ASIAN INFRASTRUCTURE INVESTMENT BANK

People's Republic of China
Henan Flood Emergency Rehabilitation and Recovery Project Zhengzhou Component

Integrated Jinshui River Management Sub-Project Supplementary (Downstream Qili River Flood Control Improvement and Management Project)

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

Prepared by Zhengzhou Water Resources Bureau

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ABBREVIATIONS

AIIB	Asian Infrastructure Investment Bank
AHs	Affected Households
APs	Affected Persons
CNY	Chinese Yuan
DI	Design institute
EM	Ethnic Minority
EMDP	Ethnic Minority Develop Plan
EMP	Environmental Management Plan
ES	Environmental and Social
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMPF	Environmental and Social Management Planning Framework
ESP	Environmental and Social Policy
ESS	Environmental and Social Standard
FSR	Feasibility Study Report
GBV	Gender-based Violence
GDP	Gross domestic product
GRM	Grievance Redress Mechanism
HFERRP	Henan Flood Emergency Rehabilitation and Recovery Project
HH	Household
IJRMSP	Integrated Jinshui River Management Sub-project
LA	Land Acquisition
LAR	Land Acquisition and Resettlement
M&E	Monitoring and Evaluation
MLS	Minimum Living Security
PAP	Project Affected People
PCDI	Per Capita Disposable Income
PCCE	Per Capita Consumption Expenditure
PMO	Project Management Office
PPM	Project-affected People's Mechanism
PRC	the People's Republic of China
RP	Resettlement Plan
SMP	Social Management Plan
ZEDZ	Zhengzhou Economic Development Zone

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EXECUTIVE SUMMARY

1. Introduction

This Report is the Environmental and Social Impact Assessment and Management Plan of the Asian Infrastructure Investment Bank (AIIB) loan supplement to Integrated Jinshui River Management Sub-project (Downstream Qili River Flood Control Improvement and Management Project). The main construction content includes river regulation works and ecological restoration projects.

Among them, the river regulation works includes:

(1)River dredging: The dredging length of the expanded channel in the section from Shangdu Road Xiangjiao Dam (stake No. 14+150) to Wansan Road (stake No. 20+950) is 6.35km (excluding railway sections involved, the same below), maintaining the current river axis unchanged.

(2)Slope protection: Ecological protection is provided for the main channel slope below the normal water level, with a total length of 12.8km for slope protection on both sides.

(3)Embankment filling: The total length of embankments arranged within the project scope is 13.6km (on both sides), with a railway section length of 0.95km (specifically implemented by the railway). The new embankments constructed in this project are 12.65km (on both sides) in length, with a level 1 embankment and a width of 10m at the top. The new flood control road is 12.65km in length, and the urban branch road is 7m in width.

(4)Supporting buildings: A total of 9 water gates, inverted siphons, bridges, and water retaining structures will be arranged within the scope of the project.

(5)The ecological restoration project: mainly includes the construction of ecological green corridor within the scope of the project, including earthwork balance within the blue-green line, terrain consolidation, green planting engineering, paving engineering, supporting facilities, and cultural display facilities. Except for water area and engineering land, the total area of green corridor construction within the blue-green line is approximately 1.329 million m^2.

According to the ESF of the AIIB, the identified associated facilities at this stage include a special section involving the Longhai Railway.

2. Methodology

According to the Environmental and Social Policy(ESP) requirements of the AIIB, the Environmental and Social Management Planning Framework (ESMPF) of the HFERRP, and the ES risk screening opinions of the supplement of Integrated Jinshui River Management Sub-project(Downstream Qili River Flood Control Improvement and Management Project)(Hereinafter referred to as "the Project"), the Project is an ES class A project, and it is required to prepare an Environmental and Social Impact Assessment Report, including an ESMP. The ESIA of the Project is carried out based on the following methods:

1. Literature and design documents review to identify key environmental and social impacts.

2. From March to April 2023, the field survey carried out by the ESIA preparation unit composed of the domestic environmental assessment unit (Henan Keren Technology Co., Ltd.) and Sichuan Fontal Strategic Consulting Co., Ltd., which surveyed the proposed construction site involved in the Project construction, in order to more objectively understand the site selection, land, sensitive points, impact factors, residents composition and needs of each project area, And the socioeconomic living conditions of the PAP in the area.

