, pipe channels and other important urban drainage facilities. Efforts shall be made to strengthen the operation management systematically and scientifically, significantly improve the city's ability to cope with emergencies and extreme heavy rains, and give full play to the project benefit. According to the project characteristics, measures for rainstorm, drought, hail, low temperature freezing and other disastrous weathers are mainly considered during the operation period.

(1) Rainstorm response during the operation period

In order to strengthen the perception and response capacities of a rainstorm, Jiaozuo Municipal Emergency Management Bureau has carried out to build an urban smart water environment (flood control) platform. After completion, the project will comprehensively promote the intelligent management level of the flood control and drainage business in the whole city. The platform mainly has two functions of model analysis and flood control emergency command. During the operation of the Subproject, projects related to the climate change response capacity mainly include model analysis, flood control emergency command, emergency rescue mechanism perfection, and engineering operation management, etc.

① Model analysis

Static models can be used to check and inspect the climate change adaptability analysis, economic evaluation and other situations of the well kick and pipe layout projects, observe the possible waterlogging conditions due to different rainfalls in the central urban area, more intuitively inspect the drainage capacity of the central urban area, and provide plans for pipe network capacity promotion before disasters; in the disaster, areas that need to be strengthened with protection shall be deployed. The real-time dynamic waterlogging and pump station models can be used to push the possible waterlogging early-warning level with the prediction of the rainfall in the next 2 hours and the emergency plans corresponding to the early-warning level, and display the possible waterlogging area in the command center; meanwhile, recommendations on pump station operation can be provided according to the current water level of the pump station and in combination with the possible water level in the next 2 hours. Timely and efficient auxiliary decision making for flood control and drainage shall be provided for the flood control personnel.

② Flood prevention emergency command

Through the data collection of precipitation station, river level, road water point and intelligent video monitoring, and in combination with the analysis data of the waterlogging model, relevant information about rain condition and waterlogging is provided to the decision maker to initiate the emergency plans, relevant flood control task, scheduling notice and other work orders are issued to the relevant responsible persons at the first time through the emergency call system, and the platform will also remind the responsible persons through SMS. The person in charge can report the field conditions to the decision maker in time through the smart water management system APP, so that the leaders can better understand the relevant situation on site and the progress of task processing. This mechanism improves the flood control and drainage emergency linkage and comprehensive decision-making ability, realizes a modern flood control pattern of in-time early-warning, accurate study and evaluation, rapid response, unified command and joint action, and comprehensively promotes the ability to respond to the extreme climates.

When an excessive flood occurs, the residents in the flooded area shall be moved to safety zones. Flood control personnel in relevant departments shall be familiar with the terrain, road traffic information, population size of residents in the flooded area and other information,

determine the diagram of the flooded area in the preliminary stage, and formulate reasonable routes for personnel evacuation according to the traffic condition in the flooded area, so that a planned and orderly evacuation can be achieved in case of a disaster to avoid hurry and confusion during the evacuation process. In addition, relocation sites for victims shall be clarified in the diagram of the preliminarily determined flooded area, the best evacuation routes for victims shall be selected, and the relocation site information and evacuation routes shall be notified to the residents in the flooded area in advance, so that when a disaster occurs, the masses can be dredged and get to a safe place as soon as possible.

③ Emergency rescue mechanism perfection

First, clearly divide the responsibilities of the government and relevant departments to actively promote the orderly implementation of post-disaster emergency rescue work. After flood subsidence, the government and the flood control office in the affiliated administrative region shall immediately organize the masses to return home, and devote to the post-disaster reconstruction as soon as possible. For the masses that have suffered great losses from the disaster and cannot save themselves with their own forces, the government of the affected area under administration shall timely issue the disaster relief funds and actively organize personnel to help them to reconstruct their homes and restore the production. Second, the materials shall be supplemented in time according to the material consumption in the emergency protection in flood defense and the requirements of different measures of the governments at all levels in the area under jurisdiction, to ensure that the flood control work can be carried out successfully. Third, the current flood control projects that are damaged in floods exceeding the designed level shall be restored or reconstructed as soon as possible to restore their main functions of flood control and play their role of flood control before the next flood. For infrastructures that are seriously damaged in floods exceeding the designed level, such as communication cables, power, traffic roads and hydrologic monitoring stations, relevant departments shall be organized to repair them and restore their function. Fourth, the relevant departments shall take overall consideration and make reasonable planning for the post-disaster reconstruction work, and the newly built flood control engineering system must meet the *Flood Control Standards* issued by the State. Fifth, disaster evaluation shall be carried out. The flood control and drought relief departments at all levels in the area under jurisdiction shall carry out qualitative and quantitative summary, analysis and evaluation of each link and each aspect of the flood control work during the flood exceeding the designed level. The flood control and drought relief departments shall actively seek for opinions and suggestions on the flood control work from relevant departments and the masses in the disaster area, summarize the work experience, and find out the problems and loopholes in the flood control work.

④ Engineering operation management measures

During the operation, corresponding energy management measures and systems shall be formulated for the operation of all kinds of energy consumption equipment to reduce the energy consumption. The management personnel and operation personnel shall be trained on energy conservation, the operating personnel shall have the work permit on energy conservation, and fuel management shall be strengthened to take full advantage of existing conditions and reduce the energy consumption. For example, the road lighting lamps shall be controlled in groups according to the production requirements and the natural lighting conditions to reduce power consumption.

Meanwhile, in order to maintain the safe, natural and ecological rivers, and guarantee the river water quality and slope protection, the control and management of the sewage discharge along the river shall be strengthened, and the implementation rules shall be formulated for the

management and maintenance of the watershed systems, which shall be specifically implemented to the relevant responsible personnel. The operation, management and maintenance of river retaining walls, slope protection and other settings shall be carried out according to the principles of "constant maintenance, repair and clear at any time, maintenance superior to repair, and repair superior to rescue.

(2) Low temperature freezing response during the operation period

The low temperature freezing disaster is mainly due to the temperature decrease for days caused by the intrusion of severe cold air and cold wave from the polar regions as well as agro-meteorological disasters that causes crop damages and reduces production due to the too low environmental temperature. The low temperature freezing disasters include continuous low temperature overcast and rainy days, low temperature damage, frost, cold wave, etc.

Preventative measures for low temperature freezing disasters are mainly to: determine the suitable crop varieties and the planting period according to the local climate conditions, to avoid harmful low temperature during the low temperature sensitive period; adjust the plant layout and variety proportion according to the forecasting of low temperature damages; regulate the regional microclimate, which can not only overcome the harms due to low temperature in spring, but also make plants avoid low temperature in autumn; and strengthen the basic construction and management in the planting area, etc.

In terms of the defense of low temperature damages, the meteorological research personnel have mastered the microthermal climate rules and strengthened the forecast of low temperature damages. In particular, the long-term trend forecast provides a reliable basis for the regulation of crop layout and variety matching, while the short and medium-term forecasts provide a reliable basis for the application of in-time emergency resistance measures.

(3) Hail response during the operation period

Disaster caused by hails has great harms to the agriculture. The violent hails destroy crops, damage houses, injure people and kill livestock; the outsize hails are even bigger than a grapefruit, and can kill people, destroy large areas of crops and trees, and destroy buildings and vehicles, etc. They have a powerful lethality. Disaster caused by hails is one of the severe natural disasters in China.

Weather forecasting shall be made, manual intervention shall be taken in advance to increase the hail embryo, reduce the hail diameter and destroy the water transport of hail cloud. Protective measures shall be taken for important plants and varieties of trees, and the operating personnel shall be evacuated in advance. If an outdoor operation is necessary, protective measures shall be taken to avoid personal casualties.

(4) Drought response during the operation period

Drought refers to a climate phenomenon that the total amount of fresh water is less and not enough to meet the human survival and the economic development, which is generally a long-term phenomenon. Drought is a main natural disaster faced by the mankind, and even with developed science and technology, its disastrous consequence can be found everywhere.

For droughts, it is necessary to make reasonable adjustment of the regional planting structure, and select hardy plant varieties; in addition, the water volume shall be allocated, modern technologies and water-saving measures shall be taken to reduce the water consumption. Unconventional water bodies shall be reasonably developed and utilized.

8 Public Participation and Information Disclosure

8.1 Purpose

Public participation in the ESIA aims to improve the quality of ESIA by incorporating more public opinions and suggestions.

Public participation is an important part of the ESIA and an effective means of scientific decision-making. Through extensive public participation, those affected directly or indirectly by the Subproject will fully understand its potential E&S impacts, mitigation measures taken, and the Subproject's economic and social benefits, and raise opinions and suggestions to minimize the Subproject's E&S impacts. The objectives include:

1) Analyzing public opinions comprehensively, and incorporating them into the E&S mitigation measures;

2) Realizing two-way communication between the public and construction agency to promote mutual understanding;

3) Learning public attitudes and opinions to eliminate public concerns and minimize adverse impacts on public interests;

4) Involving the public in post-ESIA evaluation and supervision as an integral part of the E&S management mechanism, thereby improving the Subproject's E&S benefits and realizing sustainable development.

8.2 Applicable laws, regulations and policies, and stakeholder identification

1) ESMFP and Stakeholder Engagement Plan of the Project, and domestic policies on public participation (see Chapter 2 for details);

2) Stakeholder identification and demand analysis (see Chapter 5 for details)

8.3 Completed public participation and information disclosure activities

In the Subproject, public participation and information disclosure is conducted by means of the Internet, newspaper, poster, bulletin board, questionnaire survey, FGD, in-depth interview and key informant interview.

According to the Environmental Impact Assessment Law of the PRC, Interim Measures for Public Participation in Environmental Impact Assessment, AIIB's ESF (2021 amendment) and ESMPF disclosed in November 2021, the Jiaozuo PMO and agencies concerned have conducted a series of information disclosure and public consultation activities.

In February, June, July and August 2022, the taskforce conducted a public survey in the affected counties / districts with the assistance of the Jiaozuo PMO, JMURCB, JMWRB, Jiaozuo Municipal Emergency Management Bureau, XCWRB, MDARAB, JLAO, sub-district offices, village / community committees, and APs.

Table 8.3-1 Summary of public participation activities

Type	Time	Venue	Scope	Participants	Remarks
Information disclosure	Nov. 2021	Affected villages	Information disclosure	Local PMOs, feasibility study agency, sub-district and village officials, APs	1st round
	Nov. 2021	Affected villages	Conducting information disclosure, and collecting attitudes and opinions	Local PMOs, owner, consultants, sub-district and village officials, APs	
	Nov. 2021	Websites	Learning the Subproject's updates	Local PMOs, APs	

	Mar. and Jun. 2022	Websites	Online disclosure	Owner, EIA agency	2nd round
	Jun. 2022	Affected villages	Announcement	Owner, EIA agency	
	Jul. and Sep. 2022	Provincial and local newspapers	Online disclosure, announcement	Owner, EIA agency	
Field visit	Feb. 17-19, Jun. 9-16, 2022	Affected villages	Sampling socioeconomic survey	Village officials, PMOs, owner, RAP preparation agency	1st round
	Feb. 17-19, Jun. 9-16, 2022	Affected villages	Collecting local residents' opinions and suggestions on the Subproject	sub-district and village officials, PMOs, owner, taskforce	
	Feb. 17-19, Jun. 9-16, 2022	Construction sites	Communicating on the Subproject's preparation, and raising suggestions on design optimization	Taskforce	
	Jun. 1-2, 2022	Construction sites, environmentally sensitive sites	Visiting the proposed sites and nearby sensitive sites	Taskforce	2nd round
	Jun. 15-16, 2022	Construction sites, environmentally sensitive sites	Visiting the proposed sites and nearby sensitive sites	Taskforce	
	Jul. 11-15, 2022	Construction sites, environmentally sensitive sites	Visiting the proposed sites and nearby sensitive sites	Taskforce	
Questionnaire survey	Jun. 2022	Affected villages, homes	Distributing 400 copies, all valid, 54.5% from males and 45.5% from females	APs, taskforce	1st round
	Jul. and Aug. 2022	Affected villages, homes	Distributing 390 copies	Taskforce, sub-district and village officials, APs	2nd round
FGD	Jun. 2022	Affected villages	Holding 13 FGDs, with 453 participants in total, including 134 women, accounting for 29.58%; 78 elders, accounting for 17.22%; and 241 village officials and villager representatives, accounting for 53.2%	Taskforce, sub-district and village officials, APs	1st round
	Aug. 2022	Affected villages	Holding 10 FGDs on EIA, involving 175 persons in 13 villages	Taskforce, sub-district and village officials, APs	2nd round
Key informant interview	Jun. 2022	Affected villages, agencies concerned	87 interviews, including 19 in Jiefang District, 20 in Shanyang District, 18 in Zhongzhan District, 15 in Macun District and 15 in Xiuwu County	Heads of agencies concerned, village officials, APs, enterprise workers, taskforce	/

8.3.1 Public participation outcomes at the preparation stage

8.3.1.1 Social public participation

1) Since November 2021, when the feasibility study was conducting fieldwork, the PMO began to communicate with local residents about the scope of construction, necessity and social benefits of the Subproject in the subproject area, and collected their attitudes and comments.

2) Since December 2021, under the direction of the technical assistance consultants, the Jiaozuo Municipal Government, municipal finance bureau, county / district governments and design agency have conducted a public willingness survey and public consultation (with about 30% of participants being women) by means of village congress, questionnaire survey, brochure, WeChat public account, etc.

3) In June 2022, the taskforce visited the affected counties / districts, and learned local production and living conditions, economic and social conditions, traffic conditions, expectations

for the Subproject, and potential impacts of the Subproject in detail, and notified local residents of the scope of construction, social benefits and impacts of the Subproject, compensation policies, restoration measures, etc. by means of questionnaire survey, FGD, organizational interview, in-depth interview, etc. Consultation results have been incorporated into the completed RAP.

From December 2021 to date, the Jiaozuo Municipal Government, municipal finance bureau, and 5 affected county / district governments have disclosed updates of the Subproject on their websites.

8.3.1.2 Environmental public participation

For the EIA conclusions of the construction and operation stages, the EIA agency conducted a second public participation survey, covering stakeholders subject to environmental impacts.

1) Online disclosure and announcement

During March-September 2022, the EIA agency conducted information disclosure by means of online disclosure, announcement and newspaper disclosure (see Appendix 4).

2) FGD

In August 2022, the owner and EIA agency held FGDs in the villages / communities subject to environmental impacts in the 5 affected counties / districts to notify potential noise, dust, sanitation, personal safety and traffic impacts during construction, and relevant mitigation measures, and collected suggestions from local residents.

3) Questionnaire survey

In August 2022, the EIA agency conducted a questionnaire survey in the villages / communities subject to environmental impacts.

8.3.2 Organizational interview

Organizational interviews and FGDs were held with the Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), Land Acquisition Office under the Jiaozuo Municipal Natural Resources Bureau (JLAO), natural resources bureau, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, etc. 65 times, and relevant data and literatures related to the Subproject collected. See Table 8.2-2.

Table 8.3-2 Summary of organizational interviews

County / district	Organizational interviews	Agencies interviewed
Jiefang District	15	Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), JLAO, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, Jiaoxi and Shangbaizuo Sub-district Offices
Shanyang District	9	Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), JLAO, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, Jiaoxi and Shangbaizuo Sub-district Offices
Zhongzhan District	11	Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), JLAO, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, Licun and Wangfeng Sub-district Offices
Macun District	16	Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), JLAO, ecology and

		environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, Xiaozhuang and Daiwang Sub-district Offices
Xiuwu County	14	Jiaozuo PMO, water resources, urban and rural construction, emergency management, and other competent authorities (IAs), JLAO, ecology and environment bureau, statistics bureau, labor and social security bureau, rural revitalization bureau, ethnic affairs commission, women's federation, civil affairs bureau, transport bureau, Wuliyuan Xiang and Zhouzhuang Town Governments
Total	65	----------

8.3.3 Field visit

The taskforce paid field visits to the 5 counties / districts to have a more objective understanding of the Subproject's potential impacts on local residents, local residents' production and living conditions, and their suggestions, concerns and expectations. See the figure and table below.

Figure 8.3-1 Fieldwork photos

(Upper left: Minzhu Road; upper right: Hei River; middle left: Tianjian Ditch; middle right: urban river; lower

left: Shanmen River, lower right: Dasha River)

Table 8.3-3 Summary of field visits

City	County / district	Sub-districts	Sub-districts visited
Jiaozuo	Jiefang District	Minzhu, Minsheng, Xinhua, Qibaijian, Jiaoxi, Jiaonan, Jiaobei, Shangbaizuo, Wangchu	Jiaoxi, Shangbaizuo
	Shanyang District	Baijianfang, Jiaodong, Yixin, Dongfanghong, Taihang, Guangya, Dinghe, Xincheng, Zhongxing	Dongfanghong, Xincheng
	Zhongzhan District	Wangfeng, Lifeng, Zhucun, Yueshan, Fengfeng, Longdong, Danhe, Fucheng, Xuheng, Longxiang	Lifeng, Wangfeng
	Macun District	Fengcun, Fengying, Jiulishan, Xiaozhuang, Daiwang, Anyangcheng, Yanma, Wuwang	Xiaozhuang, Daiwang
	Xiuwu County	Wangtun Xiang, Wuliyuan Xiang, Xicun Xiang, Chengguan Town, Xunfeng Town, Qixian Town, Zhouzhuang Town, Yuntaishan Town	Wuliyuan Xiang, Zhouzhuang Town

8.3.4 FGD

1) SIA survey

To further learn needs and suggestions of the APs (including women, poor residents, vulnerable groups, village officials, etc.), comments and concerns, the taskforce held FGDs during the fieldwork. The taskforce held 13 FGDs with 453 persons, including 134 females, accounting for 29.58%; 78 elders, accounting for 17.22%; and 241 village officials and villager representatives, accounting for 53.2%. See the figure and table below.


Figure 8.3-2 FGDs (part)

(Upper left: municipal finance bureau; upper right: JMURCB; middle left: Xiaozhuang Village Committee, Macun District; middle right: Daiwang Village Committee, Macun District; lower left: Gesi Village Committee, Xiuwu County; lower right: XCWRB)

Table 8.3-4 Summary of FGDs and participants

County / district	FGD participants and numbers						Total	
	Women		Old people		Village officials and villager representatives		Participants	Number of FGDs
	Participants	FGDs	Participants	FGDs	Participants	FGDs	Participants	FGDs
Jiefang District	21	3	12	3	55	3	88	3
Shanyang District	37	3	23	3	52	3	112	3
Zhongzhan District	25	2	16	2	48	2	89	2
Macun District	22	2	13	2	43	2	78	2
Xiuwu County	29	3	14	3	43	3	86	3
Total	134	13	78	13	241	13	453	13

2) EIA survey

In July and August 2022, the owner and EIA agency held 10 FGDs in 13 villages / communities to notify potential noise, dust, sanitation, personal safety and traffic impacts during construction, and relevant mitigation measures, and collected suggestions from local residents, involving 175 persons in total, including women, elders and young people.

Through these FGDs, all local residents were aware of the Subproject's environmental impacts during construction, and support the mitigation measures to be taken and the Subproject.


Qiangnan Village (Shanyang District)


Mahe Village (Shanyang District)

Wulipu Village (Xiuwu County)

Liegangying Village (Xiuwu County)

Licun Village (Xiuwu County)

Gengzuo Village (Jiefang District)

Qintun Village (High-tech Zone)

Zhangnan Village (High-tech Zone)

Tiejiang Village (High-tech Zone)

Macun District

Figure 8.3-3 FGDs

8.3.5 Key informant interview

The taskforce interviewed 87 key informants at the county / district, sub-district and village / community levels to further collect attitudes and suggestions from stakeholders. See Table 8.3-5.




Figure 8.3-4 Key informant interviews

Table 8.3-5 Summary of key informant interviews

County / district	Heads of agencies	Village / community officials	Total
Jiefang District	11	8	19
Shanyang District	10	10	20
Zhongzhan District	9	9	18
Macun District	8	7	15
Xiuwu County	8	7	15
Total	46	41	87

8.3.6 Questionnaire survey

1) SIA survey

The sample size was 400 based on a confidence level of 95% and a maximum absolute error of 5% using the probability proportional to size (PPS) method. 400 copies of the questionnaire were completed.

See Table 8.3-6.

Figure 8.3-5 SIA survey

Table 8.3-6 Sample of the questionnaire survey

County / district	Number of respondents	Percent (%)
Jiefang District	77	19.25
Shanyang District	78	19.50
Zhongzhan District	82	20.50
Macun District	90	22.50
Xiuwu County	73	18.25
Total	400	100%

The questionnaire database was established and analyzed using the IBM SPSS software. See Table 8.3-7.

Table 8.3-7 Basic information of the valid sample

Indicator	Statistical data
Gender	Male (218): 54.5%; female (182): 45.5%
Age	18-24 years: 12.96%; 25-34 years: 27.78%; 35-44 years: 25.93%; 45-54 years: 22,22%;

	55-64 years: 9.26%; 65 years or above: 1.85%
Urban / rural	Urban: 59.26%; rural: 40.74%.
Educational level	Illiterate: 1%; primary school: 7%; junior high school: 54.5%; senior high school / secondary technical school: 22.25%; junior college or above: 15.25%
Occupation	Civil servant: 6.75%; worker of public institution: 16.0%; enterprise worker: 14.75%; self-employer: 16.5%; freelancer: 19.0%; unemployed: 0%; student: 6.25%; retiree: 7.25%; farmer: 5.25%; other: 7.5%

2) EIA survey

In August 2022, the owner and EIA agency conducted a sampling survey in some affected villages / communities, and distributed and recovered 390 copies of the questionnaire, covering women, elders and young people.

About 60% of the respondents think that noise, dust and pollution during construction have major impacts on them; over 90% think that noise can be reduced effectively by reducing or avoiding overnight construction, setting up temporary barriers, and selecting low-noise construction machinery; over 95% think that dust can be reduced effectively by controlling vehicle speed, applying wet processes and sprinkling water regularly; over 80% think that environmental pollution can be reduced effectively by setting up waste bins rationally and transferring waste timely. Provided such measures are taken, all respondents support the Subproject.

Qunying New Community (Shanyang District)

Jinhua Garden (Jiefang District)

Shilin Village (Jiefang District)

Qintun Village (High-tech Zone)

Gengzuo Village (High-tech Zone)

Nanzhang Village (High-tech Zone)

Nanzhang Village (High-tech Zone)

Daiwang Village (Macun District)

Baizhuang Village (Macun District)

Liyuan Community (Macun District)

Figure 8.3-6 EIA survey

8.4 Public participation plan

Information disclosure and public participation will run through the whole lifecycle of the Subproject.

Based on the Subproject's stakeholder identification and scope of construction, the following public participation plan has been prepared.