3. In March 2023, field survey was carried out at project sites within the scope of project implementation:

- Institutional interviews and data collection. The ESIA preparation unit conducted institutional interviews and discussions with various institutions and departments involved in the project area, including the Municipal Water Resources Bureau, Zhengzhou Housing Acquisition Affairs Center, Housing and Urban Rural Development Bureau, Natural Resources and Planning Bureau, Ecological Environment Bureau, Emergency Bureau, Statistics Bureau, Human Resources and Social Security Bureau, Rural Revitalization Bureau, People's Committee, Women's Federation, Transportation Management Bureau, and collected basic data and literature materials closely related to the project.

- Focus group discussions. In order to gain a more comprehensive understanding of the needs and suggestions of the PAP(including women, poverty, vulnerable groups, residents along the line, village committee leaders, etc.), the ESIA preparation unit conducted 5 resident focus group discussions in the towns and sub-districts of the project area, with a total of 96 participants. Among them, 39 are women, accounting for 40.6%; 13 vulnerable groups, accounting for 13.5%; 44 other villager representatives and village cadres, accounting for 45.8%.

- Interview with key informants. The ESIA preparation unit conducted interviews with key informants at the project area, town/sub-district, and village levels. The interviewees included the owner unit, DI, the district/county governments, water resources bureaus, natural resources and planning bureaus, transportation bureaus, women's federations, rural revitalization bureaus, sub-district offices/town governments, and relevant leaders or staff of institutions, as well as village committees and resident representatives involved in the Project. This survey interviewed a total of 29 key informants, including 4 people from project owners and DI, and 11 people in Zhengdongxin District; 10 people in Zhengzhou Economic and Technological Development Zone(ZETDZ); 4 people from Zhongmou County. In addition, the ESIA preparation unit conducted a separate interview with one representative from the Land Management Department of Zhengzhou Branch of Zhengzhou Railway Bureau Group Co., Ltd. The organization will participate in on-site investigation, compensation for railway land, application and approval of railway land, and other related work of railway land for special railway sections. Currently, the representative of the organization has no opinions on the implementation of this project. The railway section of the project will be independently implemented by Zhengzhou Railway Bureau of Zhengzhou Railway Bureau Group Co., Ltd, There are no directly affected individuals, and will not

increase the social risk of this project.

- Questionnaire investigation. A total of 270 environmental and social impact survey questionnaires were completed using random sampling, of which 261 were valid, with a response rate of 96.7%.

3. Major Environmental Impacts and Mitigation Measures

(1)Atmospheric environmental impacts

a.Construction period

The waste gas generated during the construction period mainly includes construction dust generated from excavation and backfilling of earth and rock, open-air stacking of materials, vehicle and construction machinery exhaust gas, wood processing waste gas in processing plants, welding smoke and so on. In this project, vehicle washing platform is set at the exit entrance of the construction site; Bulk material transport vehicles to cover closed, according to the prescribed route, driving time; Construction area with sprinkler; The construction site is set up construction enclosure, stacking is easy to produce dust pollution temporary storage yard using mesh cover and sprinkling water dust suppression; Strengthen pollution prevention and control measures for construction vehicles and non-road mobile machinery, use qualified fuel, and regularly monitor the exhaust gas emitted by transport vehicles.

This project uses commercial asphalt, which will produce a certain amount of asphalt flue gas in the process of asphalt paving. The project of the road on the gate is small, and the construction duration is short, the pollution sources are located on both sides of the river, with good atmospheric diffusion conditions, easy to be diluted diffusion, after natural diffusion and dilution, the impact on the surrounding environment is small. After the construction diversion, the river will be dried for several days and mechanical excavation will be carried out using a dry operation method, after the sludge is dried to a moisture content of less than 60%, it will be stored in the soil storage area for greening the landscape. Reasonably arrange the construction time, arrange the dredging work in the autumn and winter seasons, reduce the intensity of odor gas emissions, and ensure that the impact of construction odor on the surrounding environment is within an acceptable range. Strengthen the operation management and maintenance of equipment, reduce the smoke pollution caused by the poor running condition of welding equipment.

The project area is open and the air diffusion condition is good. After taking the corresponding control measures, the exhaust gas during the construction period will have less impact on the ambient air quality.

b. Operation period

There is no waste gas pollution source during the operation period.

(2)Surface water environmental impact

a. Construction period

The wastewater generated by the construction of this project mainly includes the stagnant area construction machinery and vehicle flushing wastewater, the construction site import and export vehicle flushing wastewater, mud wastewater, pit drainage. SS is the main pollutant of foundation pit water. After the foundation pit drainage is settled in the foundation pit for more than 2 hours, it is discharged to the downstream river; Stagnation area mechanical vehicle washing wastewater after oil separation precipitation treatment, back for mechanical vehicle washing, watering and dust suppression, not discharged; Construction site at the entrance and exit of the vehicle mechanical washing wastewater, after the precipitation tank precipitation treatment back to the car wash, not discharged. Mud wastewater in the mud pond flocculation precipitation can be used as the site dust sprinkling water, not discharged; During the construction period, the construction camp shall set up environment-friendly toilets, which shall be equipped with temporary septic tanks and shall be cleared regularly. During the construction period, the project wastewater has little impact on the surface water environment.

The influence of the construction diversion on the hydrological situation is generally manifested as the change of the flow direction and river flow, the construction period of the project is mainly arranged in the non-flood season, cofferdam construction, not cut off the river, will not affect the flow process of the downstream reach, the downstream hydrological situation is less.

The construction and removal of cofferdam around the site will be local disturbance of the bottom of the river, so it will make the local water sediment and other suspended substances increase, underwater structures around the range of about 100m suspended substances in the water will have a more significant increase, with the increase of the distance, this influence will gradually reduce, from the construction point 200~300m outside, The influence of suspended sediment is basically very small, and with the end of the construction, this influence will soon disappear.

According to the above analysis, the impact of the construction period on the surface water environmental quality and hydrological regime is small.

b. Operation period

There are 8 supporting service stations in this project. As there is currently no supporting municipal sewage pipe network in the project area, the domestic sewage generated by the supporting stations is discharged into outdoor septic tanks for treatment, regularly cleaned, and connected after the subsequent sewage pipe network facilities are improved. Finally, it will be treated in the sewage treatment plant in Zhengdongxin District and discharged after reaching the standard.

(3)Environmental impact of solid waste

a. Construction period

The solid waste generated during the construction period mainly includes the construction personnel's household waste, construction waste, abandoned soil and sedimentation tank mud. Construction personnel's household waste shall be uniformly

collected and treated by the sanitation department.

The total excavation of the project is 2,242,500 m^3, the total fill 1,084,900 m^3, the abandoned soil is 1,157,500 m^3, including dredging amount about 40,000 m^3, and the dredged sludge will be turned over and sun dried in the soil storage area, after the water content is less than 60%, it will be stored in the soil storage area and used together with other abandoned soil for micro-terrain creation and ecological greening.

During the construction process of the Yangqiao Canal Bridge, Qiancheng Avenue Bridge, Fengqi Road Bridge, and Shangdu Road Bridge in this project, the use of bored cast-in-place tpiles will produce approximately 17600 m^3 of mud, after natural drying in the sedimentation tank, it will be buried on site.

After oil separation and sedimentation treatment, construction machinery flushing wastewater will generate about 0.3t of waste oil sludge, which will be transportation immediately after production, and are required to be carried out by units with hazardous waste operation licenses for disposal.

b. Operation period

The solid waste generated during the project operation period is mainly domestic waste generated by tourists. After setting up garbage bins in the project area for collection, the environmental sanitation department will promptly clear and dispose of them uniformly.

(4)Environmental impact of noise

The noise source during the construction period mainly comes from the noise generated during the operation of machinery and equipment such as site leveling and earth excavation, as well as the traffic noise generated by transportation vehicles in the transportation process.

During the construction period, construction preparations and coordination should be made, construction fences should be raised, site layout should be optimized, high noise equipment should be set up near the river and far from sensitive points (The sensitive points distributed within a 200m range outside the construction boundary of this project are mainly the Jindi Mingyue Community located 130m south of the Huaxi Flood Control Sluice Project, the County Party School located about 50m north of Shangdu Avenue), construction time should be reasonably arranged, and mobile sound barriers should be set up near sensitive points such as the county party school and carry out noise monitoring during construction period. After taking the above measures, the impact of construction noise on surrounding sensitive points is acceptable.

There are residential areas on both sides of the transportation route of transport vehicles.During the construction period, heavy transport vehicles should avoid circumnavigating sensitive points on the roads entering and exiting the roads, and measures such as reasonably arrange the transportation time of construction materials, slowing down and limiting honking should be taken. Traffic noise has little influence on the environment of sensitive points.