Table 8.4-1 Public Participation Plan

Stage	Activity	Mode	Implemented by	Participants	Topic	Progress	Funding source
Preparation	Subproject information disclosure	TV, broadcast, poster, leaflet, village committee, internet	PMO, township governments, village committees	Residents, township officials, PMO	Disclose the Chinese and English versions of the ESMPF on the websites of the Henan Provincial Department (https://czt.henan.gov.cn/2021/11-05/2342160.html) and AIIB (China: Henan Flood Emergency Rehabilitation and Recovery Project - Projects - AIIB). The PMO discloses basic information of the Subproject. The PMO, sub-district offices and village committees collect comments and suggestions from residents. The PMO answers questions of residents.	Completed	Subproject budget
	Willingness survey	Village congress, questionnaire survey	PMO, consulting agency	Residents, PMO, consulting agency	The PMO and consulting agency conduct a willingness survey on residents. The questionnaire survey is conducted on actual households. The Subproject will be implemented only if over 80% of residents approve of it (actual proportion: 83.49%).	Completed	Subproject budget
	Design consultation	Interview, FGD, disclosure	PMO, design agency, consulting agency	Residents, PMO, design agency, consulting agency, village committees	The PMO develops a public participation plan, including flood safety education and training, early warning and drilling, to improve local residents' flood control and safety awareness. The design and consulting agencies encourage residents to give comments and suggestions on the subproject design. The PMO will disclose the preliminary design in the affected villages, and collect comments and suggestions.	Completed	Subproject budget
	EIA information disclosure and consultation	Internet, newspaper, post, leaflet, village meeting, notice, FGD, questionnaire survey	PMO, owner	Sub-district offices, village committees, residents, schools, stores	The owner discloses the construction program and schedule. Disclose the distribution of construction sites. Disclose key environmental impacts and proposed mitigation measures. Disclose key conclusions of the EIA. Disclose environmental issues of concern to villagers.	Completed	Subproject budget
Implementation	LA	Consultation	Village committees, PMO	Residents, village committees, PMO, natural resources bureau	Confirming land occupation. The village committees determine the compensation mode through consultation. The village committees sign compensation agreements and pay compensation accordingly.	Not started	Subproject budget
	Construction information disclosure	Village congress, bulletin board, poster, broadcast	PMO, contractors, village committees	Residents, PMO, contractors, village committees	The construction agency discloses the construction schedule. Disclose the distribution of construction sites. Disclose key construction impacts. Disclose environmental issues of concern to villagers. Disclose the liaison man and contact information of the construction agency.	Not started	Internal budget of contraction agency
	GRM	Media, poster,	PMO, owner,	Sub-district offices,	The owner and construction agency disclose the Subproject's supervision hotline at	Not	Subproject

	disclosure	leaflet, FGD, questionnaire survey	construction agency	village committees, residents, schools, stores	appropriate places. The owner accepts grievances by means of field appeal, letter, call, etc., and gives a reply on the spot or within 15 days. The construction agency collects comments from women, poor residents and other vulnerable groups, and ensuring that the Subproject is implemented openly, fairly and transparently.	started	budget
	Information disclosure before subproject implementation	Online and on-site disclosure	PMO	Sub-district offices, village committees, residents, schools, stores	Disclose the Chinese and English versions of the ESIA and ESMP of the Subproject on the websites of the Jiaozuo PMO and AIIB. In addition, the Jiaozuo PMO prepares hardcopies thereof for public review.	Not started	Subproject budget
	Subproject information disclosure	On-site disclosure	Construction agency	Sub-district offices, village committees, residents, schools, stores	The construction agency sets up signs at entrances of construction sites, specifying the contractor, supervising agency and construction period. The construction agency attends public participation meetings held by the owner in affected communities, and assigns someone to explain construction activities, and environmental protection measures taken or too be taken.	Not started	Subproject budget
	Reducing construction impacts	Design optimization	PMO, contractors, village committees	PMO, contractors, transport bureau, traffic police, ecology and environment bureau, village committees, villager representatives	The construction agency leaves a passage for local residents during road excavation. The construction agency takes dust and noise reduction measures. The construction agency evades living areas and daily passages during the construction of temporary works. The construction agency collects suggestions on reducing construction impacts from residents.	Not started	Subproject budget
	Participation in construction	Village meeting, village congress	PMO, contractors, village committees	Residents, PMO, contractors, village committees	The construction agency determines the jobs to be generated by the Subproject. The construction agency determines the selection criteria for construction workers, and making jobs first available to poor residents and women. The construction agency determines salaries, and skills and safety training for workers. The village committees encourage women to participate in public affairs and FGDs under the Subproject, and establish an incentive mechanism. The village committees offer special training on water safety and flood control to women to improve their participation awareness.	Not started	Internal budget of contraction agency
	Management of nonlocal workers	Health and safety publicity, and worker education	PMO, contractors, health bureau, village committees,	PMO, contractors, health bureau, health centers, village committees, nonlocal workers,	The health commission conducts education and publicity on public health, AIDS and COVID-19 prevention, etc., and includes it in contracts. The construction agency conducts physical checkups for construction workers regularly. The construction agency strengthens education on local customs for nonlocal workers. The construction agency protects female workers' physical and mental health at construction sites, and provides regular mental counseling.	Not started	Subproject budget

			local residents	local residents	The construction agency strengthens the regulation of construction sites to avoid SEA / SH and GBV, and establishes a clear GRM. The construction agency establishes a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.		
	GRM disclosure	Media, poster, leaflet, FGD, questionnaire survey	PMO, owner, construction agency	Sub-district offices, village committees, residents, schools, stores	The construction agency discloses the Subproject's supervision hotline at appropriate places. The owner and construction agency accept grievances by means of field appeal, letter, call, etc., and gives a reply on the spot or within 15 days. The construction agency collects comments from women, poor residents and other vulnerable groups, and ensuring that the Subproject is implemented openly, fairly and transparently.	Ongoing	/
Operation	Flood and water safety education	Workshop	PMO, village committees	Residents, village committees	The village committees strengthen flood safety education to improve residents' safety awareness. The village committees organize a workshop on flood control and safety, and conduct early waning and drilling to improve residents' flood safety awareness. Diversified disaster training is offered (earthquake, flood control, etc.). The village committees increase the proportions of women, old people and children in flood control education and training. The PMO and village committees strengthen the training of natural disaster officers. The village committees create a good atmosphere of river environment protection in resident communities, including: a) improving the river chief system to strengthen river management; b) establishing community river protection teams to take coordinated actions; c) conducting river patrol regularly; and d) creating a good atmosphere that all community residents participate in river management	Not started	Special budget of competent authority, collective finance
	Road traffic safety workshop	Workshop	PMO, village committees, transport authority, construction agency	Villagers, village committees	The transport authority holds road safety workshops in nearby communities to disseminate traffic safety knowledge by means of video and leaflet. The construction agency ensures that sufficient road safety facilities are provided to protect the traffic safety of residents. The construction agency ensures that sufficient public facilities are provided to facilitate residents' traffic, life and recreation. The construction agency ensures that sufficient streetlamps are set up to ensure women's safety at night.	Not started	Special budget of competent authority, collective finance
	GRM disclosure	TV, broadcast, poster, leaflet, village committee, internet	PMO, government agencies concerned, village committees	PMO, government agencies concerned, township governments, village committees	The owner discloses the Subproject's supervision hotline at appropriate places. The owner accepts grievances by means of field appeal, letter, call, etc., and gives a reply on the spot or within 15 days. The owner collects comments from women, poor residents and other vulnerable groups, and ensuring that the Subproject is implemented openly, fairly and transparently.	Not started	/

9 GRM

9.1 Grievance redress procedure

During the preparation, construction and operation of the Subproject, the Jiaozuo PMO will establish a project-level GRM to address the Subproject's potential issues, and ensure local residents' extensive participation. All grievance records and dispositions will be reported to AIIB though quarterly / semiannual E&S monitoring reports.

The Subproject has two GRMs:

The first is the project-level GRM for APs, NGOs and business entities.

The second is the GRM for project workers, including direct and contracted workers.

1) GRM for APs

Grievances may relate to flying dust and noise arising from construction, the improper disposal of construction waste, traffic inconvenience, etc. Currently, local residents file grievances via the mayor hotline (0391-12345) and environmental protection hotline (0391-12369) mainly. The improved GRMs under the Subproject comply with the regulatory standard of the PRC, which protects citizen rights from construction-related E&S impacts.

The Jiaozuo PMO was established in December 2021, and 4 staff members of the Overall Coordination are responsible for GRM operation. If the Jiaozuo PMO receives a grievance, it will first check if such grievance relates to the Subproject. If yes, it will redress such grievance through coordination. If no, it will forward such grievance to the competent authority for the griever. All grievances will be recorded, and the whole grievance redress process notified to relevant staff. The basic procedure and timeframe of the GRM are as follows:

Stage 1 (5 days): If any problem occurs at the construction or operation stage, an AP may file a written or oral grievance to the contractor. The contractor will: 1) stop the relevant activity (e.g., construction with noise impact on nearby residents) immediately); 2) not restore such activity before the grievance is closed; 3) notify the IA of the grievance received and the proposed solution; 4) give a definite reply to the AP within two days; and 5) close the grievance within 5 days after receipt where possible.

Stage 2 (5 days): If the contractor cannot find a solution, or the AP is dissatisfied with the proposed solution, the IA will hold a meeting with the main stakeholders (including the contractor and AP) to develop a solution accepted by all, including key steps. The contractor should implement such solution immediately, and close the grievance within 15 days. All measures and results should be recorded.

Stage 3 (15 days): If the IA cannot find a solution, or the AP is dissatisfied with the proposed solution, the Jiaozuo PMO will hold a stakeholder consultation meeting within 7 days (including the griever, contractor, local ecology and environment bureau, human resources and social security bureau, urban administration bureau, etc.) to develop a solution accepted by all, including key steps. The contractor should implement such solution immediately, and close the grievance within 15 days. All measures and results should be recorded. At the end of Stage 3, the Jiaozuo PMO will notify the outcome to AIIB.

Stage 4: If the griever is still dissatisfied with the disposition of Stage 3, he/she may apply for arbitration with the competent authority in accordance with the Administrative Procedure Law of the PRC.

Stage 5: If the griever is still dissatisfied with the arbitration award, he/she may file a suit in a civil court in accordance with the Civil Procedure Law.

2) GRM for workers

The IAs will establish a separate grievance redress center for construction workers to handle grievances about salaries and payment, overtime pay, accommodation safety, health, medical care, etc.

In addition, in GBV management, dedicated staff for protecting women's rights will be appointed, and effective measures taken to protect female workers from sexual harassment at the workplace, and allow them to file grievances. Such grievances should be handled timely, and victim privacy protected.

In addition, the PPM was established by AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement its Environmental and Social Policy (ESP) when their concerns cannot be addressed satisfactorily through Project-level grievance redress mechanisms or AIIB Management's processes. For more information, visit: https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html.

9.2 Recording and feedback of grievances and appeals

During the implementation of the ESMP, the relevant agencies should register and manage appeal and handling information, and submit such information to the Jiaozuo PMO monthly, which will inspect the registration of appeal and handling information regularly.

To record grievances and their handlings, the Jiaozuo PMO and IAs have prepared a registration form, as shown in Table 9.2-1.

Table 9.2-1 Grievance registration form

Appellant	Time	Location	Feedback of accepting agency	PMO's advice	External M&E agency's advice	Progress	AIIB's opinion
Appeal							
Expected solution							
Proposed solution							
Actual handling							
Person responsible (signature)							
Notes: 1. The recorder should record the appeal and request of the appellant factually. 2. The appeal process should not be interfered with or hindered whatsoever. 3. The proposed solution should be notified to the appellant within the specified time.							

9.3 Contact information for grievance redress

The IAs will assign dedicated staff members to collect and accept grievances and appeals from the APs. See Table 9.3-1.

Table 9.3-1 Contact information for grievance redress

Agency	Contact	Address	Tel
Jiaozuo PMO	Wu Haixing	municipal finance bureau	15903912281
XCWRB	Liu Quanshun	No.515 Qixian Avenue, Xiuwu County	13839159653
MDARAB	Wang Fengguang	No.694 Jianxing Road, Macun District	13782726590
JMWRB	Du Changsheng	No.3226 Dongnan Road, Jiaodong Sub-district, Jiefang District	13839119533
JMURCB	Wang Kun	Jianshe Building, No.88 Zhanqian Road, Jiaonan Sub-district, Jiefang District	18839188183
Jiaozuo Municipal	Miao Lili	Opposite to Administrative Committee of	13523368918

Emergency Management Bureau		High-tech Zone, Shenzhou Road, Shanyang District	
XCWRB	Liu Junli	No.515 Qixian Avenue, Xiuwu County	13782658769
MDARAB	Chen Weidong	No.694 Jianxing Road, Macun District	15939153093

10 ESMP

10.1 Organizational responsibilities for ESMP implementation

The Jiaozuo PMO at the municipal finance bureau is responsible is responsible for the Subproject's organizational leadership, management, implementation and supervision, and contacting the Henan Provincial PMO and AIIB. The Jiaozuo PMO has one director (director-general of the municipal finance bureau) and 4 deputy directors, and governs the Overall Coordination, Procurement and Bidding, Implementation Management, and Finance Teams.

Subproject leading groups have been established at the Jiefang, Shanyang, Zhongzhan and Macun Districts, and Xiuwu County, responsible for the coordination and implementation of the subproject under the leadership of the Henan Provincial Project Leading Group and Jiaozuo PMO.

The PMO is mainly responsible for the Subproject's overall coordination, bidding and procurement, financial statistics, project implementation supervision, etc. to ensure the successful implementation of the Subproject. The sectoral authorities have also established their own PMOs, responsible for conducting routine project management, and directing IAs to conduct project preparation, implementation and evaluation, covering planning, finance, procurement, training, monitoring and file management.

The Jiaozuo PMO is the IA of the Subproject, responsible for: 1) appointing an E&S coordinator to coordinate ESMP implementation; 2) including the ESMP, monitoring plan and mitigation measures in the bidding documents and contracts; 3) running the GRM; 4) handling unforeseeable adverse impacts and reporting to AIIB timely; and 5) appointing qualified E&S external monitoring agencies.

Contractors: 1) ensuring that sufficient financial and human resources are available to implement the mitigation measures in the ESMP; and 2) running the GRM during construction.

Supervising agency: 1) ensuring that sufficient financial and human resources are available to supervise and direct the contractors to act on the ESMP; 2) supervising construction progress and quality; 3) appointing qualified OHS staff to supervise the contractors on site regularly; 4) supervising the contractors' ESMP performance. See Figure 10-1.

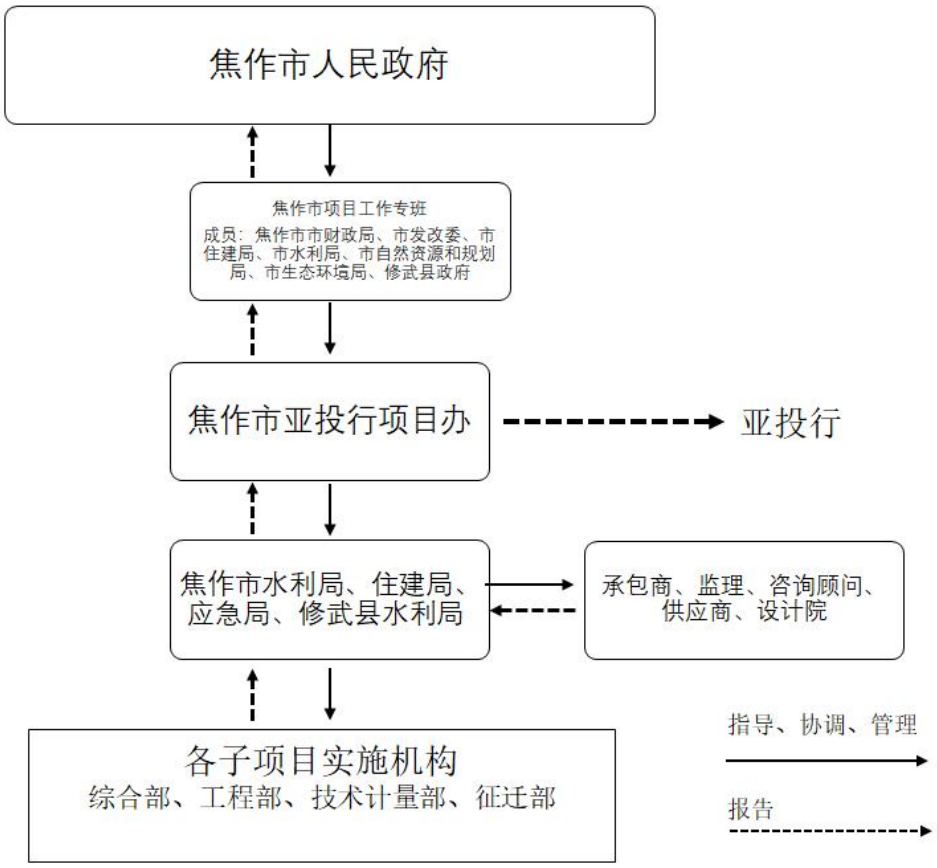


Figure 10.1-1 Organizational Chart for E&S Management

10.2 Expected E&S impacts and mitigation measures

Mitigation measures have been developed based on the identified E&S impacts. The design agency and contractors will include such measures into the design and bidding documents, contracts, and operation management. The effectiveness of such measures will be monitored and evaluated for adjustment and improvement.

10.2.1 Reducing LAR risks

a) Develop a detailed RAP; b) Pay particular attention to how vulnerable groups (if any) will use compensation for income restoration in the RAP.

10.2.2 Conducting regular education and training on flood control in communities along rivers, and improving riverside infrastructure

Past flood control training is inadequate. The taskforce thinks it very necessary to strengthen flood control and safety training. To further prevent negative flood impacts, the Jiaozuo PMO, emergency management bureau, flood control headquarters, county / district governments, sub-district offices and village committees should conduct regular education and training on flood control, including: a) conducting education and training on flood control (frequency, men-times and women's proportion); b) conducting diversified disaster training (earthquake, flood control, etc.); c) evaluating the effectiveness of training regularly; d) establishing a process for using and managing disaster relief materials and funds.

For riverside infrastructure problems: a) Set up clean public toilets along densely populated river segments with signs and full-time cleaners; b) Set up special passages for the disabled and elders along rivers; c) Appoint river management agencies and staff, and develop relevant policies to solve dredging problems timely; d) Set up small parking lots along densely populated river segments for residents to park their electric bikes.

10.2.3 Improving traffic safety facilities and strengthening regulation

Urban roads have such problems as aged or damaged infrastructure, mixed traffic, nonobservance of traffic rules (crossing roads, not using sidewalks), and low awareness of publicity channels of traffic safety knowledge. For these problems: a) Check road infrastructure regularly, and replace any damaged facility timely; b) Separate motorized and non-motorized vehicles, strengthen management, and impose speed limits; c) Assign more policemen during the peak hours, and prohibit sidewalk occupation; d) Regulate traffic signals and streetlamps; and f) Strengthen road traffic safety education.

10.2.4 Protecting women's labor rights and making jobs available to local women

a) Pay more attention to the employment free female labor during construction, especially those aged above 50 years; b) The contractors should recruit some women to involve more women in the Subproject, and should ensure equal pay for equal work; c) Strengthen the protection of female workers' rights, and offer relevant training to prevent GBV; d) Appoint at least one staff member responsible for women's rights protection in each IA and contractor (who may also be the E&S specialist), and take effective measures to prevent workplace sexual harassment; e) Strengthen the supervision of construction sites, and establish a clear GRM to avoid SEA / SH and GBV; f) Establish a construction site grievance redress team, which includes at least two female members, and protect the safety of the team members.

10.2.5 GBV management

a) Strengthen the protection of women's labor rights, and guard against GBV; b) The construction agency provides regular mental counseling and rights protection training to female laborers; c) Appoint at least one staff member responsible for women's rights protection in each IA and contractor (who may also be the E&S specialist), and take effective measures to prevent workplace sexual harassment; d) The construction agency strengthens the regulation of construction sites to avoid SEA / SH and GBV, and establishes a clear GRM; the construction agency establishes a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.

10.2.6 Strengthening the management of external workers to prevent AIDS, COVID-19 and other social risks

During construction, nonlocal workers will be recruited, and may pose social and health risks. Thus, it is necessary to strengthen safety and health publicity, and worker management to prevent such risks.

- Conduct public health and AIDS prevention education and publicity in the subproject area, covering epidemics (including AIDS, COVID-19, influenza, etc.), and include these in contracts to ensure effective implementation;
- Conduct education and publicity on AIDS and other infectious diseases, social interactions and communications, etc. for construction workers;
- Conduct physical checkups for nonlocal workers, set up temporary infirmaries if necessary, and ensure that only healthy workers can participate in construction;
- Conduct diversified publicity on AIDS prevention by means of brochure, poster, etc.;
- Strengthen publicity and education on local customs for nonlocal workers to make them respect local customs.

In addition, to involve beneficiaries in the Subproject extensively, and promote good communications between local residents and contractors, local workers (including women) will be recruited.

- Not less than 25% of construction workers should be women, including certain

proportions of women and poor residents;

- Make unskilled jobs first available to vulnerable groups, including women;
- Offer labor remuneration not less than the local minimum salary standard, and offer subsidies for environmental supervision;
- Offer employment training to local workers recruited.

10.2.7 Applying appropriate construction methods to reduce impacts on local residents

a) Schedule construction rationally and set up fences to protect the personal safety of nearby residents; b) Identify underground power, water and gas pipes before excavation; c) Give publicity in advance, and conduct construction in stages to minimize impacts on nearby enterprises and shops; d) Take measures to control construction and traffic noise, select low-noise equipment where possible, and use high-noise equipment in the daytime; e) Sprinkle access roads regularly to reduce flying dust; f) Set up no-horning signs near communities, and design sludge transport routes rationally; g) Evade social sensitive sites, and avoid overnight construction where possible; h) Educate and train construction workers regularly, and avoid gathering in the noon break and at night; i) Post construction and contact information on fences and near sensitive sites, and assign dedicated staff to handle grievances; j) Take strict COVID-19 prevention and control measures, and conduct health screening regularly to minimize community health and safety impacts.

10.2.8 Improving labor and working conditions to protect lawful rights and interests of workers

a) Employ workers equally and fairly without discrimination; b) Provide appropriate protection and assistance measures to certain worker groups, such as women, the disabled, migrant workers and underage workers; c) Allow workers to establish and join worker organizations, and protect their collective bargaining right.

10.3 ESMP

Through consultation with the PMO, owner, IAs, agencies concerned and local residents, a practical ESMP has been prepared for the Subproject's potential E&S risks, as detailed below.

Table 10.3-1 Basic requirements of the EMP

Stage	Environmental factor		Measure	Regulated by	Implemented by
Construction	Ambient air protection measures	Dust control	• Manage flying dust strictly during construction by ensuring 100% fencing, 100% material coverage, 100% vehicle flushing, 100% pavement hardening, 100% wet demolition and 100% closed transport, prohibit on-site concrete mixing and mortar preparation, and conduct dust control in heavy pollution and strong wind weathers. • Compact or harden the roads in the construction site, and sprinkle and clean them regularly to avoid dust. • For bare grounds on the construction site, take covering, landscaping or hardening measures, keep them wet every day, and control the sprinkling amount. • Set up fences of not lower than 2.5m around urban construction areas, and not lower than 1.8m around suburban and rural ones continuously, with an anti-overflow base and an upper sprinkler, with spacing of not more than 4m. • Cover or enclose loose materials, construction waste, muck and earth on the construction site, and arrange construction materials properly to minimize stock and storage period. • Install video monitoring sites on the construction site at the main entrance and key dust monitoring points. • Provide sprinkling vehicles for each construction camp, and sprinkle 3 times a day or more frequently in windy and dry weathers. • Flush all vehicles entering the construction site at a pressure of not less than 0.3MPa for not less than 3min, and ensure that vehicles are free from dirt and mud. • Stop earthwork in heavy pollution weathers, including structure demolition, earth and rock excavation and backfilling, transfer, road and pipe ditch excavation, and construction waste transfer. • If there is a break in earth transfer, cover it with an anti-dust net, and sprinkle the road immediately.	Environmental protection authority, construction agency	Contractor
		Tail gas control	• Use low energy consumption, low pollution and low emission construction machinery and vehicles, and comply with the limits and measurement methods for exhaust pollutants from diesel engines of non-road mobile machinery (China III and IV) (GB20891-2014), limits and measurement methods for exhaust pollutants from compression ignition and gas fuelled positive ignition engines of vehicles (China III, IV and V) (GB17691-2005), and emission standard of air pollutant for gasoline transport (GB20951-2007). • Apply the China V standard to transfer vehicles, and use electric vehicles where possible.	Transport authority, construction agency	Contractor
	Water environment protection measures		• Use machine cleaning wastewater for vehicle washing after treatment in the settling tank, and the excess for sprinkling without discharge.	Environmental protection authority, construction agency	Contractor

Stage	Environmental factor		Measure	Regulated by	Implemented by
	Sound environment protection measures		• Noise source control: Use low noise machinery where possible, and avoid using machinery exceeding the noise standard; use an anti-vibration base for high vibration machinery; maintain machinery regularly to prevent noise increase. • Adjust the construction schedule reasonably: With a short-term construction noise impact, the night construction will disturb the residents along the line nearby. Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site. • Rational layout: Determine a rational construction site boundary according to the ambient noise emission standard at construction site boundary, and arrange the construction site rationally, such as arranging vibration sources centrally and keeping them away from environmental sensitive sites, and arranging fixed machinery (air compressors, generators, etc.) in a temporary room with acoustic panels. • Determine the transport route and timing rationally, and keep away from villages and schools.	Environmental protection authority, construction agency	Contractor, transport agency
	Solid waste disposal measures		• Set up waste bins to collect domestic waste, and transfer it to the landfill.	Environmental protection authority, construction agency	Contractor
	Sound environment protection measures	Land use	• Restore temporarily used land ecologically after construction. • Plan the construction site rationally to minimize land occupation, especially shrub and arbor woodland. • Set up the production area in an area with sparse vegetation, and keep a 30cm topsoil layer. cover with topsoil, and take vegetation restoration measures after construction. • Clean up temporarily occupied land after construction, including loosening compacted soil, leveling pits and reclaiming land. • Avoid hardening roads, and use gravel pavements to reduce soil damage. • Set up roads in an area with sparse vegetation, and keep a 30cm topsoil layer; cover with topsoil, and take vegetation restoration measures after construction.	Land authority, environmental protection authority, river management authority	Contractor
		Terrestrial environment	• Record the original vegetation before temporary land occupation, and restore the vegetation after construction so that the vegetation coverage rate is restored or improved. • After the completion of the main part, landscape the construction camp, temporary roads, stockyard, spoil ground, etc. timely to minimize biomass losses. • Protect topsoil and vegetation before construction, and collect 30m topsoil and store it centrally. • Restore the vegetation after construction.		
		Aquatic environment	• Strengthen the sanitation management of construction workers (e.g., feces and domestic wastewater) to avoid surface water pollution. • Select construction machinery and vehicles that conform to the national standards, and control		

Stage	Environmental factor	Measure	Regulated by	Implemented by
		noise to reduce impacts on aquatic organisms. • Optimize the construction schedule, avoid water pollution from the source, and minimize impacts on the aquatic environment.		
	Health protection	• Perform a health checkup for construction workers before they enter the construction site, perform health checkups regularly during construction, and quarantine anyone suffering an infectious disease. • Kill rats, mosquitoes and flies in a planned manner. • Strengthen drinking water management and food health supervision, disinfect the canteen strictly, conduct pandemic monitoring, and take measures timely. • Disinfect waste bins and dumps regularly to prevent pests from breeding. • After construction, dismantle and disinfect the work sheds timely. • Set up warning signs at positions where occupational hazards are likely to occur, such as entrance, lifting equipment and temporary power facilities, provide PPE to construction workers, such as helmets, lifebelts, safety shoes hearing protectors, and use low-noise equipment.	Construction agency	Contractor
	Cultural heritage protection	If cultural heritage is found during construction, protect the site, and report to the local culture authority immediately. Evade it if necessary.	Culture authority	Contractor
	Other	Environmental management, environmental monitoring, etc.	Environmental protection authority	Contractor
		Prepare an environmental emergency response plan.	Environmental protection authority, construction agency	Contractor
	Information disclosure	Organize public participation for stakeholders.	Construction agency	Contractor
Operation	Other	Conduct follow-up environmental monitoring.	Environmental protection authority	Construction agency

Table 10.3-2 EMP for river management components

Component		Stage	Environmental factor		Measure	Regulated by	Implemented by	Investment /0,000 yuan
Contract	Component							
JZTJ101	Dasha River Restoration	Construction	air protection	Dust control measures	• Provide 5 sprinkling trucks to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m,	Environmental protection authority,	Contractor	947.47

					and avoid flying dust where possible.	construction agency		
				Transport dust	• Set up 5 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor	
				River dredging odor control measures	• Bottom mud is stored temporarily in the temporary stockyard, with no sensitive site within 200m; transfer it to the spoil ground when the moisture content of the silt layer is <60%; fully cover vehicles to avoid material loss during transport; • Schedule dredging out of the flood period, and dry bottom mud on the riverbed to a certain extent before dredging to reduce odor; • When bottom mud is transferred from 16+500-23+600 to 12+700-16+500 and 23+600-31+000, cover vehicles with tarpaulin to avoid material loss.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge; • Provide PPE to operators and strengthen labor protection to minimize bodily harm.		Contractor	
				Canteen fume	• Use LPG and electricity in the living area where possible; • Install an efficient electrostatic fume purifier.		Contractor	
			Water environment protection measures		• Construct 5 oil traps, 5 septic tanks and 5 integrated wastewater treatment facilities; • Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank; use machine cleaning wastewater for vehicle washing after treatment in the settling tank, and the excess for sprinkling without discharge; use domestic wastewater of the construction camp after treatment in the septic tank and integrated wastewater treatment facility, and disinfection up to the standard for construction or sprinkling without discharge.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures	Construction waste and spoil	• Store dredged earth at the temporary stockyard, and transfer it to the Renmin Road spoil ground when its moisture content is <60%; • Use excavated earth for backfilling where possible, and transfer the excess to the Renmin Road spoil ground; • Remove bottom mud in the settling tank regularly, store it at the temporary stockyard, and transfer it to the Renmin Road spoil ground when its moisture content is <60%;	Environmental protection authority, construction agency	Contractor	

					• Construction waste will be collected and reutilized where possible, and the excess will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.			
				Bottom mud control	• Separate bottom mud with original soil, and conduct dredging before earth excavation; • Transfer dried bottom mud to the Renmin Road spoil ground.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Ecological restoration area for temporary land occupation: 240 mu, including construction camp 30 mu, spoil ground 180 mu and drying yard 30 mu; • Keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction; • Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage; • Conduct fish breeding and release after construction (March, June, December).	Land authority, river management authority, environmental protection authority	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• This component will be constructed across the flood season. Prepare a flood control plan and feasible preventive measures, and reserve rescue tools and materials in advance; • Collect flood and weather forecast information in various ways, and forecast floods and meteorological disasters properly; • Once any flood or meteorological sign threatening work and personal safety, take effective flood or disaster prevention measures; • Reserve flood control materials, and remove obstacles inside and outside diversion or flood discharge structures;	Environmental protection authority, construction agency	Contractor	

					• Strengthen patrol during rainstorms, and clean up landslides timely.			
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Diversion cofferdam seepage and collapse	• In the flood period, cofferdams may leak or locally collapse due to floods, so precautions should be taken to avoid such risks. • When a cofferdam leaks, first find the leaking point on the front side and block it timely, and then fill the outlet on the back side to reduce the flow rate until there is no leakage. • When a cofferdam locally collapses, repair it with rock blocks using a dumper to restore the size of the cross section. • When an out-of-limit flood occurs above the cofferdam, issue an urgent evacuation notice, and transfer all staff and equipment in the cofferdam and foundation pit.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
		Operation	Water environment protection measures		Ensure river water quality through strict management and other measures.	Environmental protection authority	River management authority	
			Sound environment protection measures		Conduct eco-compensation by putting common local aquatic organisms into the river together with the fishery authority.	River management authority	River management authority	
JZTJ102	Dasha River Restoration in Xiuwu County	Construction	Ambient air protection measures	Dust control measures	• Provide 3 sprinkling trucks to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	347.65
				Transport dust	• Set up 3 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor	

				River dredging odor control measures	• Strengthen the management of dredging and ensure stable equipment operation; • Complete dredging out of the flood period in strict conformity with the schedule; • Stack bottom mud along banks where possible, but more than 100m from sensitive sites, and cover grass to minimize odor; transfer it to the spoil ground when the moisture content of the silt layer is <60%.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge; • Provide PPE to operators and strengthen labor protection to minimize bodily harm.		Contractor	
				Canteen fume	• Use LPG and electricity in the living area where possible; • Install an efficient electrostatic fume purifier.		Contractor	
			Water environment protection measures		• Construct 3 settling tanks, 3 oil traps, 3 septic tanks and 3 integrated wastewater treatment facilities; • Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank; use machine cleaning wastewater for vehicle washing after treatment in the settling tank, and the excess for sprinkling without discharge; use domestic wastewater of the construction camp after treatment in the septic tank and integrated wastewater treatment facility, and disinfection up to the standard for construction or sprinkling without discharge.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures	Construction waste and spoil	• Dry dredging sludge and earth at the drying yard until moisture content is <60%, and then transfer to the spoil ground; • Transfer spoil of the Dasha River to the Wacun, Beiqiao and Changqiao spoil grounds, and cover it during transfer to avoid water loss, soil erosion and flying dust; • Collect domestic waste in the construction site, and transfer to the Jiaozuo Landfill; • Construction waste will be transferred by Xiuwu Ningyi Environmental Sanitation Service Company to Xiuwu Bo'ao New Building Material Factory and Jiaozuo Haoda Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	

				Bottom mud control	• Shorten the storage time of dredged mud, and transfer it to the spoil ground timely after drying; • Lay impermeable membrane in the temporary drying yard to prevent leachate from entering soil.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Ecological restoration area for temporary land occupation: 208 mu, including spoil ground 185.5 mu and mud drying yard 22.5 mu; • Keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction; • Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage; • Conduct fish breeding and release after construction.	Land authority, river management authority, environmental protection authority	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• This component will be constructed across the flood season. Prepare a flood control plan and feasible preventive measures, and reserve rescue tools and materials in advance; • Collect flood and weather forecast information in various ways, and forecast floods and meteorological disasters properly; • Once any flood or meteorological sign threatening work and personal safety, take effective flood or disaster prevention measures; • Reserve flood control materials, and remove obstacles inside and outside diversion or flood discharge structures; • Strengthen patrol during rainstorms, and clean up landslides timely; • Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the	Environmental protection authority, construction agency	Contractor	

					smooth passage of fire wagons • Check diversion cofferdams for stability regularly; once an accident occurs, evacuate the construction staff timely and contact the local rescue team for rescue.			
				Diversion cofferdam seepage and collapse	• In the flood period, cofferdams may leak or locally collapse due to floods, so precautions should be taken to avoid such risks. • When a cofferdam leaks, first find the leaking point on the front side and block it timely, and then fill the outlet on the back side to reduce the flow rate until there is no leakage. • When a cofferdam locally collapses, repair it with rock blocks using a dumper to restore the size of the cross section. • When an out-of-limit flood occurs above the cofferdam, issue an urgent evacuation notice, and transfer all staff and equipment in the cofferdam and foundation pit.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
		Operation	Water environment protection measures		Ensure river water quality through strict management and other measures.	Environmental protection authority	River management authority	
			Sound environment protection measures		Conduct eco-compensation by putting common local aquatic organisms into the river together with the fishery authority.	River management authority	River management authority	
JZTJ103	Shanmen River Restoration in Xiuwu County	Construction	Ambient air protection measures	Dust control measures	• Provide two sprinkling trucks to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	114.28
				Transport dust	• Set up 4 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor	
				River dredging odor control measures	• Strengthen the management of dredging and ensure stable equipment operation; • Complete dredging out of the flood period in strict conformity with the schedule; • Stack bottom mud along banks where possible, but more than 100m from sensitive sites, and cover grass to minimize odor; transfer it to the spoil ground when the moisture content of the silt layer is <60%.		Contractor	
				Asphalt	• Do not pave asphalt in early morning or at night when atmospheric		Contractor	

				fume control measures	dispersion is unsmooth; • Avoid unorganized equipment discharge; • Provide PPE to operators and strengthen labor protection to minimize bodily harm.			
				Canteen fume	• Use LPG and electricity in the living area where possible; • Install an efficient electrostatic fume purifier.			Contractor
			Water environment protection measures		• Construct 4 settling tanks, 4 oil traps, 2 septic tanks and 2 integrated wastewater treatment facilities; • Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank; use machine cleaning wastewater for vehicle washing after treatment in the settling tank, and the excess for sprinkling without discharge; use domestic wastewater of the construction camp after treatment in the septic tank and integrated wastewater treatment facility, and disinfection up to the standard for construction or sprinkling without discharge.	Environmental protection authority, construction agency	Contractor
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency
			Solid waste disposal measures	Construction waste and spoil	• Dry dredging sludge and earth at the drying yard until moisture content is <60%, and then transfer to the spoil ground; • Transfer spoil of the Shanmen River to the Xinzhuang and Wacun spoil grounds, and cover it during transfer to avoid water loss, soil erosion and flying dust; • Collect domestic waste in the construction site, and transfer to the Jiaozuo Landfill; • Construction waste will be transferred by Xiuwu Ningyi Environmental Sanitation Service Company to Xiuwu Bo'ao New Building Material Factory and Jiaozuo Haoda Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor
				Bottom mud control	• Shorten the storage time of dredged mud, and transfer it to the spoil ground timely after drying; • Lay impermeable membrane in the temporary drying yard to prevent leachate from entering soil.	Environmental protection authority, construction agency	Contractor
			Sound environment protection measures		• Ecological restoration area for temporary land occupation: 71.9 mu, including spoil ground 64.4 mu and temporary road 7.5 mu; • Keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and	Land authority, river management	Contractor	

					vegetation restoration after construction; • Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage; • Conduct fish breeding and release after construction.	authority, environmental protection authority		
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• This component will be constructed across the flood season. Prepare a flood control plan and feasible preventive measures, and reserve rescue tools and materials in advance; • Collect flood and weather forecast information in various ways, and forecast floods and meteorological disasters properly; • Once any flood or meteorological sign threatening work and personal safety, take effective flood or disaster prevention measures; • Reserve flood control materials, and remove obstacles inside and outside diversion or flood discharge structures; • Strengthen patrol during rainstorms, and clean up landslides timely.	Environmental protection authority, construction agency	Contractor	
				Diversion cofferdam seepage and collapse	• In the flood period, cofferdams may leak or locally collapse due to floods, so precautions should be taken to avoid such risks. • When a cofferdam leaks, first find the leaking point on the front side and block it timely, and then fill the outlet on the back side to reduce the flow rate until there is no leakage. • When a cofferdam locally collapses, repair it with rock blocks using a dumper to restore the size of the cross section. • When an out-of-limit flood occurs above the cofferdam, issue an urgent evacuation notice, and transfer all staff and equipment in the cofferdam and foundation pit.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp;			

					• Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
		Operation	Water environment protection measures		Ensure river water quality through strict management and other measures.	Environmental protection authority	River management authority	
			Sound environment protection measures		Conduct eco-compensation by putting common local aquatic organisms into the river together with the fishery authority.	River management authority	River management authority	
JZTJ104	Shanmen River Restoration in Macun District	Construction	Ambient air protection measures	Dust control measures	• Provide 3 sprinkling trucks to sprinkle areas where dust is likely to occur and keep the ground wet; • Set up fences of not lower than 2.5m around urban construction areas, and not lower than 1.8m around suburban and rural ones continuously, with an anti-overflow base and an upper sprinkler, with spacing of not more than 4m.	Environmental protection authority, construction agency	Contractor	507.23
				Transport dust	• Set up 3 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor	
				Canteen fume	• Use LPG and electricity in the living area where possible; • Install an efficient electrostatic fume purifier.		Contractor	
			Water environment protection measures		• Construct 3 settling tanks, 3 oil traps, 3 septic tanks and 3 integrated wastewater treatment facilities; • Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank; use machine cleaning wastewater for vehicle washing after treatment in the settling tank, and the excess for sprinkling without discharge; use domestic wastewater of the construction camp after treatment in the septic tank and integrated wastewater treatment facility, and disinfection up to the standard for construction or sprinkling without discharge.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Spoil and bottom mud will be transferred by Jiaozuo Bencheng Muck Transfer Company to the spoil grounds north of Majie Village and northwest of Zhangtianhe Village in Macun District; • Waste rock will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Qianye New Material Company for integrated utilization;	Environmental protection authority, construction agency	Contractor	

					• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.			
			Sound environment protection measures		• Ecological restoration area for temporary land occupation: 198.49 mu, including spoil ground 155.49 mu, construction camp 12 mu and construction road 31 mu; • Reclaim 4 mu in the construction camp; keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction; cultivate wheat and corn mainly, and restore its fertility to the pre-occupation level; • Restore vegetation for 142 mu (construction camp, spoil ground and construction road); keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction, Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage.	Land authority, river management authority, environmental protection authority	Contractor	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures; • Strengthen patrol during rainstorms, and clean up landslides timely.	Environmental protection authority, construction agency	Contractor	
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	52.34
				Transport dust	• Set up two automatic vehicle cleaning devices at the entrance of the construction site.		Contractor	
			Water environment protection measures		• Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank, and drain the remainder to the urban sewer network for treatment.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction	Contractor, transport agency	

					agency		
			Solid waste disposal measures	• Spoil will be transferred by Jiaozuo Bencheng Muck Transfer Company to the Houyugou spoil ground; • Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures	• Ecological restoration area for temporary land occupation: construction camp 7.5 mu; • Keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction; • Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage.	Land authority, river management authority, environmental protection authority	Contractor	
			Environmental emergency response – Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
			Environmental emergency response – Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ106	Qunying River Restoration	Construction	Ambient air protection measures – Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	
			Ambient air protection measures – Transport dust	• Set up 4 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor	
			Water environment protection measures	• Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank, and drain the remainder to the urban sewer network for treatment.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures	• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal	• Spoil will be transferred by Jiaozuo Bencheng Muck Transfer Company to	Environmental	Contractor	

			measures		the Houyugou spoil ground; • Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	protection authority, construction agency		
			Sound environment protection measures		• Ecological restoration area for temporary land occupation: construction camp 9 mu; • Keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction; • Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage.	Land authority, river management authority, environmental protection authority	Contractor	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures; • Strengthen patrol during rainstorms, and clean up landslides timely.	Environmental protection authority, construction agency	Construction agency	
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ107	Urban River Facility Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	22.72
				Transport dust	• Set up 3 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor	
			Water environment protection measures		• Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank, and drain the remainder to the urban sewer network for treatment.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Spoil will be transferred by Jiaozuo Bencheng Muck Transfer Company to the Houyugou spoil ground;	Environmental protection	Contractor	

					• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	authority, construction agency		
			Sound environment protection measures		• Ecological restoration area for temporary land occupation: construction camp 7.5 mu; • Keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction; • Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage.	Land authority, river management authority, environmental protection authority	Contractor	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures; • Strengthen patrol during rainstorms, and clean up landslides timely.	Environmental protection authority, construction agency	Contractor	
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ110	Upgrading and Construction of Urban Flood Ditches	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	81.92
				Transport dust	• Set up 4 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor, transport agency	
			Water environment protection measures		• Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank, and drain the remainder to the urban sewer network for treatment.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Spoil will be transferred by Jiaozuo Bencheng Muck Transfer Company to the Houyugou spoil ground;	Environmental protection	Contractor	

					• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	authority, construction agency		
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	Construction	Ambient air protection measures	Dust control measures	• Provide two sprinkling trucks to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	436.97
				Transport dust	• Set up 4 automatic vehicle cleaning devices at the entrance of the construction site.		Contractor, transport agency	
			Water environment protection measures		• Use water drained from the foundation pit for sprinkling and construction after treatment in the settling tank, and drain the remainder to the urban sewer network for treatment.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Bypass villages in principle; if not possible, decelerate (to 15km/h) and avoid horning; schedule transport rationally based on construction schedule, and minimize overnight transport.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Spoil will be transferred by Jiaozuo Bencheng Muck Transfer Company to the Houyugou spoil ground; • Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Ecological restoration area for temporary land occupation: construction camp 6 mu, temporary road 72.23 mu and temporary earth yard 14.29 mu; • Keep a 30cm topsoil layer, and restore it by land leveling, topsoil filing and vegetation restoration after construction; • Plant native species (Cynodon, bluegrass, etc.) to over 60% in coverage.	Land authority, river management authority, environmental	Contractor	

					protection authority		
			Traffic management and road safety	• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers: • Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures. Fires: • Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.	Environmental protection authority, construction agency	Contractor	

Table 10.3-3 EMP for municipal components

Component		Stage	Environmental factor		Measure	Regulated by	Implemented by	Investment /0,000 yuan
Contract	Component							
JZTJ108	Urban Sewer Network Inspection and Restoration (Phase 1)	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	65.77
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	

			Water environment protection measures		• Sieve and dehydrate sludge, and drain wastewater into the urban sewer network.	Environmental protection authority, construction agency	Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Sieve and dehydrate sludge until moisture content is <60%, and then transfer to the Jiaozuo Sludge Disposal Center for disposal; • Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Health protection		• Before confined space operation, take isolating measures, set up visible warning signs around the working site, keep the entrance smooth, and check the operating environment, equipment, PPE, tools, etc. to ensure conformity; • Provide a lifebelt, a life rope and an isolated respirator for the operator; • Set up a visible no-smoking sign around the sewer pipe and shaft.	Construction agency	Contractor	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Fires, explosions and poisoning	• Wear a lifebelt, a life rope and an isolated respirator during operation to avoid risks; • Do not smoke or use any flame near the sewer pipe and shaft to avoid gas combustion, and avoid generating any spark in the shaft; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons. • Prepare a CO_2 poisoning emergency plan and offer on-site first-aid training to the operator.			
JZTJ109	Urban Road Facility Restoration	Construction	protection	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	19.2
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt	• Do not pave asphalt in early morning or at night when atmospheric dispersion is		Contractor	

				fume control measures	unsmooth; • Avoid unorganized equipment discharge.			
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ111	Flood Control Upgrading of Urban Rivers and Bridges	Construction	protection	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	28.91
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt	• Do not pave asphalt in early morning or at night when atmospheric dispersion is		Contractor	

				fume control measures	unsmooth; • Avoid unorganized equipment discharge.			
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Spoil will be transferred by Jiaozuo Bencheng Muck Transfer Company to the Houyugou spoil ground; • Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the			

					construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ112	North Ring Road (Puji Road-Tabei Road) Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	72.99
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			emergenc	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction	Contractor	

				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.	agency		
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ113	Shanyang Road (Taihang Road-Jianshe Road) Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	41.87
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend	Transport authority	Contractor, construction agency	

					their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.			
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	38.66
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority,	Contractor, transport agency	

			measures			construction agency		
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ115	Fengshou Road Restoration	str uc	protection	Dust control	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet;	Environmental protection	Contractor	38.69

				measures	• Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	authority, construction agency		
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, environmental protection authority	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid			

					risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ116	Minzhu Road Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	26.24
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff	Transport authority	Contractor, construction agency	

					to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.			
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ117	Industry Road Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	53.53
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority,	Contractor	

						construction agency		
				Traffic management and road safety	• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ118	Jiaowu Road Restoration	Construction	protection	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	6.11
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt	• Do not pave asphalt in early morning or at night when atmospheric dispersion is		Contractor	

				fume control measures	unsmooth; • Avoid unorganized equipment discharge.			
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the			

					construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ119	Jianshe Road Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	23.62
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.	Transport authority	Contractor, construction agency	
			emergenc	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction	Contractor	

				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.	agency		
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			
JZTJ120	Jiefang East Road Restoration	Construction	Ambient air protection measures	Dust control measures	• Provide one sprinkling truck to sprinkle areas where dust is likely to occur and keep the ground wet; • Fence the construction site continuously for a height of not less than 2.5m, and avoid flying dust where possible.	Environmental protection authority, construction agency	Contractor	87.2
				Transport dust	• Set up an automatic vehicle cleaning device at the entrance of the construction site.		Contractor	
				Asphalt fume control measures	• Do not pave asphalt in early morning or at night when atmospheric dispersion is unsmooth; • Avoid unorganized equipment discharge.		Contractor	
			Sound environment protection measures		• Overnight construction is prohibited. If continuous construction is necessary for any special reason, the approval of the local competent authorities is required and should be disclosed on the construction site.	Environmental protection authority, construction agency	Contractor, transport agency	
			Solid waste disposal measures		• Construction waste will be transferred by Jiaozuo Bencheng Muck Transfer Company to Jiaozuo Weitai Green Building Material Company for integrated utilization.	Environmental protection authority, construction agency	Contractor	
			Traffic management and road safety		• Safety isolation: Fence the construction site and separate it from nearby roads using steel plates; reduce fencing where possible to reduce urban traffic impacts. • Traffic guidance: Set up signs at crossroads and occupied segments to guide vehicles to pass safely; contact the local police to assign more policemen or extend	Transport authority	Contractor, construction agency	

					their working hours to strengthen traffic guidance and avoid congestion. • Traffic sign setup: Set up slow driving (reflective paint) and warning signs at both ends of the road segment under construction and on the right side. • Traffic coordination: Strengthen coordination with the transport authority at key crossings of the construction area and special operation sites to assign more staff to guide traffic; where necessary, set up mobile fences and warning signs, and take isolation measures.			
			Environmental emergency response	Disastrous weathers	• Collect weather forecast information in various ways, and forecast meteorological disasters properly; • Once any meteorological sign threatening work and personal safety, take effective disaster prevention measures.	Environmental protection authority, construction agency	Contractor	
				Pipeline breaking accidents in excavation	• Include protective measures for existing pipelines and facilities in the construction organization design, and have proprietors confirm pipeline position, depth and construction scheme feasibility before construction; take the following emergency measures once an accident occurs; • Stop construction, and evacuate all downwind staff upward immediately to avoid risks; • Contact the competent authority to report the accident and request assistance; • Close the upstream control valve as quickly as possible; • Put out the fire with sand and a dry powder extinguisher, and ask the fire department for help if necessary.			
				Fires	• Set up fire-fighting apparatus and fireproof materials at certain positions of the construction camp; • Organize self-rescue and ask the local fire department for help once a fire occurs; keep the roads on the construction site unobstructed to ensure the smooth passage of fire wagons.			