The project operation does not involve the operation of noisy equipment, and there is no

noise generated, which will not affect the surrounding sound environment.

(5)Impact on ecological environment

The impact of the construction period on the ecological environment is mainly manifested in land use, aquatic and terrestrial plants and animals, soil and water loss, landscape ecology and so on. The construction period of the project will have adverse effects on all aspects of ecology, among which the impact on land use, vegetation coverage, soil and water loss is particularly prominent, that is, the construction will reduce vegetation coverage, aggravate soil and water loss, change the land use mode and landscape. The project enters the later stage of construction, according to the requirements of reclamation, vegetation restoration and other measures, the negative impact on the environment and ecology has been significantly reduced, the ecological environment can be restored and improved.

4. Major Social Impacts and Mitigation Measures

The main positive impacts of this project include: (1) improving river flood control standards, reducing the impact of flood disasters, promoting the improvement of flood control and drainage capacity of the Jialu River system, and enhancing the flood control and drainage capacity of the urban area of Zhengzhou City; (2) Improve the supporting facilities of river channels and enhance the safety of river channels along the line; (3) Improve the ecological environment and living environment along rivers; (4) Increase temporary or long-term employment opportunities and increase residents' income; (5) Enhance the flood control awareness and ability of residents along the line, and reduce the impact of flood disasters.

The negative impacts of the Project implementation include: (1) LA and HD impacts: The LA and HD affect 3 districts/counties in Zhengzhou City, with a total population of 846 people in 200 HHs. Among them, 431 people in 96 HHs will be affected by the permanent LA, which are rural residents; 13 people from 3 households will be affected by residential HD, which are rural residents. Temporary land use will affect 79 HHs with 334 persons; Non-residential HD will affect 93 HHs / enterprises with 373 persons, including 88 HHs with 282 villagers and 91 person in 5 enterprises. 71 HHs with 305 persons will be simultaneously affected by the LA, temporary land use and demolition. (2) Possible natural and social environmental impacts during project construction and operation. A. Improper disposal methods or stacking locations for abandoned soil and other waste may have a certain impact on the living and production of residents around the project area. B. During the construction period, during the transportation of construction vehicles, they may pass through residential communities and internal roads in the project area, interfering with residents' daily traffic and potentially increasing traffic safety risks. C. During the construction peak period, the construction area is expected to have 387 external construction personnel entering, which may increase the risk of infectious diseases (including AIDS, COVID-19, influenza, etc.), or cause public security disputes, Gender-based Violence (GBV) and other social risks. D. The Project is constructed along the river, with a long construction route, some areas may not be fully enclosed, and there may be safety hazards caused by surrounding residents mistakenly entering the construction site.(4)Impact of migrant workers: the increased communication

and contact between migrant workers and residents along the rivers can increase health risks, and conflicts of social and cultural customs (including religious beliefs, living habits, etc.) may occur between migrant workers and local residents;(5)During the construction process and in the daily affairs of the construction site, there may be gender impacts, leading to gender inequality, or the risk of GBV.

Based on the identified main social impacts, corresponding negative impact mitigation measures and SMP have been formulated: (1) Reducing the risk of LA and demolition; (2) Provide education and training related to flood control and drainage; (3) Implement community participatory river management along the Qili River, and create a good atmosphere and governance mechanism for protecting the water environment in residential areas along the river; (4) Provide employment opportunities for vulnerable groups such as women and low-income groups during project construction and operation periods; (5) Promote women's participation and protection of women's rights and interests in all stages of the Project (including prevention of GBV);(6)Take measures to avoid social risks during the project construction, such as strengthening health and infectious disease prevention education and publicity, and conducting diversified infectious disease prevention and publicity activities; Including the prevention of AIDS, COVID-19 and other infectious diseases, which shall be included in the contract documents. Civilized construction education and training shall be carried out regularly for construction personnel. During construction, safety work shall be done well, and construction time and site shall be reasonably arranged; (7) Improve the labor force security system and safeguard the legitimate rights and interests of workers; (8) Strengthen institutional capacity building. The effectiveness of these measures will be evaluated based on the monitoring results of the supervision and external monitoring units to determine whether adjustments and improvements are needed to these measures.

5. Implementation Arrangements

The Zhengzhou Water Resources Bureau is the implementing agency for the Project, to coordinate and promote the construction. The Zhengzhou Water Resources Bureau is responsible for (1) designating an environmental and social coordinator for each bid section to coordinate the implementation of the EMDP; (2) ensuring that the EMDP, monitoring program, and mitigation measures are incorporated into the bidding documents and construction contract; (3) maintaining the GRM; (4) addressing unforeseen adverse impacts and report them to AIIB in a timely manner; and (5) engage qualified environmental external monitoring units and social external monitoring units. The Zhengzhou PMO is required to regularly report on the implementation of the ESMP for its sub projects within its jurisdiction, as an independent document and as part of the project implementation report.

6. Stakeholder Engagement

Based on the nature of the Qili River Flood Control Improvement and Management Project in the lower reaches of the Jinshui River, the on-site investigation results, and interviews with relevant institutions, it has been identified that the main stakeholders of this project are the direct beneficiaries within the project scope and the groups negatively affected by the project construction. The main stakeholders include residents, vulnerable groups, and people affected by LA and HD within the project scope. Secondary stakeholders

include indirect beneficiaries, project owners, DI, construction units, supervision units, etc., as well as the government and its relevant functional departments.

In the preliminary preparation stage of the project, the feasibility study preparation unit, ESIA preparation unit have conducted project information disclosure and notification, as well as sufficient informed consultation and public participation activities such as institutional interviews, on-site surveys, focus group discussions, key informant interviews, and questionnaire surveys. The investigation found that the residents in the project area have an urgent demand for the Project, and the residents along the line hope to: repair or dismantle dangerous bridges to ensure the safety of traffic on both sides of the river; dredging the river channel, ensuring flood discharge, and improving the flood discharge capacity of the river channel; repair and improve the infrastructure along the river, such as river gates; open up emergency channels along the river to ensure smooth flow of emergency channels; improve the ecological environment along the river, improve the quality of the water environment, beautify the landscape, and appropriately increase leisure places and supporting facilities (such as outdoor fitness equipment) on both sides of the river. Low income groups have high enthusiasm and willingness to participate in project construction; Women have a strong willingness to participate; The cadres and masses in the project area have a high awareness of the project; The residents in the project area have a high level of project support. At the same time, on the basis of questionnaires, symposiums, in-depth interviews and interviews with key informants, the information disclosure and public participation plan was formulated through participatory ESIA.

The Chinese and English version of the ESMPF for HFERRP has been posted on the website of Henan Provincial Department of Finance (https://czt.henan.gov.cn/2021/11-05/2342160.html) and the website of the AIIB (China: Henan Flood Emergency Rehabilitation and Recovery Project - Projects - AIIB). The Chinese and English versions of the ESIA and ESMP of this Project, including the GRM, will be published on the website of Zhengzhou Water Resources Bureau and the website of the AIIB before construction. The specific requirements for disclosure will be implemented according to the A-class projects of the AIIB. At the same time, Zhengzhou Water Resources Bureau will prepare the paper version of the ESIA and ESMP for public reference.

7. Grievance Redress Mechanism(GRM)

The grievance mechanism for this project consists of two main types.

The first is a grievance mechanism at the project level, i.e., a channel of appeal to affected residents, social groups, institutions, etc., during the implementation and operation of the project.

The second is a grievance mechanism provided to project workers including direct and contract workers.

The staff of a department under the Zhengzhou Water Resources Bureau are responsible for the operation of the GRM. If a complaint is received, the person in charge should first verify whether the content of the complaint is related to the Project. If the appeal content is related to the Project, regardless of whether the appeal is related to the

environment and society, the person in charge should initiate coordination to resolve the appeal. If the appeal content is unrelated to this project, the person in charge shall submit the appeal to the relevant competent department on behalf of the complainant. All appeals should be recorded and the entire appeal process notified to relevant personnel.

The AIIB has established the Project-affected People's Mechanism (PPM). When PAP believe that the failure of the AIIB project to implement its Environmental and Social Policy (ESP) has had or may have adverse effects on them, and their concerns cannot be satisfactorily addressed through the Project GRM or the AIIB management mechanism, the PPM provides an independent and impartial review opportunity. PPM related information can be obtained by visiting the following link: https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html.