Table 10.3-4 SMP for River Management Components

Component / contract	Stage	Measures or actions		Regulated by	Implementers	Funding source	Monitoring indicators
JZTJ101 JZTJ102 JZTJ103 JZTJ104	Construction	LAR risks	• Implement the approved RAP; • Pay particular attention to how vulnerable groups (if any) will use compensation for income restoration in the RAP.	PMO, owner, taskforce	PMO, taskforce	Subproject budget	RAP implementation

JZTJ105 JZTJ106 JZTJ107 JZTJ110 ZTJ121		Potential E&S risks	• Disclose subproject information, including overview, construction agency, scope, form and period of consultation, emergency plan, etc. • Ensure that construction operations comply with the state laws and regulations on work safety, including using necessary PPE (helmet) and COVID-19 protective equipment (face mask, thermometer, health code, travel code, etc.). • Schedule construction rationally, and reduce noise, dust, slag and tail gas impacts during construction. • Regulate the discharge of domestic wastewater and land occupation for sludge drying. • Set up road safety signs and take protective measures on construction sites to improve construction efficiency. • Reduce the frequency of construction vehicles entering residential communities, and conduct construction in low traffic hours.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Lawful construction signs, public consultation records and emergency plan; • EHS measures included in bidding documents and contracts, and implementation of COVID-19 control measures; • Number of violation cases on construction sites and records; • Type and quantity of dust suppression measures on construction sites; • Frequency and scope of serious disturbance to nearby residents, such as overnight construction; • Number of measures to address construction disturbance; • Number of accidents and other complaints due to the absence of road safety signs and protection measures; • Number and information of safety signs on construction sites; • Number of workers trained on safety
		GBV risks	• Strengthen the protection of women's labor rights, and guard against GBV; • The construction agency provides regular mental counseling and rights protection training to female laborers; • The construction agency strengthens the regulation of construction sites to avoid SEA / SH and GBV, and establishes a clear GRM; the construction agency establishes a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Ratio of male to female workers of construction agency; • Frequency of mental counseling and rights protection training, appointment of officers for women's rights protection, and measures taken to prevent workplace sexual harassment; • Establishment and staffing of grievance redress teams, and smoothness of the GRM

		AIDS, COVID-19 and other social risks	• Strengthen education and publicity on public health, AIDS, COVID-19 and other infectious diseases, and include this in contracts; • Conduct physical checkups for workers, and set up temporary infirmaries if necessary; • Conduct diversified publicity on AIDS prevention by means of brochure, poster, etc.; • Strengthen publicity and education on local customs for nonlocal workers by means of brochure, poster, etc.; • Sign labor contracts with temporary workers.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Provisions of construction contracts, and performance; • Frequency of training and number of trainees; • Number of health centers; • Frequency of publicity on disease prevention and treatment; • Frequency of publicity and education on local customs
		Labor rights infringement risks	• Employ workers equally and fairly without discrimination; • Provide appropriate protection and assistance measures to certain worker groups, such as women, the disabled, migrant workers and underage workers; allow workers to establish and join worker organizations, and protect their collective bargaining right; • Establish a labor protection supervision mechanism, and protect the privacy of reporters.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Proportion of women, the disabled and other special groups in recruited workers; • Protective measures taken; • Frequency of training and education; • Frequency of collective bargaining; • GRM and operation, number and proportion of female workers, feedback and suggestions

	Operation	Potential E&S risks	• Prepare an education and training program for nearby communities, and conduct relevant education and training, including early warning and drilling, to improve residents' flood safety awareness; • Offer diversified disaster training (earthquake, flood control, etc.) • Pay particular attention to the proportion of women, elders and children educated and trained; • Train disaster information staff actively; • Set up clean public toilets along densely populated river segments with signs and full-time cleaners; • Set up special passages for the disabled and elders along rivers; • Appoint river management agencies and staff, and develop relevant policies to solve dredging problems timely; • Set up small parking lots along densely populated river segments for residents to park their electric bikes.	PMO, emergency management bureau, flood control headquarters, JMURCB, sub-district offices, village committees, local women, taskforce	PMO, emergency management bureau, flood control headquarters, JMURCB, sub-district offices, village committees, local women	Subproject budget, government finance	• Frequency of education and training on flood control, men-times and women's proportion; • Diversified disaster training (earthquake, flood control, etc.); • Effectiveness of training regularly; • Process for using and managing disaster relief materials and funds; • Layout of public toilets; • Setup of special passages for the disabled and elders; • River chief system, signs and regulations; • Setup of parking lots; • Frequency of traffic accidents
	Operation	Social gender risks	• At the operation stage, each agency (PMO, construction agency, etc.) has at least one female member; • The time, venue and form of publicity should be suited to women's needs, educational level and daily activities.	Owner, PMO, JMURCB, sub-district offices, village committees, women and poor residents, taskforce	Design agency, construction agency, owner, PMO, JMURCB, civil affairs bureau, women's federation, transport bureau, sub-district offices, village committees, women and poor residents	Subproject budget, government finance	• Number and proportion of female members in community participation teams, and their feedback and suggestions; • Number of female members in agencies at the operation stage; • Time, venue and mode of training; • Number of women trained

Table 10.3-5 SMP for Municipal Components

Component / contract	Stage	Measures or actions		Regulated by	Implementers	Funding source	Monitoring indicators
JZTJ108 JZTJ109 JZTJ111	Construction	LAR risks	• Implement the approved RAP; • Pay particular attention to how vulnerable groups (if any) will use compensation for income restoration in the RAP.	PMO, owner, taskforce	PMO, taskforce	Subproject budget	RAP implementation

JZTJ112 JZTJ113 JZTJ114 JZTJ115 JZTJ116 JZTJ117 JZTJ118 JZTJ119 JZTJ120		Potential safety risks	• Disclose subproject information, including overview, construction agency, scope, form and period of consultation, emergency plan, etc. • Ensure that construction operations comply with the state laws and regulations on work safety, including using necessary PPE. • Schedule construction rationally, and reduce noise, dust, slag and tail gas impacts during construction. • Regulate the discharge of domestic wastewater and land occupation for sludge drying. • Set up road safety signs and take protective measures on construction sites to improve construction efficiency. • Reduce the frequency of construction vehicles entering residential communities, and conduct construction in low traffic hours.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Lawful construction signs, public consultation records and emergency plan; • EHS measures included in bidding documents and contracts; • Number of violation cases on construction sites and records; • Type and quantity of dust suppression measures on construction sites; • Frequency and scope of serious disturbance to nearby residents, such as overnight construction; • Number of measures to address construction disturbance; • Number of accidents and other complaints due to the absence of road safety signs and protection measures; • Number and information of safety signs on construction sites; • Number of workers trained on safety
		GBV risks	• Strengthen the protection of women's labor rights, and guard against GBV; • The construction agency provides regular mental counseling and rights protection training to female laborers; • The construction agency strengthens the regulation of construction sites to avoid SEA / SH and GBV, and establishes a clear GRM; the construction agency establishes a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Ratio of male to female workers of construction agency; • Frequency of mental counseling and rights protection training, appointment of officers for women's rights protection, and measures taken to prevent workplace sexual harassment; • Establishment and staffing of grievance redress teams, and smoothness of the GRM

		AIDS, COVID-19 and other social risks	• Strengthen education and publicity on public health, AIDS, COVID-19 and other infectious diseases, and include this in contracts; • Conduct physical checkups for workers, and set up temporary infirmaries if necessary; • Conduct diversified publicity on AIDS prevention by means of brochure, poster, etc.; • Strengthen publicity and education on local customs for nonlocal workers by means of brochure, poster, etc.; • Sign labor contracts with temporary workers.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Provisions of construction contracts, and performance; • Frequency of training and number of trainees; • Number of health centers; • Frequency of publicity on disease prevention and treatment; • Frequency of publicity and education on local customs
		Labor rights infringement risks	• Employ workers equally and fairly without discrimination; • Provide appropriate protection and assistance measures to certain worker groups, such as women, the disabled, migrant workers and underage workers; allow workers to establish and join worker organizations, and protect their collective bargaining right; • Establish a labor protection supervision mechanism, and protect the privacy of reporters.	PMO, owner, SIA agency, taskforce	Construction agency Contractors	Subproject budget	• Proportion of women, the disabled and other special groups in recruited workers; • Protective measures taken; • Frequency of training and education; • Frequency of collective bargaining; • GRM and operation, number and proportion of female workers, feedback and suggestions
	Operation	Potential E&S risks	• Check road infrastructure regularly, and replace any damaged facility timely; • Separate motorized and non-motorized vehicles, strengthen management, and impose speed limits; • Assign more policemen during the peak hours, and prohibit sidewalk occupation; • Regulate traffic signals and streetlamps; • Strengthen road traffic safety education.	PMO, finance bureau, JMURCB, taskforce	PMO, finance bureau, JMURCB	Subproject budget, government finance	• Checklist of road facilities (streetlamps, monitoring); • Separation of lanes (motorized vehicle lanes, non-motorized vehicle lanes and sidewalks); • Traffic accidents (quarterly); • Traffic safety education
	Operation	Social gender risks	• At the operation stage, each agency (PMO, construction agency, etc.) has at least one female member; • The time, venue and form of publicity should be suited to women's needs, educational level and daily activities.	Owner, PMO, JMURCB, sub-district offices, village committees, women and poor residents, taskforce	Design agency, construction agency, owner, PMO, JMURCB, civil affairs bureau, women's federation, transport bureau, sub-district offices, village committees, women and poor residents	Subproject budget, government finance	• Number and proportion of female members in community participation teams, and their feedback and suggestions; • Number of female members in agencies at the operation stage; • Time, venue and mode of training; • Number of women trained

10.4 Construction camp management plan

The construction camp management plan covers construction camp construction, infrastructure, living conditions, waste gas and wastewater treatment, solid waste disposal, material storage and management, equipment use and management, labor influx management, OHS management, etc.

The Subproject has 31 construction camps in total. Some camps are located in the urban area, and have a production area only, where nearby residential buildings are leased as the living area; the other camps include both living and production areas. See Tables 10.4-1 and 10.4-2.

Table 10.4-1 Construction camp management plan for river management components

No.	Item	Description		
1	Camp construction	JZTJ101	Dasha River Restoration	Construct 5 construction camps, each including living and production areas.
		JZTJ102	Dasha River Restoration in Xiuwu County	Construct 3 construction camps, each including living and production areas.
		JZTJ103	Shanmen River Restoration in Xiuwu County	Construct 2 construction camps, each including living and production areas.
		JZTJ104	Shanmen River Restoration in Macun District	Construct 3 construction camps, each including living and production areas.
		JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	Construct one construction camp, with a production area only, and lease a nearby residential building.
		JZTJ106	Qunying River Restoration	Construct one construction camp, with a production area only, and lease a nearby residential building.
		JZTJ107	Urban River Facility Restoration	Construct one construction camp, with a production area only, and lease a nearby residential building.
		JZTJ110	Upgrading and Construction of Urban Flood Ditches	Construct one construction camp, with a production area only, and lease a nearby residential building.
		JZTJ121	Tianjian Ditch (Yingshi Road-Puji River) Management	Construct one construction camp, with a production area only, and lease a nearby residential building.
2	Infrastructure	Water supply	Domestic water will be from the municipal water supply network, and construction water from rivers.	
		Power supply	The municipal power supply network can be connected to the construction area.	
3	Working conditions	• Set up a guard room, dormitory, canteen, toilet, washing facility, bathroom, laundry, water room, enclosed waste bin, etc. • The living area is well landscaped, and smooth drainage ensured. • The canteen in the living area is single-storied, and kept at a safe distance from the dormitory. • The buildings in the living area should resist Level 10 winds, and meet the local seismic fortification intensity and the technical code for fire safety of construction sites (GB50720-2011). • Flushing toilets are set up in the living area, and cleaned regularly to prevent pests from breeding. • If a nearby residential building is leased, the dormitory has a toilet, washing facility, bathroom, laundry, waste bin, etc. • Single or double beds are set up in the dormitory, and each person' living space is not less than 2 m^2; storage spaces for personal belongings are provided; the dormitory is kept tidy, ventilated, cool in summer and warm in winter. • Drinking water meets the national hygienic standard; a temporary boiling water point is provided, and personal containers used. • Strengthen the labor protection of workers, provide conforming PPE properly, and improve working conditions to ensure workers' physical and mental health. • Arrange work and rest reasonably, and pay salaries and benefits on time.		
4	Waste gas treatment	• For JZTJ101-JZTJ104, each camp is provided with one canteen, and its fume is treated by an efficient electrostatic fume purifier up to Table 1 in the emission standard of fume pollutants in the catering industry (DB41/1604-2018), and discharged via a flue higher than the roof.		
5	Wastewater treatment	JZTJ101-JZTJ104	For domestic wastewater from the living area, an oil trap, a septic tank and an integrated wastewater treatment facility are provided. Use domestic wastewater of the construction camp after treatment in the septic tank and integrated wastewater	

			treatment facility, and disinfection up to the standard for construction or sprinkling without discharge.
		JZTJ105-JZTJ107, JZTJ110, JZTJ121	A nearby residential building is leased as the living area, and domestic wastewater is discharged into the urban sewer network.
6	Solid waste disposal	• Some waste bins are set up in the construction camp, and domestic waste is collected and transferred to the Jiaozuo Landfill.	
7	Storage and management of construction materials	Hazardous materials	• The canteens in JZTJ101-JZTJ104 involve LPG, and the standby generators involve diesel oil. Therefore, a storeroom for LPG and diesel oil tanks is provided. • The storeroom • The storeroom is separated from the dormitory, and kept cool and ventilated. No smoking and no flame signs are set up. • The storeroom is managed by a specially assigned person, and provided with fire-fighting equipment. • Tanks in the diesel oil storeroom are kept clean and enclosed; if a leak occurs, diesel oil is transfer to another empty tank, and absorbed with an inert material. • In the LPG storeroom, empty and non-empty tanks are separated. Knocking, collision, heating and inversion are prohibited. If a leak occurs, find out the leaking point quickly, and take effective measures to eliminate leakage.
		Other materials	• Transfer materials to right positions based on planned consumption, weather conditions, etc. to avoid secondary transfer. • Strengthen the management of excess and depreciated materials. When construction is close to completion, check excess materials carefully, make up any deficiency, and dispose of any excess.
8	Use and management of machinery	• Machinery must be operated by a fixed operator with fixed duties, and any large equipment operated by multiple operators is managed by a head. Operators must be trained and certified before operation. • The operator checks the equipment before the shift to ensure that it is tidy and clean, and free from scratches, corrosion, and water, oil, gas and electric leakage. • The equipment should be stored at a safe position after operation to avoid nonproductive damage, and its parts and accessories should not be dismantled or lent.	
9	Labor influx management	• Employ workers equally and fairly without discrimination. • Provide appropriate protection and assistance measures to certain worker groups, such as women, the disabled, migrant workers and underage workers. Allow workers to establish and join worker organizations, and protect their collective bargaining right. • Establish a labor protection supervision mechanism, and protect the privacy of reporters. • Strengthen the protection of female workers' rights, and offer relevant training to prevent GBV. • The construction agency provides regular mental counseling and rights protection training to female laborers. • The construction agency strengthens the regulation of construction sites to avoid SEA / SH and GBV, and establishes a clear GRM; the construction agency establishes a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.	
10	OHS management	• Provide sufficient lighting in the office and living areas, check electric equipment in the production area regularly, and test the lightning and grounding protectors, and transformer quarterly for insulation. • Do not use nonstandard heating equipment in the office and living areas, and cut off the power supply if there is no one in these areas. • Assign someone to check positions where a fire is likely to occur in the production and living areas to prevent fires, and provide fire extinguishers as stipulated. • Make sure cooks have a health certificate; set up ventilation, exhaust and wastewater discharge facilities in the canteen, mark raw and cooked food; disinfect dinnerware timely and put it orderly; provide reliable facilities to prevent flies and rats. • Set up flushing toilets, assign someone to manage them, clean and disinfect them to prevent pests from breeding. • Make sure drinking water meets the national standard, set up a temporary boiling water point, and use personal containers. • If there is a steel bar processing plant, keep it well ventilated, and provide earmuffs and eye patches.	

Table 10.4-2 Construction camp management plan for municipal components

No.	Environmental	Description

	factor		
1	Camp construction		• One construction camp will be set up for JZTJ108, JZTJ109 and JZTJ111-JZTJ120, with a production area only, and a nearby residential building will be leased as the living area.
2	Infrastructure	Water supply	• Centralized water supply
		Power supply	• Centralized power supply
3	Working conditions		• If a nearby residential building is leased, the dormitory has a toilet, washing facility, bathroom, laundry, waste bin, etc. • Single or double beds are set up in the dormitory, and each person' living space is not less than 2 m^2; storage spaces for personal belongings are provided; the dormitory is kept tidy, ventilated, cool in summer and warm in winter. • Strengthen the labor protection of workers, provide conforming PPE properly, and improve working conditions to ensure workers' physical and mental health. • Arrange work and rest reasonably, and pay salaries and benefits on time.
4	Storage and management of construction materials		• Store construction materials under proper conditions to ensure their service life. • Transfer materials to right positions based on planned consumption, weather conditions, etc. to avoid secondary transfer. • Strengthen the management of excess and depreciated materials. When construction is close to completion, check excess materials carefully, make up any deficiency, and dispose of any excess.
5	Use and management of machinery		• Machinery must be operated by a fixed operator with fixed duties, and any large equipment operated by multiple operators is managed by a head. Operators must be trained and certified before operation. • The operator checks the equipment before the shift to ensure that it is tidy and clean, and free from scratches, corrosion, and water, oil, gas and electric leakage. • The equipment should be stored at a safe position after operation to avoid nonproductive damage, and its parts and accessories should not be dismantled or lent.
6	Labor influx management		• Employ workers equally and fairly without discrimination. • Provide appropriate protection and assistance measures to certain worker groups, such as women, the disabled, migrant workers and underage workers. Allow workers to establish and join worker organizations, and protect their collective bargaining right. • Establish a labor protection supervision mechanism, and protect the privacy of reporters. • Strengthen the protection of female workers' rights, and offer relevant training to prevent GBV. • The construction agency provides regular mental counseling and rights protection training to female laborers. • The construction agency strengthens the regulation of construction sites to avoid SEA / SH and GBV, and establishes a clear GRM; the construction agency establishes a grievance redress team at each construction site, which has at least two female members, and ensures the safety of its members.
7	OHS management		• Do not use nonstandard heating equipment in the office and living areas, and cut off the power supply if there is no one in these areas.

10.5 Institutional strengthening and capacity building

The Jiaozuo PMO has no experience in implement an AIIB-financed subproject, and there is no EIA requirement for domestic projects of this type. Therefore, implementing the ESMP is a new task for the IAs. The Jiaozuo PMO will assign an external specialist to provide preliminary training on ESMP implementation to the IAs' E&S specialists, contractors and supervising agency, including AIIB's ESP, good construction practices, monitoring and reporting, GRM, etc.

10.6 Monitoring and reporting

10.6.1 Environmental monitoring plan

Environmental monitoring will be conducted by a qualified third party appointed by the Jiaozuo PMO and IAs.

2) Ambient air monitoring

Monitoring sites: at each downwind residual community close to the construction site

Monitoring factors: TSP, PM10, PM2.5, NH3, H2S;

Monitoring frequency: once before construction, quarterly in Year 1 and semiannually afterwards, for two consecutive days per time

Monitoring method: as per the Ambient Air Quality Standard (GB3095-2012), and the Ambient Air Quality Monitoring Standard (Trial)

2) Water environment monitoring

Monitoring sites: a monitoring cross section 50m downstream the starting point, 50m upstream the end point,

Monitoring factors: pH, COD, BOD_5, ammonia nitrogen, SS, total phosphorus, total nitrogen, dissolved oxygen, fecal coliform, fluorides, petroleum

Monitoring frequency: once before construction, quarterly in Year 1 and semiannually afterwards, for two consecutive days per time

Monitoring method: as per the Environmental Quality Standard for Surface Water (GB3838-2002)

3) Sound environment monitoring

Monitoring sites: sensitive sites within 50m around the construction site

Monitoring factors: equivalent continuous sound level A

Monitoring frequency: once before construction, and quarterly during construction, for two consecutive days per time, once in the daytime and at night each

Monitoring method: as per the Environmental Quality Standard for Noise (GB3096-2008)

10.6.2 Social monitoring

Monitoring and evaluation is an important means to ensure that the Subproject is implemented according to its objectives, and also an important error correction and participation mechanism of the Subproject. Therefore, a monitoring and evaluation mechanism has been established, including internal supervision, and external monitoring and evaluation.

Internal supervision will be conducted by the Jiaozuo PMO and municipal finance bureau on the implementation of the Subproject and the SMP, information disclosure, public participation, fund use, etc.

External monitoring and evaluation will be conducted by an independent agency accepted by AIIB, and with over 10 years of experience in social and resettlement monitoring and evaluation in projects financed by AIIB, ADB, World Bank, etc. Such agency will conduct monitoring and evaluation, and submit reports to AIIB regularly (usually semiannually).

10.6.3 Reporting

The Jiaozuo PMO will report the implementation of the ESMPF, and submit a report quarterly in the first year and semiannually afterwards.

E&S monitoring reports will be submitted semiannually.

10.6.4 Cost estimate

Implementation and management costs of E&S mitigation measures are estimated to be 29.9019 million yuan, including: 1) costs of measures during construction, including fences, sprinklers, covering materials, drain ditches, acoustic barriers, traffic signs, totaling 26.7019 million yuan, borne by the contractors (as part of the construction contracts); 2) E&S monitoring costs of 2.4 million yuan; 3) capacity building and training costs of 500,000 yuan; 3) training, public participation and grievance redress costs of 300,000 yuan.