1 Introduction

In July 2021, Zhengzhou City experienced rare and extreme sustained heavy rainfall, exposing weak links and shortcomings in the Zhengzhou flood control and disaster reduction system. In order to comprehensively improve the level of flood control safety guarantee in Zhengzhou City, Zhengzhou City organized the preparation of the *Zhengzhou Urban Flood Control Plan* and the *Zhengzhou Jialu River Basin Flood Control Capacity Improvement Project Plan*, established the overall idea of basin flood control, and planned short-term and long-term flood control and disaster reduction goals.

The main urban area of Zhengzhou coordinates the flood control requirements of the Jialu River Basin, follows the overall idea of "upper storage, middle stagnation, and downstream discharge", improves the layout of regional flood control projects, and enhances the flood control capacity of the Jialu River Basin in Zhengzhou City. Raise the flood control standards for the main urban section of the Jialu River to a 200 year return period, and for the Qili River and Jinshui River to a 100 year return period.

Among them, the flood control engineering system of Jinshui River includes: "Upper storage" - strengthening the reservoir's flood storage and peak shaving functions through the restoration and reinforcement of Guojiazui Reservoir, effectively intercepting upstream floods; "Middle stagnation" - By constructing a new flood control and diversion project for the Jinshui River, efforts are made to store and divert upstream floods, further reducing the flood control pressure of the Jinshui River urban section; "Downstream discharge"- By dredging and regulating the downstream Qili River channel, the flood discharge capacity of the downstream channel will be improved to ensure the safe discharge of flood water in the main urban area. At present, the main body of the Guojiazui Reservoir restoration and reinforcement project has been completed, and the Jinshui River flood regulation and diversion project, as well as the comprehensive improvement project, are under construction. The low flood control standards (once every 20 years) of the downstream section of the Qili River from Shangdu Road to Wansan Road have become a major constraint on the flood discharge capacity improvement of the Jinshui River channel. At the same time, the drainage area of the main and tributaries of the Qili River in the main urban area of Zhengzhou reaches 623.6 km^2, accounting for 50% of the total area of 1,239 km^2 in the central urban area. The main stream undertakes the tasks of flood control in half of the main urban area, the southern part of Longhu Lake, and the drainage of Longzi Lake. The flood control function is particularly important, and the downstream of the Qili River has become a top priority affecting urban flood control safety. It is imperative to carry out timely flood control improvement and management work in the downstream section of the Qili River.

As an important component of the flood control system of the Jinshui River, the Qili River flood control improvement and control project in the lower reaches of the Jinshui River has sufficient planning and design basis. The *Special Plan for the Restoration and Reconstruction of Water Conservancy Infrastructure After Extremely Heavy Rainstorm and Flood Disasters in Zhengzhou and Other Places in Henan Province* (approved by the State Council in March 2022), the *Urban Flood Control Plan of Zhengzhou City* (2022) and the

Plan for Improving the Flood Control Capacity of the Jialu River Basin in Zhengzhou City (approved by the Henan Provincial Government in November 2022) all proposed to implement the flood control improvement and control project in the lower reaches of the Qili River to ensure the flood control safety of the main urban area.

On November 26, 2021, the General Office of the Zhengzhou Municipal Committee of the CPC and the General Office of the Zhengzhou Government issued a notice on the *Zhengzhou Water Conservancy Facility Restoration and Reconstruction Work Plan* (Z.B. [2021] No.33), which deployed the restoration and reconstruction work of water conservancy facilities in Zhengzhou. Among them, the Qili River Diversion Project for the Comprehensive Management of the Jialu River and the Qili River Flood Control Improvement and Management Project were included in the list of key projects.

On December 29, 2021, the Zhengzhou Development and Reform Commission approved the *Proposal for the Qili River Diversion Project of Comprehensive Management of the Jialu River* in the document Z.F.G.N.J. [2021] No. 850. The construction of the project is divided into two parts: one is the flood control improvement project for the downstream section of the Qilihe River (from the first intersection of the Longhai Railway to the Wansan Road), and the other is the Qili River flood diversion project.

At the beginning of 2023, the Zhengzhou Water Resources Bureau, in accordance with the *Implementation Plan for the Construction of the Qili River Flood Diversion Project for the Comprehensive Management of the Jialu River* (Z.Z.B.W. [2023] No. 12), divided the project into the Qili River Flood Control Improvement and Management Project (located in the main urban area) and the Qili River Flood Diversion Project (located in Zhongmou County) in the downstream of the Jinshui River. Based on the project proposal, the Zhengzhou Water Resources Architecture Survey and Design Institute further coordinated with the districts (counties) along the line, combined with the latest flood control requirements urban drainage planning, road network planning, etc., and the preparation of the FSR for the Integrated Jinshui River Management Sub-Project Supplementary (Downstream Qili River Flood Control Improvement and Management Project) (submitted for approval). The project name is hereinafter referred to as the Downstream Qili River Flood Control Improvement and Management Project.