Appendix A List of FGDs with Local Residents

Date	County / district	Time	Township / sub-district	Details / number of participants	Remarks
June 9	Jiefang District	10:30	Jiaoxi Sub-district	1) FGD with women: 6, 2 young (under 30), 2 middle-aged (30-55) and 2 elderly (55 or above) 2) FGD with elders: 22 (1 male, 1 female) 3) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	
		15:00	Shangbaizuo Sub-district		
June 10	Shanyang District	10:30	Dongfanghong Sub-district	1) FGD with women: 6, 2 young (under 30), 2 middle-aged (30-55) and 2 elderly (55 or above) 2) FGD with elders: 22 (1 male, 1 female) 3) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	
		15:00	Xincheng Sub-district		
June 11	Zhongzhan District	9:30	Licun Sub-district	FGD with residents: 20 (10 male, 10 female) FGD with elders: 22 (1 male, 1 female) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	
June 12	Zhongzhan District	9:30	Wangfeng Sub-district	FGD with residents: 20 (10 male, 10 female) FGD with elders: 22 (1 male, 1 female) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	
June 13	Macun District	9:30	Xiaozhuang Sub-district	1) FGD with women: 6, 2 young (under 30), 2 middle-aged (30-55) and 2 elderly (55 or above) 2) FGD with elders: 22 (1 male, 1 female) 3) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	
June 14	Macun District	9:30	Daiwang Sub-district	FGD with residents: 20 (10 male, 10 female) FGD with elders: 22 (1 male, 1 female) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	
June 15	Xiuwu County	9:30	Wuliyuan Xiang	1) FGD with women: 6, 2 young (under 30), 2 middle-aged (30-55) and 2 elderly (55 or above) 2) FGD with elders: 22 (1 male, 1 female) 3) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	
June 16	Xiuwu County	9.30	Zhouzhuang Town	1) FGD with women: 6, 2 young (under 30), 2 middle-aged (30-55) and 2 elderly (55 or above) 2) FGD with elders: 22 (1 male, 1 female) 3) FGD with vulnerable groups: 6 (2 poor, 2 disabled, 2 MLS)	

Appendix B List of Interviewees

Chapter	Interviewee
5	Interview 5-1: Ms. Zhang, etc., Jiaoxi Sub-district, Jiefang District (48 years)
	Interview 5-2: Ms Jiang, etc., Wuliyuan Xiang, Xiuwu County (54 years)
	Interview 5-3: Mr. Li, etc., Zhouzhuang Town, Xiuwu County (52 years)
	Interview 5-4: Ms Liu, etc., Dongfanghong Sub-district, Shanyang District (35 years)
	Interview 5-5: Mr. Ma, etc., Zhouzhuang Sub-district, Xiuwu County (45 years)
	Interview 5-6: Mr. Fu, etc., Licun Sub-district, Zhongzhan District (42 years)
	Interview 5-7: Mr. Hong, etc., Wuliyuan Xiang, Xiuwu County (56 years)
	Interview 5-8: Mr. Liu, Xincheng Sub-district, Shangyang District (30 years)
	Interview 5-9: Mr. Qi, Wangfeng Sub-district, Zhongzhan District (43 years)
	Interview 5-10: Mr. Wang, etc., Shangbaizuo Sub-district, Jiefang District (43 years)
	Interview 5-11: Mr. Liu, etc., Shangbaizuo Sub-district, Jiefang District (55 years)
	Interview 5-12: Mr. Zhang, etc., Xincheng Sub-district, Shangyang District (43 years)
	Interview 5-13: Mr. Wu, etc., Xincheng Sub-district, Shangyang District (66 years)
	Interview 5-14: Ms Zhang, Minzhu Road Sub-district, Jiefang District (35 years)
	Interview 5-16: Mr. Wu, Wangtun Xiang, Xiuwu County (50 years)
	Interview 5-16: Ms Zhang, Xiaozhuang Sub-district, Macun District (75 years)
	Interview 5-17: Mr. Li, Xiaozhuang Sub-district, Macun District (38 years)
	Interview 5-18: Mr. Zhang, Wangfeng Sub-district, Zhongzhan District (35 years)
	Interview 5-19: Mr. Zhang, Wangfeng Sub-district, Zhongzhan District (35 years)
	Interview 5-20: Mr. Qi, Shangbaizuo Sub-district, Jiefang District (35 years)
	Interview 5-21: Mr. Wang, Wuliyuan Xiang, Xiuwu County (45 years)
	Interview 5-22: Ms Kong, Dongfanghong Sub-district, Shanyang District (55 years)
	Interview 5-23: Mr. Wang, Macun Sub-district, Macun District (63 years)
	Interview 5-24: Ms Liu, Anyangcheng Sub-district, Macun District (35 years)
	Interview 5-25: Ms Liu, Chengguan Town, Xiuwu County (48 years)

Appendix C Interview Minutes

Time	June 2022
Venue	Gesi Village, Xiuwu County
Organizer	XCWRB
Participants	Liu Junli from the PMO, Village Head Li, taskforce
Topic	FGD on Dasha and Shanmen River restoration in Xiuwu County
Key points and results	1. Xiuwu County suffered heavy losses in the July 20 rainstorm, and the Dasha and Shanmen Rivers underwent embankment collapse, and weir and bridge damage. 2. Local residents suffered heavy property losses in the rainstorm, and all their food crops were lost. 3. Local residents are well aware and highly support of the Subproject, and think that it will improve the flood control capacity of urban rivers, and the safety of bridges and roads. 4. Residents' need: 1) They expect river infrastructure to be restored as soon as possible to restore traffic. 2) They strongly expect municipal infrastructure to be restored to ensure their traffic safety; 3) Women expect the Subproject to generate job opportunities for them, such as cleaning. 

Appendix D Social Impact Analysis

Owner	Contract	Component	Township / sub-district	Affected population / female population / percentage	Stakeholder needs	Social benefits	Social risks
JMWRB	JZTJ 101	Dasha River Restoration	29 sub-districts in Jiefang, Shanyang and Zhongzhan Districts Jiefang District: Minzhu, Minsheng, Xinhua, Qibaijian, Jiaoxi, Jiaonan, Jiaobei, Shangbaizuo, Wangchu Shanyang District: Baijianfang, Jiaodong, Yixin, Dongfanghong, Taihang, Dinghe, Guangya, Xincheng, Zhongxing, Liwan Zhongzhan District: Wangfeng, Licun, Zhucun, Yueshan, Fengfeng, Longdong, Danhe, Fucheng,	77.22/38.15-49.40%	1) Strong need for water infrastructure restoration of the Dasha River • Restoring collapse, slope, water quality, sewer shafts and sewer pipes • Restoring and upgrading landscape, lamps and roads • Restoring riverside sidewalks and landscape for recreation • Demolishing dilapidated riverside structures (power distribution rooms, storerooms, etc.) • Restoring riverside roads, improving bridges and regulate peddling • Dredging the riverbed, and restoring intercepting pipes and other auxiliary facilities to improve flood discharge capacity • Improving the quality of green spaces on both sides 2) Nearby residents expect riverside toilets and recreational places. 3) Nearby residents expect to strengthen river management along the Dasha River. 4) Poor residents wish to participate in subproject construction. 5) Women are highly willing to participate.	1) Improving the flood control standard of the Dasha River to reduce flood impacts • Ensuring the proper functions of flood control and discharge, irrigation and water supply • Realizing a beautiful countryside with clear water, smooth rivers, green banks and beautiful landscape gradually • Improve the overall flood discharge capacity of urban rivers in Jiaozuo City 2) Improving river and road facilities to create a safer living environment • Restoring and upgrading damaged bridges and embankments • Restoring and upgrading seriously damaged river segments 3) Restoring and upgrading water replenishing facilities to ensure water environment quality 4) Improving the riverside landscape and the surrounding natural environment, and increasing tourism income 5) Promoting the development of the 29 sub-districts in Jiefang, Shanyang and Zhongzhan Districts along the river, and increasing job opportunities	1) Potential LAR impacts 2) Potential environmental impacts during construction and operation • Machinery and vehicle noise, dust, waste gas, wastewater, waste, etc. may affect nearby residents' production and life. 3) Community health and safety impacts • River, road, bridge and sewer network restoration is linear in shape, and temporary traffic inconvenience will be mitigated after the completion of construction. • Construction vehicles passing through residential communities will pose safety risks. • Muck and sludge may drop from vehicles, posing an adverse impact on nearby vehicles and pedestrians.

			Xuheng, Longxiang				• Flying dust is adverse to respiratory health. • Increased vehicle traffic during construction will threaten the personal safety of nearby residents. • Labor and GBV risks
XCWRB XCWRB	JZTJ 102	Dasha River Restoration in Xiuwu County	8 townships / sub-districts in Xiuwu County: Wangtun Xiang Wuliyuan Xiang Xicun Xiang Chengguan Town Xunfeng Town Qixian Town Zhouzhuang Town Yuntaishan Town	24.86/12.09-48.63%	1) Strong need for water infrastructure restoration of the Dasha and Shanmen Rivers • Restoring collapse, slope, water quality, sewer shafts and sewer pipes • Restoring and upgrading landscape, lamps and roads • Restoring riverside sidewalks and landscape for recreation • Demolishing dilapidated riverside structures (power distribution rooms, storerooms, etc.) • Restoring riverside roads, improving bridges and regulate peddling • Dredging the riverbed, and restoring intercepting pipes and other auxiliary facilities to improve flood discharge capacity • Improving the quality of green spaces on both sides 2) Nearby residents expect riverside toilets and recreational places. 3) Nearby residents expect to strengthen river management along the Dasha River. 4) Poor residents wish to participate in subproject construction. 5) Women are highly willing to participate.	1) Improving the flood control standard of the Dasha and Shanmen Rivers to reduce flood impacts • Ensuring the proper functions of flood control and discharge, irrigation and water supply • Realizing a beautiful countryside with clear water, smooth rivers, green banks and beautiful landscape gradually • Improve the overall flood discharge capacity of urban rivers in Jiaozuo City 2) Improving river and road facilities to create a safer living environment • Restoring and upgrading damaged bridges and embankments • Restoring and upgrading seriously damaged river segments • Constructing flood discharge pump stations to improve flood discharge efficiency 3) Restoring and upgrading water replenishing facilities to ensure water environment quality 4) Improving the riverside landscape and the surrounding natural environment, and increasing tourism income 5) Promoting the development of the 29 sub-districts in Jiefang, Shanyang and Zhongzhan Districts along the rivers, and increasing job opportunities	
	JZTJ 103	Shanmen River Restoration in Xiuwu County					
MDARAB	JZTJ 104	Shanmen River Restoration in Macun District	7 sub-districts in Macun District: Macun	12.06/5.29-43.36%	1) Strong need for water infrastructure restoration of the Shanmen River in Macun District	1) Improving the flood control standard of the Shanmen River in Macun District to reduce flood impacts	

			Fengying Jiulishan Road Daiwang Anyangcheng Yanma Wuwang		• Restoring collapse, slope, water quality, sewer shafts and sewer pipes • Dredging the riverbed, and restoring intercepting pipes and other auxiliary facilities to improve flood discharge capacity • Restoring riverside sidewalks and landscape for recreation 2) Nearby residents expect riverside toilets and recreational places. 3) Nearby residents expect to strengthen river management along the Shanmen River. 4) Poor residents wish to participate in subproject construction. 5) Women are highly willing to participate.	• Ensuring the proper functions of flood control and discharge, irrigation and water supply • Realizing a beautiful countryside with clear water, smooth rivers, green banks and beautiful landscape gradually • Improve the overall flood discharge capacity of urban rivers in Jiaozuo City 2) Improving river and road facilities to create a safer living environment • Heightening embankments, and restoring and upgrading damaged bridges and embankments • Restoring and upgrading seriously damaged river segments • Constructing drainage sluices to improve the river's drainage capacity 3) Restoring and upgrading water replenishing facilities to ensure water environment quality 4) Improving the riverside landscape and the surrounding natural environment, and increasing tourism income 5) Promoting the development of the 29 sub-districts in Jiefang, Shanyang and Zhongzhan Districts along the river, and increasing job opportunities	
JMURCB	JZTJ105	Wengjian River (North Ring Road-Shanyang Road) Restoration	29 sub-districts in Jiefang, Shanyang and Zhongzhan Districts Jiefang District: Minzhu, Minsheng, Xinhua, Qibaijian, Jiaoxi, Jiaonan, Jiaobei, Shangbaizuo, Wangchu Shanyang	77.22/38.15-49.40%	1) Local residents eagerly expect the restoration of affected municipal infrastructure. • Improving the flood discharge capacity of urban flood ditches • Restoring damaged river channels and auxiliary facilities • Restoring damaged roads and auxiliary facilities	1) Improving the Wengjian River (North Ring Road-Shanyang Road) segment and auxiliary facilities to create a safer living environment • Improving river protection, and restoring and reinforcing 6 secondary revetments and 2,525m riverbed from Taihang Road to Shanyang Road • Restoring an existing rubber dam 2) Improving the riverside landscape and the surrounding natural environment, and increasing tourism income • Constructing ecological green spaces of 12,651 m^2 and sidewalks of 9,793 m^2 3) Restoring urban roads and auxiliary facilities,	

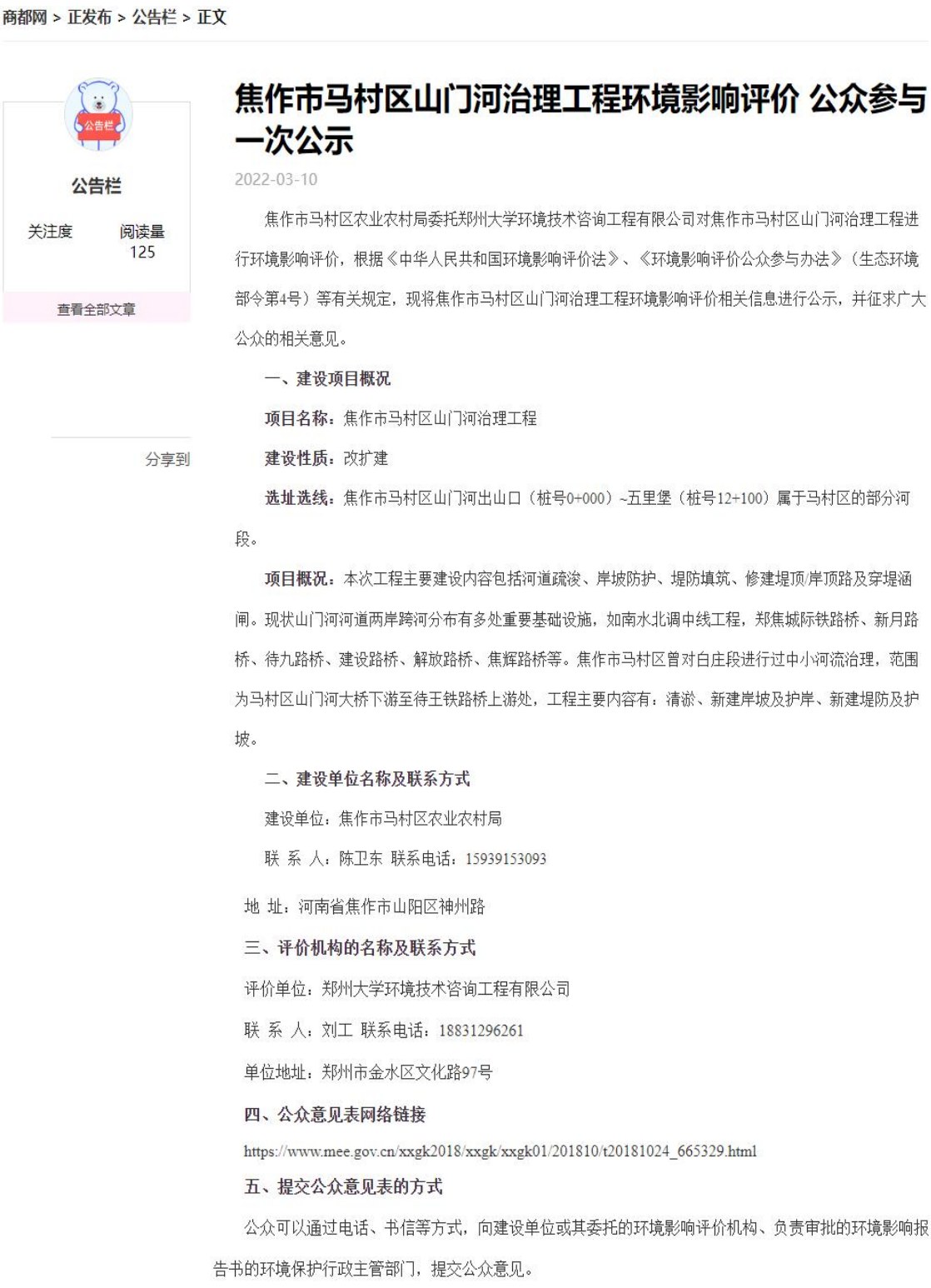
			District: Baijianfang, Jiaodong, Yixin, Dongfanghong, Taihang, Dinghe, Guangya, Xincheng, Zhongxing, Liwan Zhongzhan District: Wangfeng, Licun, Zhucun, Yueshan, Fengfeng, Longdong, Danhe, Fucheng, Xuheng, Longxiang			relieving urban traffic congestion, and realizing more convenient traffic • Setting up 230 solar streetlamps, 2 tool houses and some landscaping facilities to ensure safe and efficient traffic	
	JZTJ 106	Qunying River Restoration			2) Students of nearby schools and parents expect road restoration to be implemented as soon as possible. 4) Poor residents wish to participate in subproject construction. 5) Women are highly willing to participate.	1) Improving the flood control standard of the Qunying River to reduce flood impacts • Restoring the damaged 1.808km Qunying River (Yingshi Road-Taihang Road) segment • Restoring the Qunying River (Gongye Road-Xinyue Railway, Xinyue Railway-Xing'an Road, Xing'an Road-Longyuan Road) segment of 5.364km to improve flood control capacity • Restoring 3 rubber dams in the Qunying River (Renmin Road -Longyuan Road) segment to improve flood control capacity 2) Restoring urban roads and auxiliary facilities, relieving urban traffic congestion, and realizing more convenient traffic • Restoring light strips of 5,300m in the Qunying River (Gongye Road-Xinyue Railway, Xing'an Road-Longyuan Road) segment and auxiliary facilities, and 120 streetlamps in the Qunying River (Xing'an Road-Longyuan Road) segment and auxiliary facilities to reduce traffic accidents • Restoring and reconstructing intercepting pipes and auxiliary facilities, and checking urban sewer shafts to improve urban wastewater discharge capacity, and ensure safe and efficient traffic	
	JZTJ 107	Urban River Facility Restoration				1) Improving the Xiaozhang, Qunying and Hei Rivers and auxiliary facilities to create a safer living environment • Restoring intercepting pipes of the Xiaozhang River to improve wastewater treatment efficiency	

						• Restoring and upgrading reclaimed water pump stations of the Qunying River to restore the river function • Restoring and upgrading the Hei River to beautify the urban landscape • Expanding 4 passing pipes to improve the flood discharge capacity of urban roads	
	JZTJ 108	Urban Sewer Network Inspection and Restoration (Phase 1)				Restoring urban sewer pipes and auxiliary facilities, relieving urban traffic congestion, and realizing more convenient traffic • Checking, dredging and restoring sewer pipes • Eliminating defects in some urban roads (cracks, pits, subsidence, etc.) to ensure safety	
	JZTJ 109	Urban Road Facility Restoration				Managing urban waterlogging points, restoring urban roads and auxiliary facilities, relieving urban traffic congestion, and realizing more convenient traffic • Managing 16 waterlogging points, constructing or restoring rainwater pipes of 1.475 km, sewer pipes of 0.141 km, rainwater connecting pipes of 0.915 km and 78 rainwater outlets to improve the flood discharge capacity of urban roads • Restoring damaged pavement of 3,492 m^2, on Renmin Road (Dongjign Road-Donghai Avenue) to beautify the urban landscape • Restoring streetlamps and improving the efficiency of the urban road network to reduce traffic accidents and crimes	
	JZTJ 110	Upgrading and Construction of Urban Flood Ditches				Improving the flood discharge capacity and auxiliary facilities of urban flood ditches to improve the city's resistance to floods	
	JZTJ 111	Flood Control Upgrading of Urban Rivers and Bridges				Restoring urban bridges, roads and auxiliary facilities, relieving urban traffic congestion, and realizing more convenient traffic • Demolishing the Wengjian River bridge on	

						Fengshou Road, and improving the riverside landscape	
	JZTJ 112	North Ring Road (Puji Road-Tabei Road) Restoration				1) Restoring urban roads and auxiliary facilities, relieving urban traffic congestion, and realizing more convenient traffic • Broadening the existing road, optimizing the cross section, separating motorized vehicles from non-motorized ones, and improving traffic efficiency 2) Restoring urban bridges, beautifying the riverside landscape, and improving traffic convenience • Broadening the Qunying River bridge on North Ring Road to improve traffic efficiency 3) Improving the urban sewer network and auxiliary facilities to enhance the city's resistance to floods • Testing and restoring existing sewer pipes to improve discharge capacity 4) Improving the lighting and landscape of urban roads to improve traffic convenience and safety	
	JZTJ 113	Shanyang Road (Taihang Road-Jianshe Road) Restoration				1) Restoring urban roads and lighting facilities, relieving urban traffic congestion, and realizing more convenient traffic • Restoring damaged lanes of Shanyang Road (Jianshe Road-Jiefang Road, Jiefang Road-Taihang Road) • Replacing aged streetlamps and wires 2) Improving the urban sewer network and auxiliary facilities to enhance the city's resistance to floods • Reconstructing rainwater and sewer pipes with insufficient discharge capacity	
	JZTJ 114	Longyuan Road (Minzhu Road-Shanyang Road) Restoration				1) Reconstructing sidewalks and lanes, and remaking traffic marking lines to ensure convenient traffic and beautify the urban landscape	
	JZTJ	Fengshou Road				2) Improving the urban sewer network and	

	115	Restoration				auxiliary facilities to enhance the city's resistance to floods	
	JZTJ 116	Minzhu Road Restoration					
	JZTJ 117	Industry Road Restoration					
	JZTJ 118	Jiaowu Road Restoration					
	JZTJ 119	Jianshe Road Restoration					
	JZTJ 120	Jiefang East Road Restoration					
	JZTJ 121	Tianjian Ditch (Yingshi Road-Puji River) Management				1) Improving the flood control standard of the Yingshi Road-Puji River segment to reduce flood impacts • Ensuring the proper functions of flood control and discharge, irrigation and water supply • Improve the overall flood discharge capacity of urban rivers in Jiaozuo City 2) Improving river and road facilities to create a safer living environment • Reconstructing 5 bridges and culverts to improve the discharge capacity of the river 3) Restoring and upgrading intercepting pipes to ensure water environment quality	

Appendix E Screenshots of Disclosure



商都网 > 正发布 > 公告栏 > 正文

公告栏

关注度　　阅读量 125

查看全部文章

分享到

焦作市马村区山门河治理工程环境影响评价 公众参与一次公示

2022-03-10

焦作市马村区农业农村局委托郑州大学环境技术咨询工程有限公司对焦作市马村区山门河治理工程进行环境影响评价，根据《中华人民共和国环境影响评价法》、《环境影响评价公众参与办法》（生态环境部令第4号）等有关规定，现将焦作市马村区山门河治理工程环境影响评价相关信息进行公示，并征求广大公众的相关意见。

一、建设项目概况

项目名称：焦作市马村区山门河治理工程

建设性质：改扩建

选址选线：焦作市马村区山门河出山口（桩号0+000）~五里堡（桩号12+100）属于马村区的部分河段。

项目概况：本次工程主要建设内容包括河道疏浚、岸坡防护、堤防填筑、修建堤顶/岸顶路及穿堤涵闸。现状山门河河道两岸跨河分布有多处重要基础设施，如南水北调中线工程，郑焦城际铁路桥、新月路桥、待九路桥、建设路桥、解放路桥、焦辉路桥等。焦作市马村区曾对白庄段进行过中小河流治理，范围为马村区山门河大桥下游至待王铁路桥上游处，工程主要内容有：清淤、新建岸坡及护岸、新建堤防及护坡。

二、建设单位名称及联系方式

建设单位：焦作市马村区农业农村局

联 系 人：陈卫东 联系电话：15939153093

地 址：河南省焦作市山阳区神州路

三、评价机构的名称及联系方式

评价单位：郑州大学环境技术咨询工程有限公司

联 系 人：刘工 联系电话：18831296261

单位地址：郑州市金水区文化路97号

四、公众意见表网络链接

https://www.mee.gov.cn/xxgk2018/xxgk/xxgk01/201810/t20181024_665329.html

五、提交公众意见表的方式

公众可以通过电话、书信等方式，向建设单位或其委托的环境影响评价机构、负责审批的环境影响报告书的环境保护行政主管部门，提交公众意见。

Figure E1 Screenshot of the first online disclosure of Shanmen River Restoration in Macun District

公告栏

关注度 阅读量 923

查看全部文章

分享到

亚投行贷款河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目 --焦作市市政子项目环境影响评价一次公示

2022-03-10

一、建设项目概况

项目名程：亚投行贷款河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目

-焦作市市政子项目

地理位置：焦作市城区

项目概况：

项目工程旨在对焦作市区交通、市政设施和水利设施的修复、重建与防洪能力进行提升。

（1）水利基础设施灾后重建及提升：主要针对焦作市域内水毁严重的河道进行修复提升，包括河道疏浚和清淤、堤防工程、岸坡整治工程、生态修复工程、建筑物工程、涵闸工程、防汛道路工程等内容。

（2）市政基础设施灾后重建及提升：主要针对城区内水毁河道、水毁城市道路及附属设施、桥梁及排水设施进行修复提升等。水毁河道主要包括河道恢复、河道疏通、沿河附属设施修复等；水毁城市道路及附属设施重建主要包括道路修复、市政管网排水设施及排水泵站修复、道路局部积水点改造及路灯修复；城区阻水桥梁主要包括桥梁检测以及桥梁加固维修等；排水设施改造提升工程主要包括雨污水管网及截洪沟修复提升等。

焦作市区灾后重建项目按照工程位置分为15个子项目。各子项目工程为：JZTJ105焦作市瓮涧河（北环路一山阳路）灾后恢复工程、JZTJ106焦作市群英河（新月铁路～新安路）段综合治理工程、JZTJ106焦作市群英河灾后恢复工程、JZTJ107焦作市城区河道设施恢复工程、JZTJ108焦作市城区排水管网检测修复工程（一期）、JZTJ109焦作市城市道路设施水毁恢复工程、JZTJ110焦作市城区截洪沟过洪能力提升工程、JZTJ112焦作市北环路（普济路-塔北路）恢复工程、JZTJ113焦作市山阳路（太行路～建设路）恢复工程、JZTJ114焦作市龙源路（民主路～山阳路）恢复工程、JZTJ115焦作市丰收路道路恢复工程、JZTJ116焦作市民主路道路恢复工程、JZTJ117焦作市工业路道路恢复工程、JZTJ118焦作市焦武路道路恢复工程、JZTJ119焦作市建设路道路恢复工程、JZTJ120焦作市解放东路道路恢复工程。

二、建设单位名称和联系方式

建设单位：焦作市住房和城乡建设局 联系人：王老师

联系方式：0391-3557292

地址：河南省焦作市解放区焦南街道站前路88号

三、环境影响报告书编制单位

编制单位：郑州大学环境技术咨询工程有限公司 联系人：杨工

联系方式：0371-63888651 邮箱：1056573712@qq.com

地址：河南省郑州市金水区东三街与丰产路东南角郑大科研中心配楼二楼

四、公众意见表网络链接

https://www.mee.gov.cn/xxgk2018/xxgk/xxgk01/201810/t20181024_665329.html

五、提交公众意见表的方式

在本次信息公示后，公众可通过电话、邮箱或邮递等方式公众意见表发至建设单位。

在环境影响报告书征求意见稿编制过程中，公众均可向建设单位提出与环境影响评价相关的意见。

Figure E2 First disclosure of EIA for municipal components

公告栏

关注度 阅读量 2458

查看全部文章

分享到

亚投行紧急优惠贷款支持河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目-焦作子项目环境影响评价公众参与第一次公示

2022-06-10

根据《中华人民共和国环境影响评价法》及《环境影响评价公众参与办法》（部令第4号）等相关规定，现将本项目环境影响评价工作的有关内容进行公示。

1.项目名称：亚投行紧急优惠贷款支持河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目-焦作子项目（包括22个可研子项目，详见下表）

提出单位/机构	子项目名称
焦作市水利局	JZTJ101A-焦作市大沙河水毁修复工程（出山口-南水北调倒虹吸段）、JZTJ101B-焦作市大沙河水毁修复工程（南水北调倒虹吸-群英河入口段）
修武县水利局	JZTJ102-修武县大沙河水毁修复工程、JZTJ103-修武县山门河水毁修复工程
焦作市马村区农业农村局	JZTJ104-焦作市马村区山门河水毁恢复重建项目
焦作市住房和城乡建设局	JZTJ105-龙源河灾后恢复工程、JZTJ106-群英河灾后恢复工程、JZTJ107-城区河道设施恢复工程、JZTJ108-城区排水管网检测修复工程、JZTJ109-城市道路零星水毁恢复工程、JZTJ110-城区截洪沟过洪能力提升及新建工程、JZTJ111-城区河道桥梁防洪能力提升工程、JZTJ112-北环路（普济路～原北路）恢复工程、JZTJ113-山阳路（太行路～建设路）恢复工程、JZTJ114-龙源路（民主路～山阳路）恢复工程、JZTJ115-丰收路道路恢复工程、JZTJ116-民主路道路恢复工程、JZTJ117-工业路道路恢复工程、JZTJ118-焦武路道路恢复工程、JZTJ119-建设路道路恢复工程、JZTJ120-解放东路道路恢复工程、JZTJ121-旧涧沟河道治理工程

2.建设内容：项目实施范围分布在焦作市区、修武县等受灾区域，主要进行水利基础设施灾后重建及提升、市政基础设施灾后重建及提升、应急能力建设、机构能力加强等，包括河道疏浚及清淤、堤防修复及防护、岸坡整治及生态修复、桥梁涵闸及沿河附属设施修复重建、道路及附属设施修复、排水设施修复完善等。

1）水利基础设施灾后重建及提升：主要针对焦作市域内城区外水毁严重的河道进行修复提升，包括河道疏浚和清淤、堤防工程、岸坡整治工程、生态修复工程、建筑物工程、桥梁工程、涵闸工程、防汛道路工程等内容。

2）市政基础设施灾后重建及提升：主要针对城区内水毁河道、水毁城市道路及附属设施、桥梁及排水设施进行修复提升等。水毁河道主要包括河道恢复、河道疏通、沿河附属设施修复等；水毁城市道路及附属设施重建主要包括道路修复、市管排水设施及排水泵站修复、道路局部积水点改造及路灯修复；城区阳水桥梁主要包括桥梁检测以及桥梁加固维修等；排水设施改造提升工程主要包括雨污水管网及截洪沟修复提升等。

3.建设地点：焦作市区、修武县

4.联系人与联系方式：

孙老师，13839145456（焦作市水利局）

张老师，18739148008（修武县水利局）

陈老师，15939153093（焦作市马村区农业农村局）

王老师，18839188183（焦作市住房和城乡建设局）

5.承担评价工作的环境影响评价机构的名称及联系方式

郑州大学环境技术咨询工程有限公司 联系人：杨工 电话：15039579010

河南可人科技有限公司 联系人：李工 电话：18937670490

中南金尚环境工程有限公司 联系人：杨工 电话：13603913723

6.提交公示意见表的方式和途径

在本次信息公示后，公众可通过电话或邮递等方式将公众意见表发至建设单位。

公众意见表网络链接：

https://www.mee.gov.cn/xxgk2018/xxgk/xxgk01/201810/t20181024_665329.html

Figure E3 First disclosure of EIA for the Subproject

公告栏

关注度　　阅读量 78

查看全部文章

分享到

焦作市马村区山门河治理工程 环境影响报告书（征求意见稿）公示

2022-07-18

根据《中华人民共和国环境影响评价法》、《环境影响评价公众参与办法》（生态环境部令第4号）等有关规定，对焦作市马村区山门河治理工程环境影响评价信息进行公示，征求公众意见。

一、建设项目概况

项目名称：焦作市马村区山门河治理工程

建设性质：改扩建

选址选线：焦作市马村区山门河出山口（桩号0+000）~五里堡（桩号12+110）属于马村区的部分河段（扣除已实施的南水北调段、铁路段、待王镇右岸）。

项目概况：本次工程主要建设内容包括河道疏浚、岸坡防护、堤防填筑、修建堤顶/岸顶路及穿堤排水涵。现状山门河河道两岸跨河分布有多处重要基础设施，如南水北调中线工程，郑焦城际铁路桥、新月路桥、待九路桥、建设路桥、解放路桥、焦辉路桥等。焦作市马村区曾对白庄段进行过中小河流治理，范围为马村区山门河大桥下游至待王铁路桥上游处，工程主要内容有：清淤、新建岸坡及护岸、新建堤防及护坡。

二、建设单位名称及联系方式

建设单位：焦作市马村区农业农村局

联 系 人：陈卫东　联系电话：15939153093

地　　址：河南省焦作市山阳区神州路

三、评价机构名称及联系方式

评价单位：郑州大学环境技术咨询工程有限公司

联　系　人：刘工　　联系电话：18831296261

单位地址：郑州市金水区文化路97号

四、征求公众意见的具体形式

（1）本项目报告书征求意见稿的网络链接

链接：https://pan.baidu.com/s/1MuggdMlfYLiDHJ9abkgoQg，提取码：purz。

（2）查阅纸质版报告书的方式和途径

本项目环境影响报告书（征求意见稿）纸质版存放在建设单位，广大公众可于本公示公布之日起10个工作日内进行查阅。

五、征求意见的公众范围和主要事项

征求意见范围：公示对象为项目周边可能受项目建设影响的居民群众、企事业单位等。

主要事项：根据《环境影响评价公众参与办法》规定，主要征求与本项目环境影响和环境保护措施有关的建议和意见，涉及征地拆迁、财产、就业等与项目环评无关的意见或者诉求不属于项目环评公参内容。

六、公众意见表的网络链接

https://www.mee.gov.cn/xxgk2018/xxgk/xxgk01/201810/t20181024_665329.html

七、公众提出意见的方式和途径

公示期内，项目周边的居民群众、企事业单位可通过电子邮件的方式将公众意见表发至建设单位邮箱，或直接打印纸质版公众意见表邮寄至建设单位，或直接送至建设单位。

Figure E4 Screenshot of online disclosure of the EIA report for Shanmen River Restoration in Macun District (draft for comment)

2022年7月21日 星期四

A06 | 焦作财税

焦作日报 JIAOZUO DAILY

市财政局(国资委)开展"立足本职、真正负责"专项整治活动

财税资讯

市财政局调研县级预算绩效管理工作

市财政局全力服务乡镇管理体制机制改革

市财政局加强债券资金管理 助力全市经济发展

沁阳市加油站数据管理系统推广工作成效明显

温县完成电子非税收入一般缴款书改革试点工作

山阳区积极落实耕地地力保护补贴

中站区全面开展财政资金绩效评价

沁阳税务"云"送政策红利

焦作市马村区山门河治理工程环境影响报告书(征求意见稿)公示

Figure E5 Screenshot of the first newspaper disclosure of Shanmen River Restoration in Macun District

河南日报农村版

服务三农 第一媒体 HENAN DAILY COUNTRYSIDE SECTION

2022年7月29日 第4511期 今日4版 中共河南省委机关报 河南日报社出版

星期五 壬寅年七月初一 国内统一连续出版物号 CN41-0101 邮发代号 35-2 中原三农网 www.zysnw.cn

结对帮创志愿活动

问他们的健康情况，同时向大家发放了饮食指导等宣传资料，引导村民养成健康卫生的生活习惯。

作为此次志愿服务活动的重要内容，助力乡村振兴的爱心图书捐赠仪式在小师村农家书屋举行。经过前期宣传发动，漯河市统计局的干部职工踊跃参与，共捐赠各类图书120余本，涵盖医疗养生、经济金融、少儿科普、中华优秀传统文化等10余个种类，丰富了小师村农家书屋的图书种类和村民的阅读体验，满足了村民精神文化需求。（王红利）

省分行

虞城县睢县产业园区

县、睢县支行有关负责人及时跟进，加快办贷进度，争取早日实现信贷资金投放。

李小汇讲道，农发行河南省分行将紧紧围绕乡村振兴战略要求和商丘市"十四五"发展规划，深度结合商丘城乡重大项目建设和涉农实体经济发展，全面深化在各个领域的战略合作，为地方经济社会高质量发展筑牢强有力的金融支撑，共同谱写政银企合作共赢和谐发展的新篇章。（范纯 王晓飞）

县支行

支持光山二高新建项目

环境影响报告书（征求意见稿）公示

遗失声明

用心解决急难愁盼

走进回车镇陡沟村，65岁的退役军人谢小有新落成的二层小楼堂屋门

让青年才俊

郑州已发放高学历

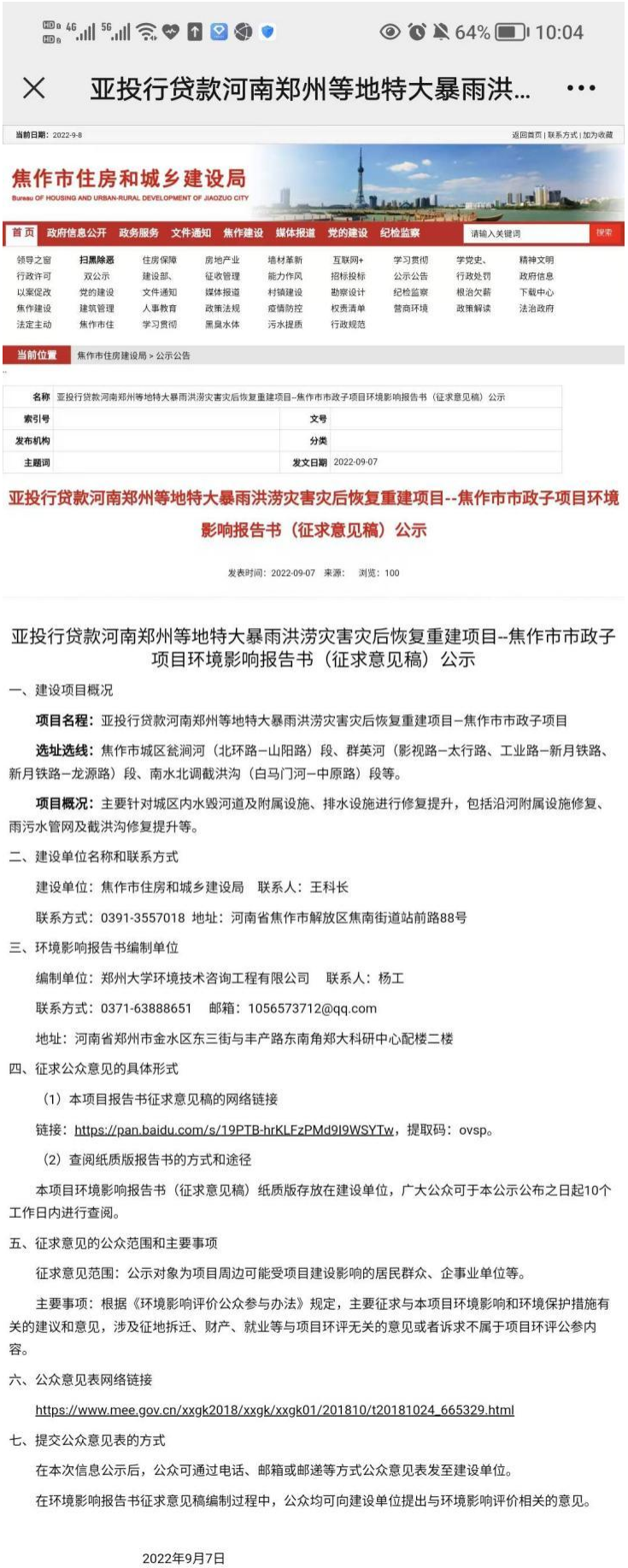
本报讯（记者杨青）引进培养高层次人才、大力吸引优秀毕业生、鼓励全国人才来郑州创新创业……7月25日，记者从郑州市人社局获悉，2018年以来，郑州已吸引121971名高学历人才落户，发放生活补贴共17.5亿元，人才政策产生的引才聚才效应不断凸显，人才汇聚的热潮正在形成。

"郑州以更加开放的胸怀吸引各类人才，除了降低落户门槛外，还对青年人才给予购房补贴、生活补贴。郑州市人社局探索建立具有郑州特色的智慧就业+政务联动+精准服务3D就业创业服务体系，集中资源优化各类服务，打造人才聚集高地，最大程度满足企业和求职者的各类需求。"郑州市人社局就业办王伟介绍说。

在青年创新创业方面，郑州市人社局制定《郑州市用人单位招用应届高校毕业生补贴实施细则》，出台了《郑州市稳就业若干措施》《关于公布就业创业相关业

青年人才生活补贴申

Figure E6 Screenshot of the second newspaper disclosure of Shanmen River Restoration in Macun District



64% 10:04

亚投行贷款河南郑州等地特大暴雨洪...

当前日期：2022-9-8　　返回首页 | 联系方式 | 加为收藏

焦作市住房和城乡建设局
Bureau OF HOUSING AND URBAN-RURAL DEVELOPMENT OF JIAOZUO CITY

首页　政府信息公开　政务服务　文件通知　焦作建设　媒体报道　党的建设　纪检监察　请输入关键词　搜索

领导之窗　扫黑除恶　住房保障　房地产业　墙材革新　互联网+　学习贯彻　学党史、　精神文明
行政许可　双公示　建设部、　征收管理　能力作风　招标投标　公示公告　行政处罚　政府信息
以案促改　党的建设　文件通知　媒体报道　村镇建设　勘察设计　纪检监察　根治欠薪　下载中心
焦作建设　建筑管理　人事教育　政策法规　疫情防控　权责清单　营商环境　政策解读　法治政府
法定主动　焦作市住　学习贯彻　黑臭水体　污水提质　行政规范

当前位置　焦作市住房建设局 > 公示公告

名称	亚投行贷款河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目--焦作市市政子项目环境影响报告书（征求意见稿）公示		
索引号		文号	
发布机构		分类	
主题词		发文日期	2022-09-07

亚投行贷款河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目--焦作市市政子项目环境影响报告书（征求意见稿）公示

发表时间：2022-09-07　来源：　浏览：100

亚投行贷款河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目--焦作市市政子项目环境影响报告书（征求意见稿）公示

一、建设项目概况

项目名程：亚投行贷款河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目--焦作市市政子项目

选址选线：焦作市城区瓮涧河（北环路—山阳路）段、群英河（影视路—太行路、工业路—新月铁路、新月铁路—龙源路）段、南水北调截洪沟（白马门河—中原路）段等。

项目概况：主要针对城区内水毁河道及附属设施、排水设施进行修复提升，包括沿河附属设施修复、雨污水管网及截洪沟修复提升等。

二、建设单位名称和联系方式

建设单位：焦作市住房和城乡建设局　联系人：王科长

联系方式：0391-3557018 地址：河南省焦作市解放区焦南街道站前路88号

三、环境影响报告书编制单位

编制单位：郑州大学环境技术咨询工程有限公司　联系人：杨工

联系方式：0371-63888651　邮箱：1056573712@qq.com

地址：河南省郑州市金水区东三街与丰产路东南角郑大科研中心配楼二楼

四、征求公众意见的具体形式

（1）本项目报告书征求意见稿的网络链接

链接：https://pan.baidu.com/s/19PTB-hrKLFzPMd9I9WSYTw，提取码：ovsp。

（2）查阅纸质版报告书的方式和途径

本项目环境影响报告书（征求意见稿）纸质版存放在建设单位，广大公众可于本公示公布之日起10个工作日内进行查阅。

五、征求意见的公众范围和主要事项

征求意见范围：公示对象为项目周边可能受项目建设影响的居民群众、企事业单位等。

主要事项：根据《环境影响评价公众参与办法》规定，主要征求与本项目环境影响和环境保护措施有关的建议和意见，涉及征地拆迁、财产、就业等与项目环评无关的意见或者诉求不属于项目环评公参内容。

六、公众意见表网络链接

https://www.mee.gov.cn/xxgk2018/xxgk/xxgk01/201810/t20181024_665329.html

七、提交公众意见表的方式

在本次信息公示后，公众可通过电话、邮箱或邮递等方式公众意见表发至建设单位。

在环境影响报告书征求意见稿编制过程中，公众均可向建设单位提出与环境影响评价相关的意见。

2022年9月7日

Figure E7 Screenshot of online disclosure of the EIA report for municipal components (draft for comment)

河南日报

服务三农 第一媒体 HENAN DAILY COUNTRYSI

2022年9月 7 日 第4539期 今日4版 中共河南省委机关报

星期三 壬寅年八月十二 国内统一连续出版物号 CN41-0101 邮发代号 35-2 中原三农网

喜迎二十大

清梗阻 正秩序 增

辉县市"三清三增"赋能乡村振

编辑:秦东凯 组版:李英 校对:黎川红

遗失声明

焦作市市政子项目环境影响报告书（征求意见稿）公示

遗失声明

□本报记者 马丙宇 刘亚鑫
通讯员 穆学花 吕西雯

乡村振兴，谁来干？地咋用？钱哪来？

"长期以来，人才、土地、资金等单向由农村流入城市，造成农村严重'失血''贫血'。"辉县市委书记刘军伟坦言，通过深化农村改革，让"人地钱"要素在共赢乡村集聚进发，推进乡村振兴。

习近平总书记指出，"全面推进乡村振兴，必须用好改革这一法宝"。今年5月份开始，辉县市强力推进"清资产、清矛盾、清'村霸'，增强基层组织建设、增强乡村治理能力、增加村集体经济收入"的"三清三增"专项行动，从农村集体资产制度改革入手，开展清产核资"回头看"，做好乡村振兴"基础题"。

"回头看"更是"向前进"，走访辉县各地，田野之间满是新气象。

筑牢堡垒"治弱"——
支部焕活力 干部冲一线

暑去凉来，秋天初始，辉县市常村镇沿东村，水泥路平坦宽阔，游园凉亭下，人休闲，孩童嬉戏。

如今这支"田园曲"，沿东村奏得并不易：一年前村"两委"组织动员力弱、带富能力不强。

沿东村被41户商户侵占的667亩荒地，是村子发展的"梗阻"。"一直在破解，但不得方法。"去年刚当选的村党支

"和以前真不一样了。"村民郭玉海这样评价村干部。

和沿东村一样，辉县市许多村庄深度清理了一批有失公允的经济合同，核销了一批债权债务，盘活了一批闲置资产；全市共收回集体资产59笔134.91万元；收回集体资金93笔166.81万元；收回拖欠租金622笔655.12万元；收回集体土地834亩2747.3亩……

"一锅粥"变成了"一本账"，陈旧的糊涂事如今明明白白。

"顺应了民意，赢得了民心。"辉县市农业农村局局长杨玉明说，"三清三增"专项行动是"来真格的"，绝不是"雨过地皮湿"，这让基层党组织的威信更高。

在孟庄镇，"揭榜挂帅"四个字近期很火。"英雄不论出处，谁有本事谁就揭榜，为民办实事，这是全镇党支部、党员的较量。去年还是'软弱涣散'的南田庄村，由村党支部书记郭绍君'挂帅'，揭榜了'三清三增'这项'榜单'，收回拖欠租金50多万元。

"三清三增"实现了与基层党建的同频共振。今年，辉县全市521个行政村全部参与"五星"支部创建，基层党组织活力被充分激发，农村党员先锋模范作用有效发挥。

乡村善治"治乱"——
民生优先 风清气正

"家底"算清了，组织又强，人心自然齐。

"不满的还有20世纪80年代的事！"

Figure E8 Screenshot of the first newspaper disclosure of the EIA report for municipal components (draft for comment)

焦作市市政子项目环境影响报告书(征求意见稿)公示

一、建设项目概况

项目名称：亚投行贷款河南郑州等地特大暴雨洪涝灾害灾后恢复重建项目-焦作市市政子项目

选址选线：焦作市城区瓮涧河(北环路—山阳路)段、群英河(影视路—太行路、工业路—新月铁路、新月铁路—龙源路)段、南水北调截洪沟(白马门河—中原路)段等。

项目概况：主要针对城区内水毁河道及附属设施、排水设施进行修复提升，包括沿河附属设施修复、雨污水管网及截洪沟修复提升等。

二、建设单位和报告编制单位联系方式

建设单位：焦作市住房和城乡建设局 联系人：王科长

联系方式：0391-3567292 地址：河南省焦作市解放区焦南街道站前路88号

编制单位：郑州大学环境技术咨询工程有限公司联系人：杨工

联系方式：0371-63888651-8110 邮箱：1056573712@qq.com

地址：河南省郑州市金水区东三街与丰产路东南角郑大科研中心

三、征求公众意见的具体形式

项目环评征求意见稿网络链接：https://pan.baidu.com/s/19PTB-brKLFzPMd9l9WSYTw，提取码：ovsp。

项目环评(征求意见稿)纸质版存放在建设单位，广大公众可于本公示公布之日起10个工作日内进行查阅。

四、征求意见范围：项目周边可能受项目建设影响的居民群众、企事业单位等。

五、公众意见表网络链接

https://www.mee.gov.cn/xxgk2018/xxgk/xxgk01/201810/t20181024_665329.html

六、提交公众意见表的方式

在本次信息公示后，公众可通过电话、邮箱或邮递等方式公众意见表发至建设单位。在环境影响报告书征求意见稿编制过程中，公众均可向建设单位提出与环境影响评价相关的意见。

河南日報 农村版

服务三农 第一媒体 HENAN DAILY COUNTRYSIDE SECTION

2022年9月14日 第4543期 今日4版 中共河南省委机关报 河南日报社出版

星期三 壬寅年八月十九 国内统一连续出版物号 CN41-0101 邮发代号 35-2 中原三农网 www.zysnw.cn

Figure E9 Screenshot of the second newspaper disclosure of the EIA report for municipal components (draft for comment)

Appendix F On-site Disclosure

Xiaozhang River (Shanyang District)

Park Avenue 1 Community (Jiefang District)

Yanhe Village (Jiefang District)

Tianjian Village (Jiefang District)

Xintazhang Village (Zhongzhan District)

Hekou Village (High-tech Zone)

Xiaoshang Village (High-tech Zone)

Tiejiang Village (High-tech Zone)

Xichangwei Village (High-tech Zone)

Guansiqiao Village (Xiuwu County)

Datitun Village (Xiuwu County)

Wulipu Village (Xiuwu County)

Zhanggongpu Village (Xiuwu County)

Liyuan Community (Macun District)

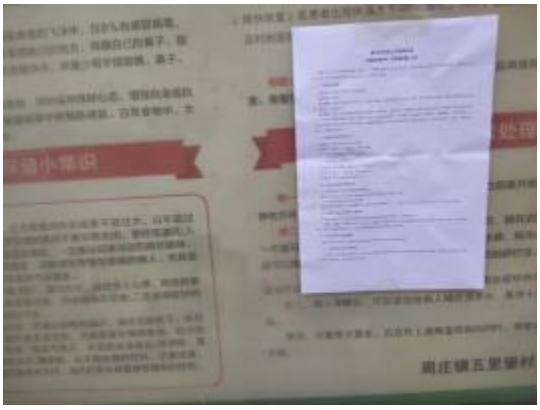
Baizhuang Village (Macun District)

Affiliated kindergarten of Macun District Experimental

School

Baizhuang Village (Macun District)

Daiwang Village (Macun District)



Wulipu Village

Zhengyun Yuecheng Community

Figure F1 On-site Disclosure

Appendix G Minutes of Pubilc Participation FGD on EIA

Date	August 2022
Venue	Qiangnan, Mahe, Wulipu, Liegangying, Licun, Gengzuo, Qintun, Zhangnan and Tiejiang Village Committees, Macun Sub-district Office
Organizer	Jiaozuo PMO, JMURCB, JMWRB, MDARAB, XCWRB, taskforce
Participants	Sub-district head, village heads, village officials, residents
Topic	FGD on EIA public participation
Key points and results	1. Qiangnan Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. 2. Mahe Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. The river cross-section should be hardened on both sides when the sewer network was being restored for the Xiaozhang River. 3. Wulipu Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. 4. Liegangying Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. 5. Licun Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken.

	6. Gengzuo Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. 7. Qintun Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. 8. Zhangnan Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. The existing check sluice on the Dasha River should be preserved when the Dasha River bridge was constructed for convenient irrigation water supply. 9. Tiejiang Village 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken. 10. Macun Sub-district (Liyuan Community, Baizhuang Village, Daiwang Village, affiliated kindergarten of Macun District Experimental School) 1) The taskforce introduced potential noise, dust, sanitation, traffic and personal safety impacts of construction, and the GRM to residents. 2) The taskforce notified residents of the environmental protection measures to be taken during construction. 3) The taskforce collected suggestions on the environmental protection measures and scope of construction from residents. 4) FGD results: Dust and environmental pollution would affect residents greatly, and all residents supported the Subproject provided that appropriate environmental protection measures were taken.

Figure G1 Location map of spoil grounds, sludge drying yards and construction camps of river management components

Figure G2 Location and status of upstream spoil ground (1)

Figure G3 Location and status of spoil ground north of Majie Village (2)

Figure G4 Location and status of spoil ground north of Majie Village (3)

Figure G5 Location of Houyugou spoil ground in the North Mountain (4)

Figure G6 Location and status of spoil ground on Renmin Road (5)

Figure G7 Location and status of spoil ground and sludge drying yard in Wacun Village (6)

Figure G8 Location and status of spoil ground in Xinzhuang Village (7)

Figure G9 Location and status of spoil ground and sludge drying yard in Beiqiao (8)

Figure G10 Location and status of spoil ground in Changqiao (9)

Satellite photo of construction camp 1

Satellite photo of construction camp 2

Satellite photo of construction camp 3

Satellite photo of construction camp 4

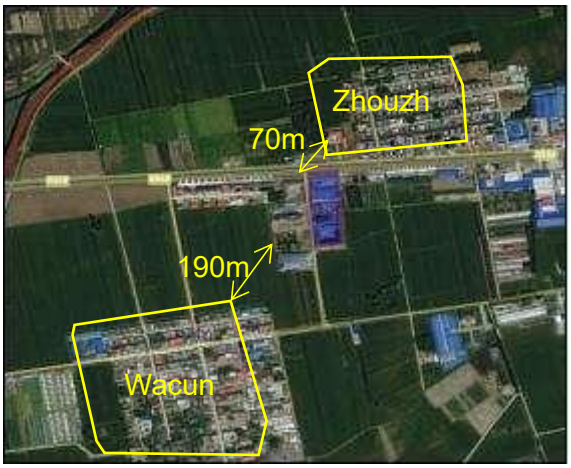
Satellite photo of construction camp 5

Figure G11 Distribution of construction camps of JZTJ101

Satellite photo of construction camp 6

Satellite photo of construction camp 7

Figure G12 Construction camp of JZTJ103



Satellite photo of construction camp 8

Satellite photo of construction camp 9

Satellite photo of construction camp 10

Figure G13 Construction camp of JZTJ102

Satellite photo of construction camp 11

Satellite photo of construction camp 12

Satellite photo of construction camp 13

Figure G14 Construction camp of JZTJ104

Figure G15 Location map of JZTJ105 and construction camp (1)

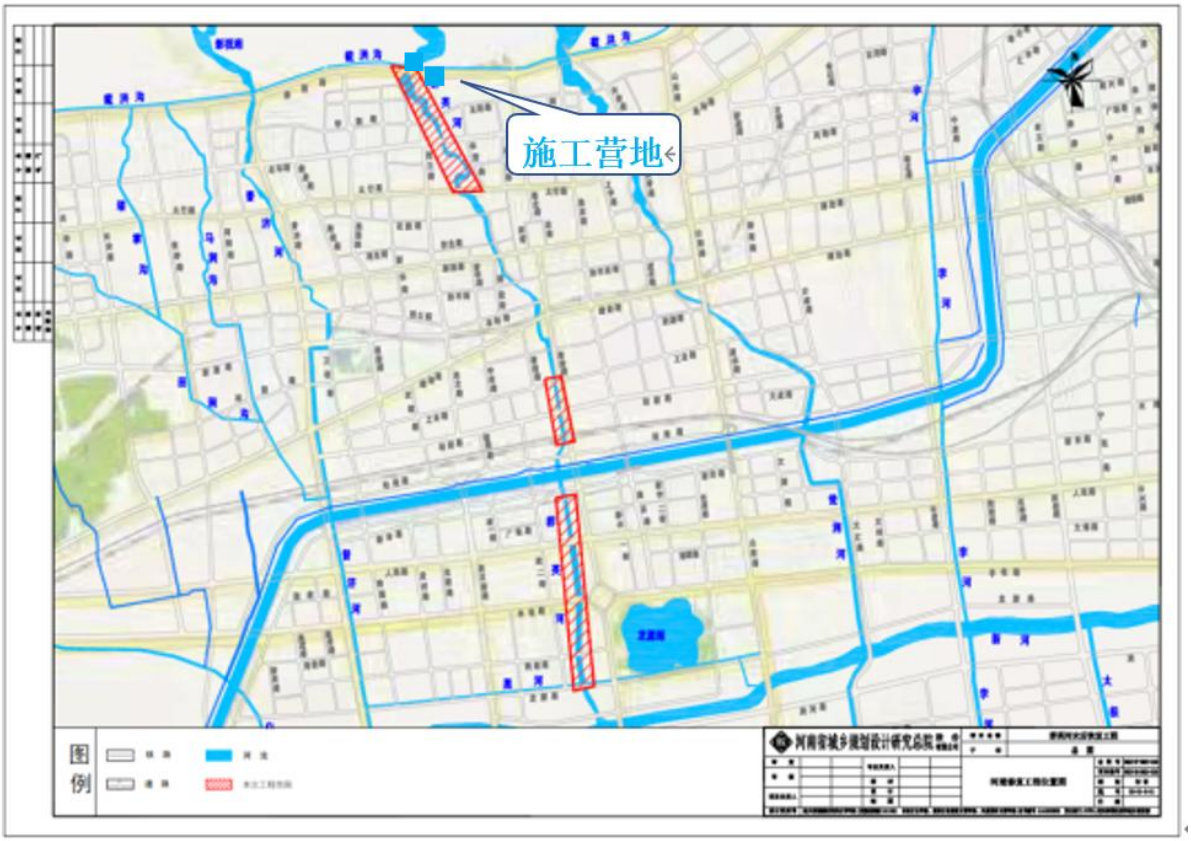


Figure G16 Location map of JZTJ106 and construction camp (2)

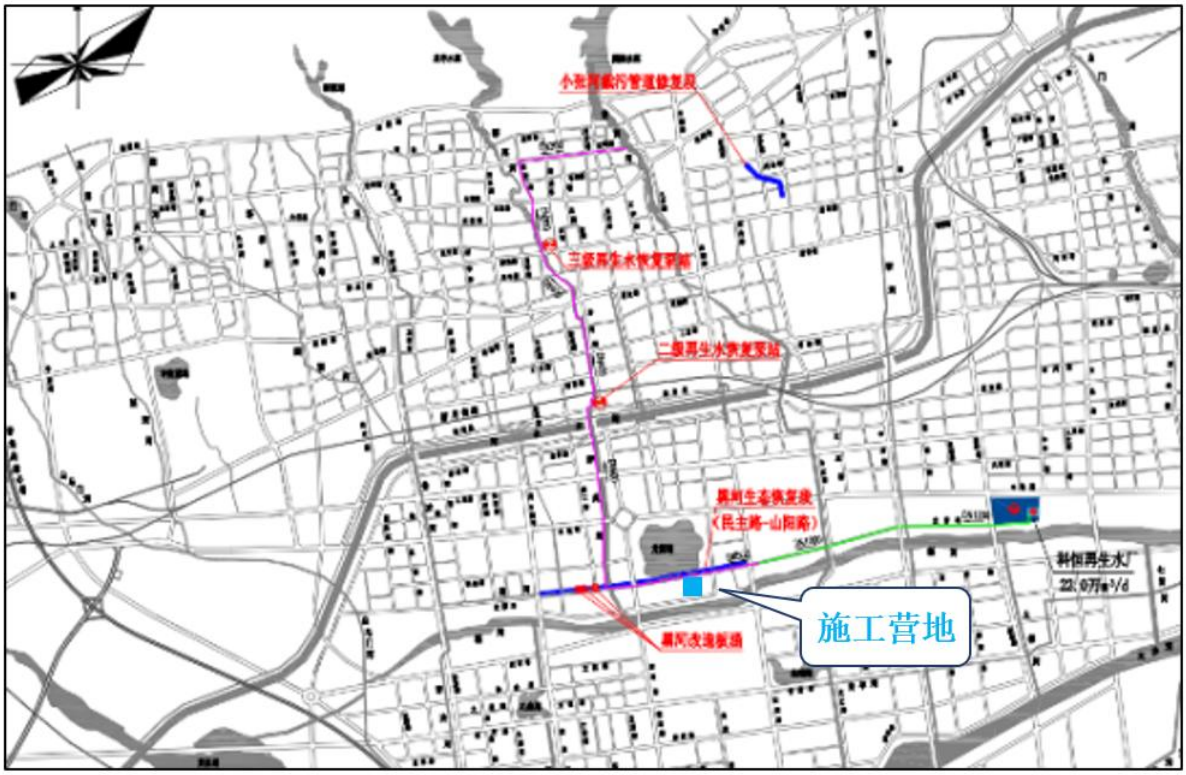


Figure G17 Location map of JZTJ107 and construction camp (3)

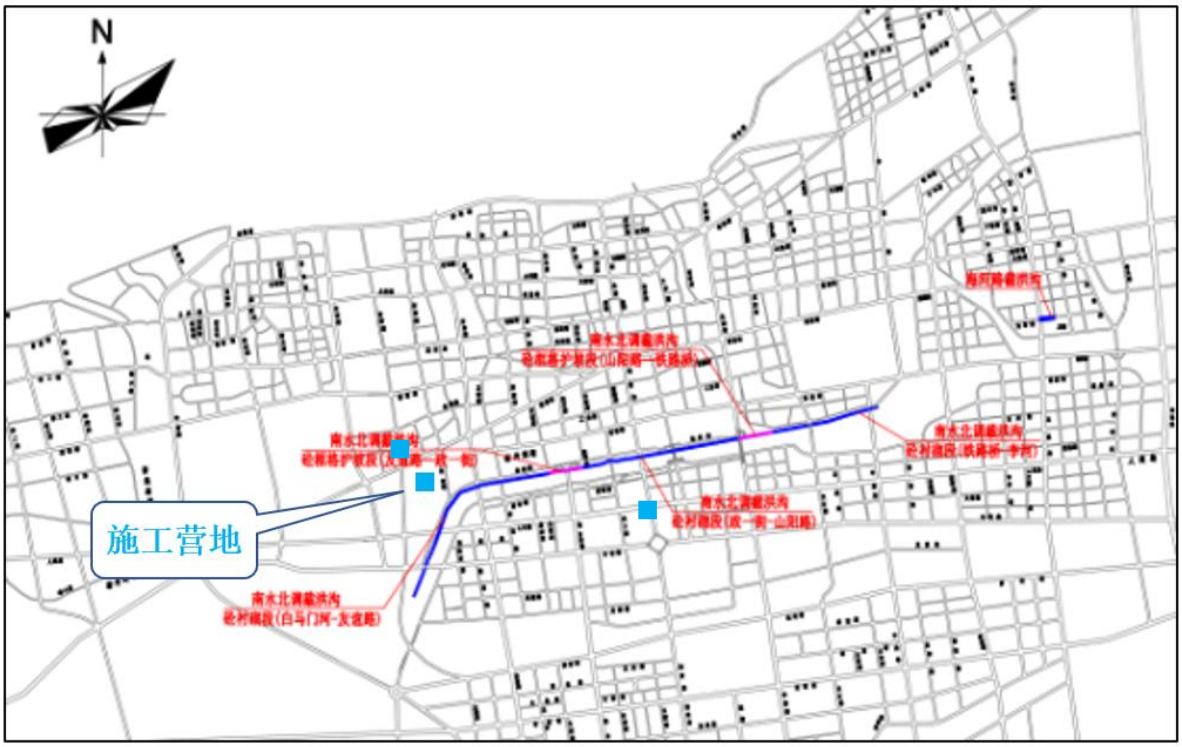


Figure G18 Location map of JZTJ110 and construction camp (4)

Figure G19 Location map of JZTJ111 and construction camp (5)

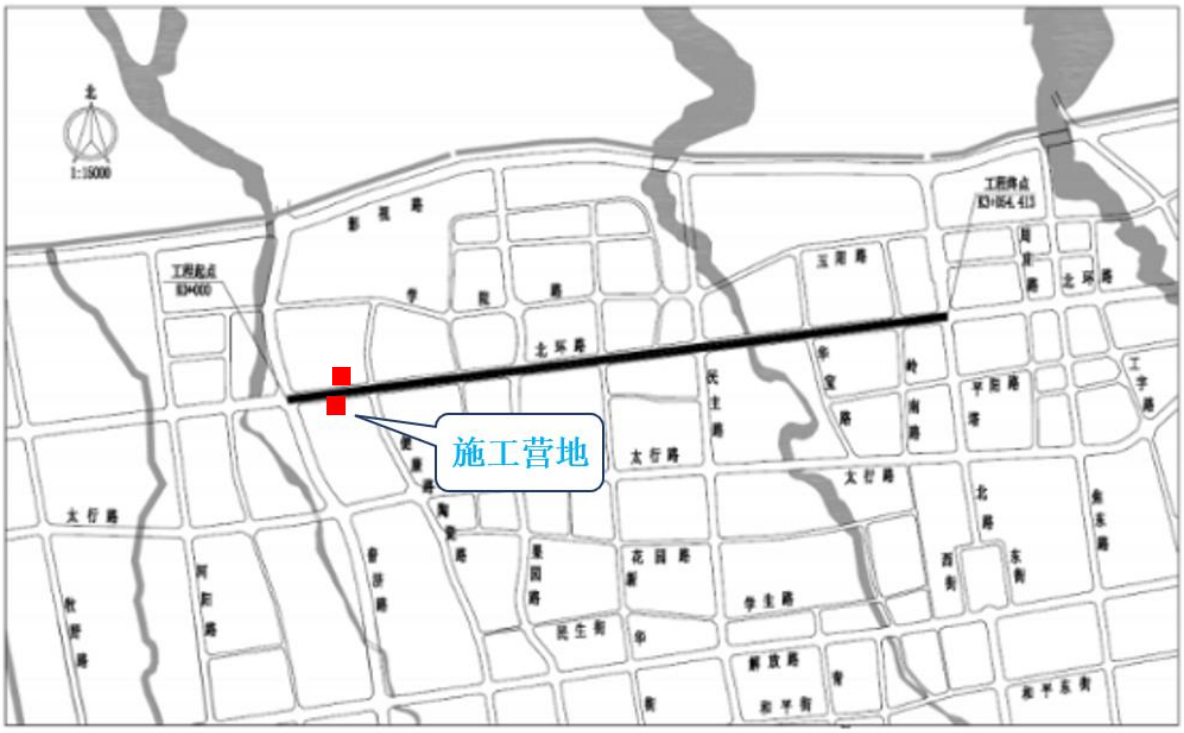


Figure G20 Location map of JZTJ112 and construction camp (6)

Figure G21 Location map of JZTJ113 and construction camp (7)

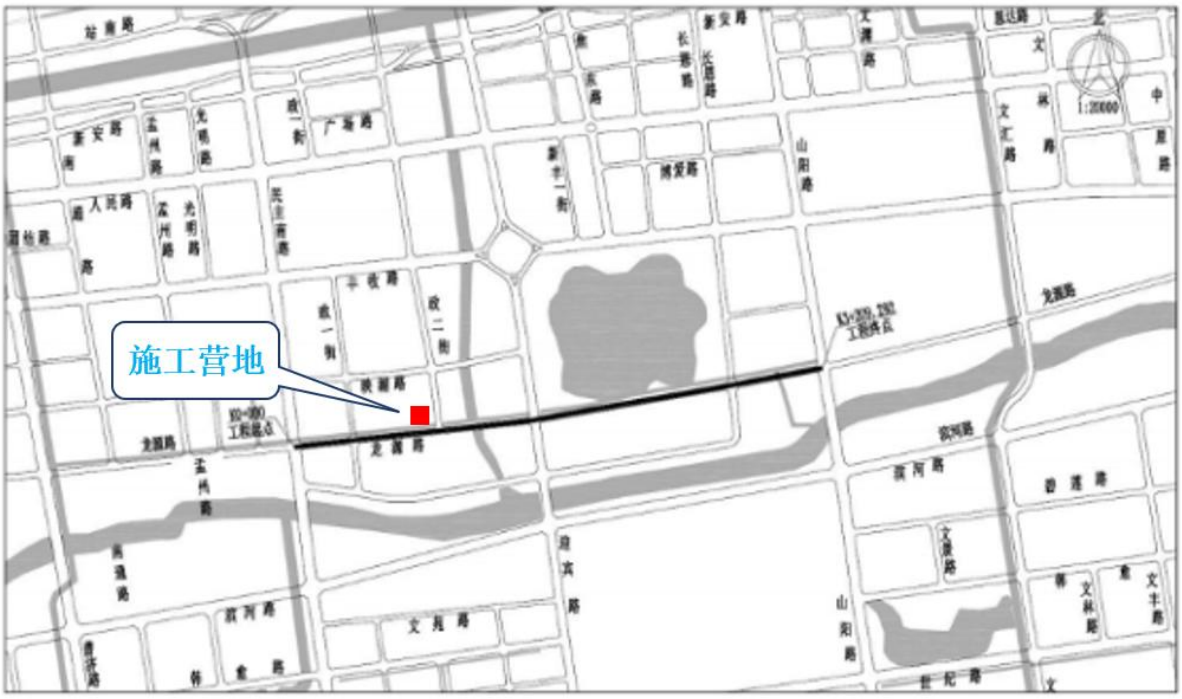


Figure G22 Location map of JZTJ114 and construction camp (8)

Figure G23 Location map of JZTJ115 and construction camp (9)

Figure G24 Location map of JZTJ116 and construction camp (10)

Figure G25 Location map of JZTJ117 and construction camp (11)

Figure G26 Location map of JZTJ118 and construction camp (12)

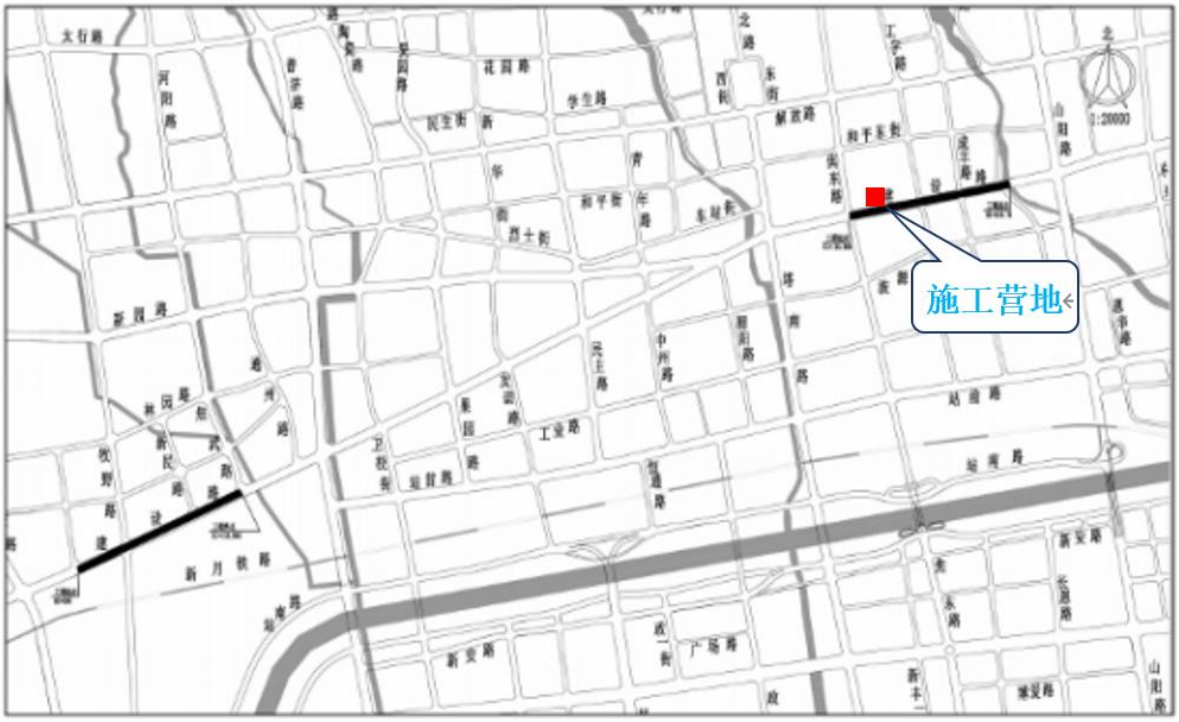


Figure G27 Location map of JZTJ119 and construction camp (13)

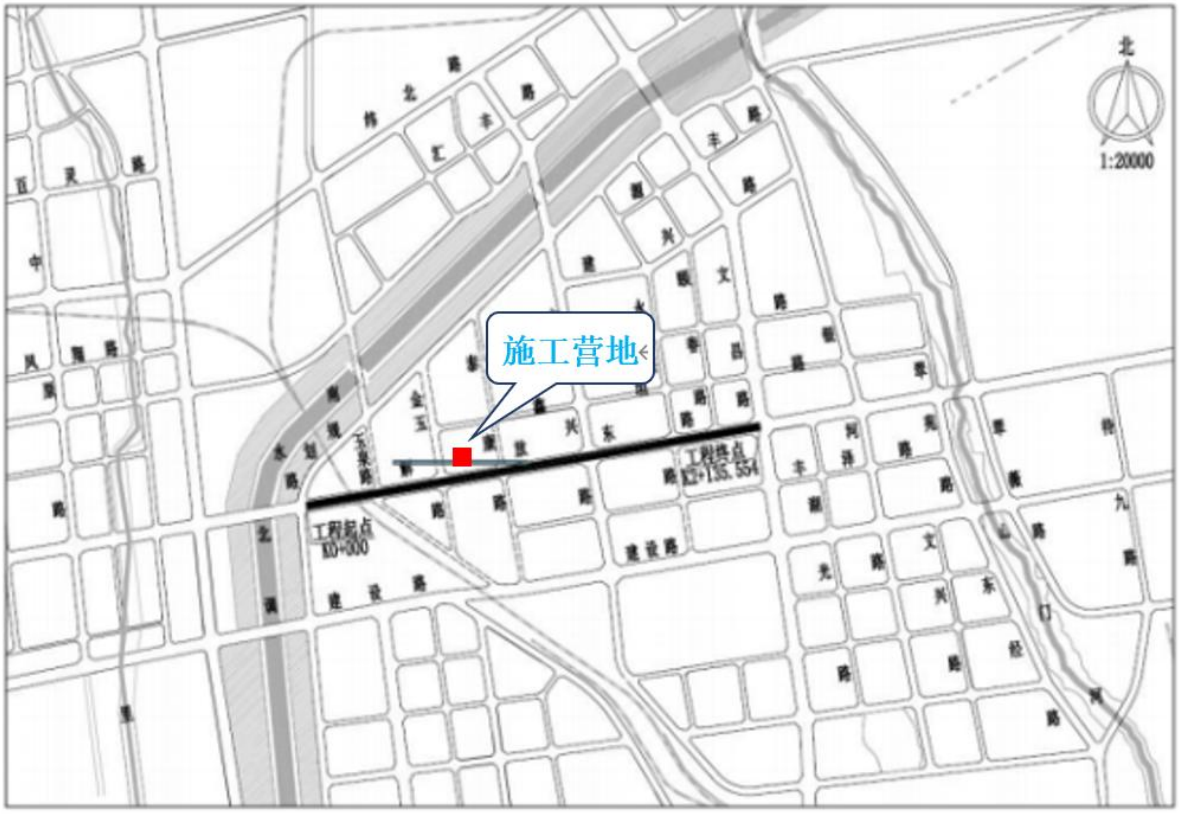


Figure G28 Location map of JZTJ120 and construction camp (14)

Figure G29 Location map of JZTJ121 and construction camp (15)

Construction camp of JZTJ112North Ring Road (Puji Road-Tabei Road) Restoration

Construction camp of JZTJ113-Shanyang Road (Taihang Road-Jianshe Road) Restoration

Construction camp of JZTJ114-Longyuan Road (Minzhu Road-Shanyang Road) Restoration

Construction camp of JZTJ115-Fengshou Road Restoration

Construction camp of JZTJ116-Minzhu Road Restoration

Construction camp of JZTJ117-Industry Road Restoration

Construction camp of JZTJ118-Jiaowu Road Restoration

Construction camp of JZTJ119-Jianshe Road Restoration

Construction camp of JZTJ120-Jiefang East Road Restoration

Construction camp of JZTJ111-Flood Control Upgrading of Urban Rivers and Bridges

Construction camp of JZTJ105-Wengjian River Restoration

Construction camp of JZTJ106-Qunying River Restoration

Construction camp of JZTJ107-Urban River Facility Restoration

Construction camp of JZTJ121-Tianjian Ditch (Yingshi Road-Puji River) Management

Temporary stockyard of JZTJ121-Tianjian Ditch (Yingshi Road-Puji River) Management

Figure G30 Satellite photo of construction camps of municipal components

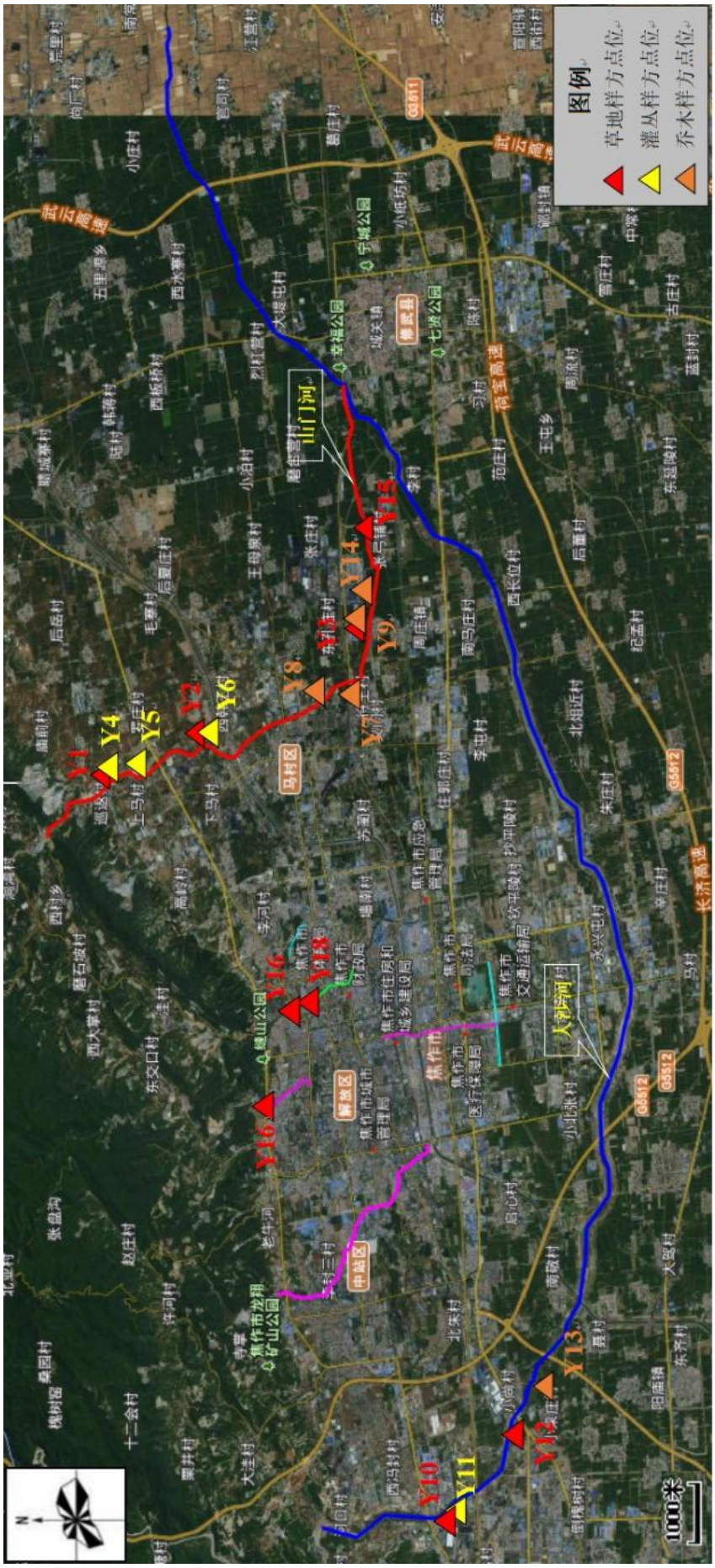


Figure G31 Location map of vegetation quadrats

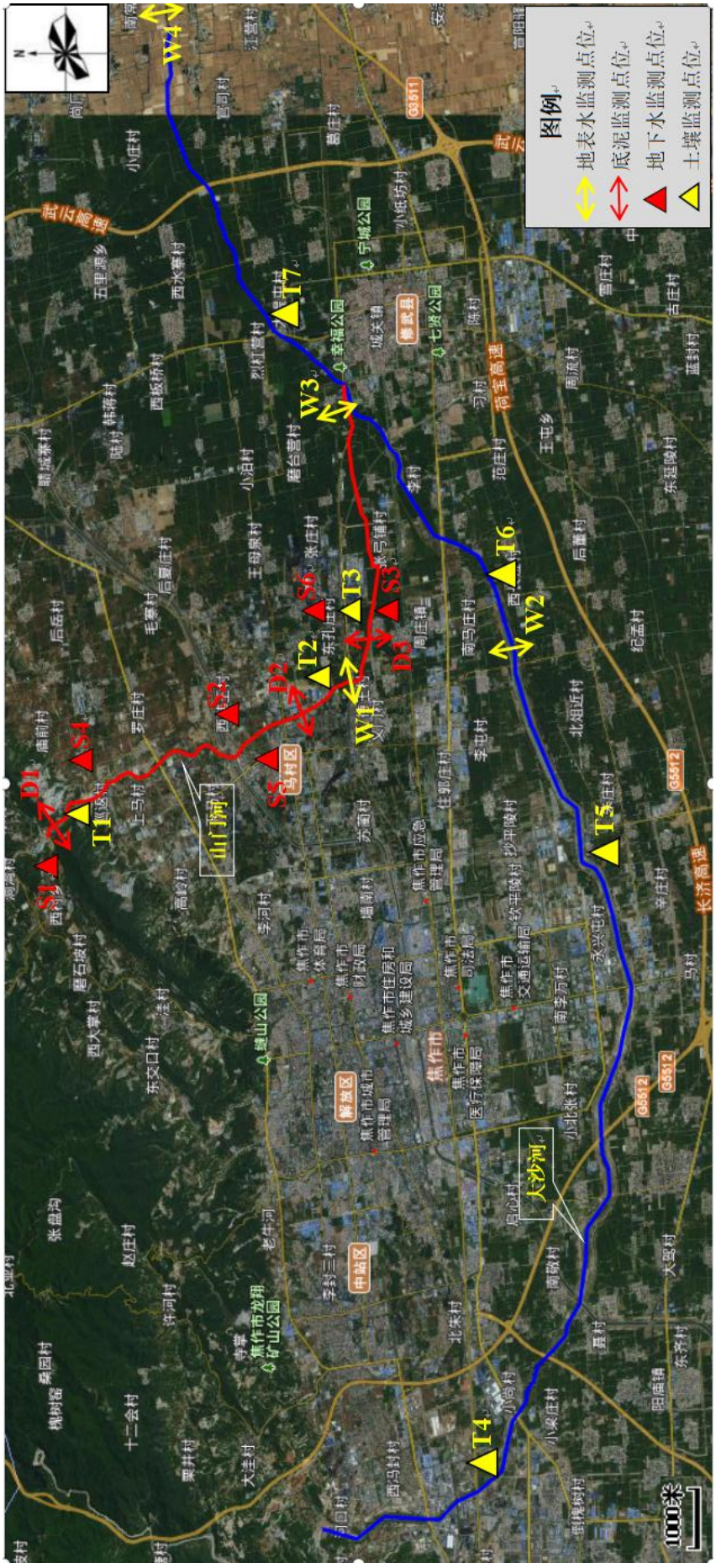


Figure G32 Distribution of monitoring sites of the Dasha and Shanmen Rivers

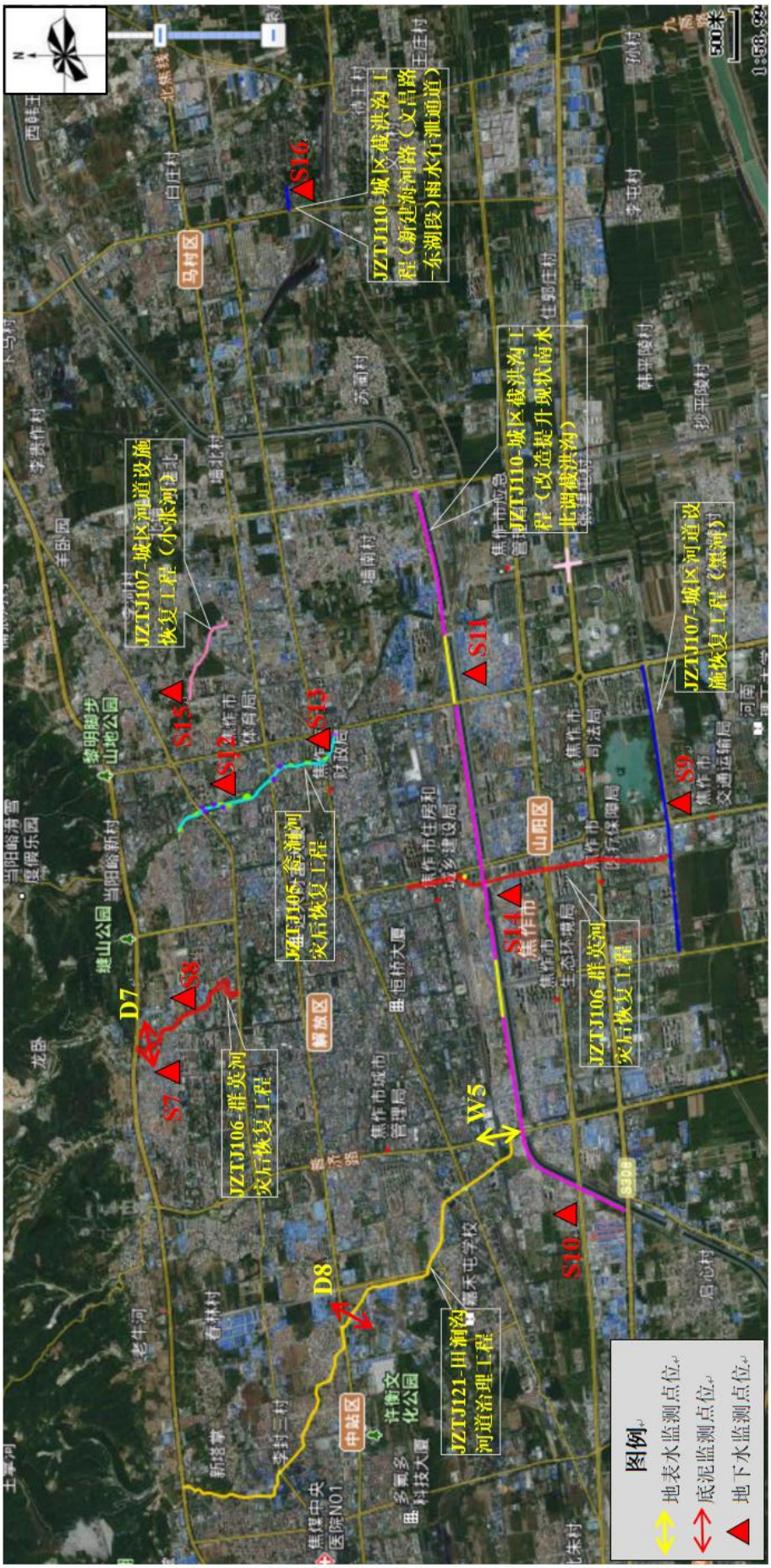


Figure G33 Distribution of monitoring sites of urban rivers and flood control works

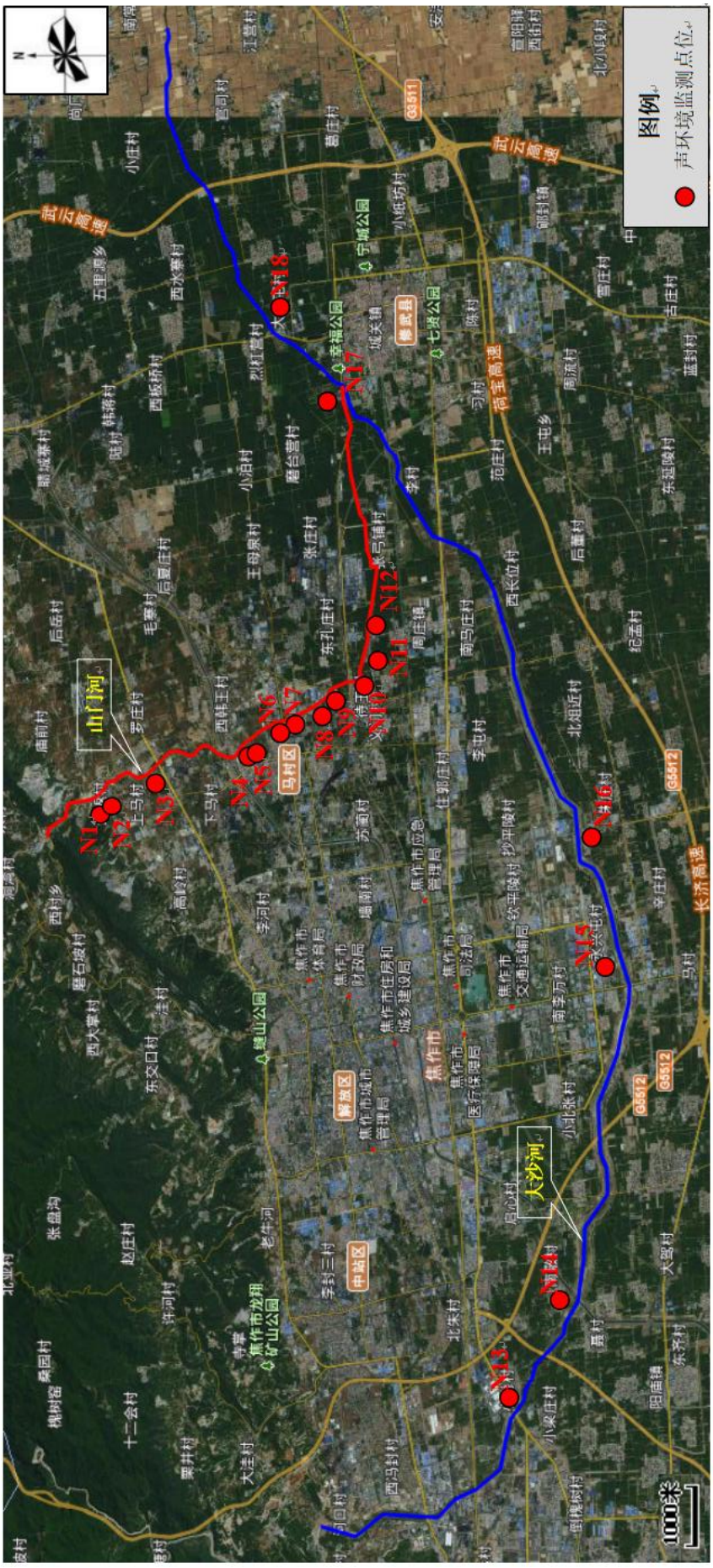


Figure G34 Distribution of acoustic environment monitoring sites of the Dasha and Shanmen Rivers

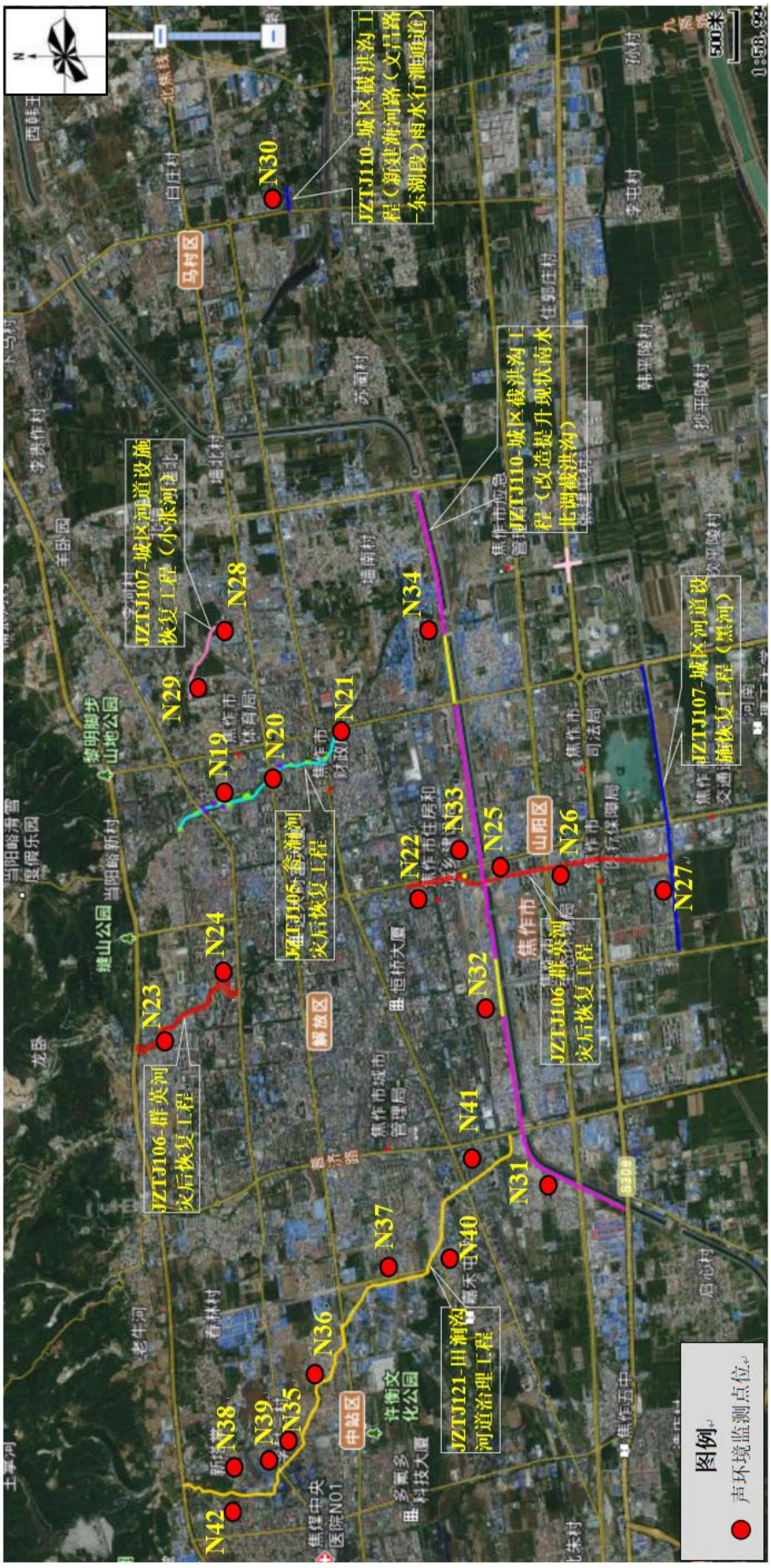


Figure G35 Distribution of acoustic environment monitoring sites of urban rivers and flood control works