The Project is located in the southeast of Zhengzhou City, from the downstream of Shangdu Road Xiangjiao Dam (Q14+150) to Wansan Road (Q20+950), with a length of 6.8km. The river mainly flows through ZEDZ and Zhengdongxin District. The main problems in this section are low flood control standards, substandard flood control safety, poor water ecological effects, unstable water quality, poor functional integration, and not meeting the development needs of livable and productive urban areas.

The ESIA and ESMP of Integrated Jinshui River Management Sub-Project has been approved by the AIIB in July 2022. This report is the ESIA and ESMP prepared for the mid-term adjustment of the Jinshui River Sub project(including Associated Facilities). The ESIA report meets the ES requirements of the AIIB and the requirements of domestic ES laws and regulations. The preparation of this report is based on: (1) the Environmental Impact Assessment Report Form for the Project; (2) FSR for the Project (April 2023); (3) Site

inspection carried out by the ESIA survey team in March 2023; (4) Discussions and focus group interviews conducted with institutions and departments such as Zhengzhou Water Resources Bureau, Zhengzhou Housing Acquisition Affairs Center, each district and county urban construction bureaus, natural resources and planning bureaus, ecological environment bureaus, emergency bureaus, statistics bureaus, human resources and social security bureaus, rural revitalization bureaus, people's committees, women's federations, transportation management bureaus, as well as PAP(including women, low-income and other vulnerable groups, residents along the line, and village committee leaders) in March 2023; (5) Questionnaire survey and ES related data disclosed by relevant government departments.

This report is structured as follows:

1. Introduction
2. Policy, legal and regulatory framework
3. Project Description
4. Environmental and social baselines
5. Environmental impact assessment
6. Social impact assessment
7. Public participation and information disclosure
8. GRM
9. Environmental and Social Management Plan

2 Policy, Legal and Regulatory Framework

This report was prepared in compliance with the current applicable environmental and social laws and regulations of the People's Republic of China, local and departmental regulations of Henan Province and Zhengzhou City, technical guidelines and specifications, and the requirements of AIIB's Environmental and Social Framework (revised 2021).

2.1 Applicable ES Related Laws and Regulations

- Law of the People's Republic of China on Environmental Protection (implemented on January 1, 2015).
- Law of the People's Republic of China on Environmental Impact Assessment (amended on December 29, 2018).
- Land Management Law of the People's Republic of China (Revised) (January 1, 2020).
- Regulations on the Implementation of the Land Management Law of the People's Republic of China (Order of the State Council No. 743) (September 1, 2021).
- Decision of the State Council on Deepening Reform and Strict Land Management (G.F. [2004] No. 28) (October 21, 2004).
- Guiding Opinions on Improving the Compensation and Resettlement System for Land Acquisition (G.T.Z.F. [2004] No. 238) (November 3, 2004)
- Notice of the State Council on Issues Related to Strengthening Land Regulation and Control (G.F. [2006] No. 31) (August 31, 2006)
- Regulations on the Expropriation and Compensation of Houses on State-owned Land (Order of the State Council No. 590) (January 21, 2011)
- Notice of the State Forestry and Grassland Administration of the Ministry of Natural Resources, Ministry of Agriculture and Rural Affairs on Issues Related to Strict Control of Arable Land Use (Z.R.Z.F. [2021] No. 166) (November 27, 2021)
- Law of the People's Republic of China on the Promotion of Cleaner Production (implemented on July 1, 2012).
- Law of the People's Republic of China on Prevention and Control of Air Pollution (amended on October 26, 2018).
- Law of the People's Republic of China on Prevention and Control of

Water Pollution (amended June 27, 2017, implemented January 1, 2018);

- Law of the People's Republic of China on Prevention and Control of Environmental Noise Pollution (amended December 29, 2018).
- Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste (amended on April 29, 2020).
- Law of the People's Republic of China on the Prevention and Control of Soil Pollution (August 31, 2018).
- Law of the People's Republic of China on Soil and Water Conservation" (implemented on March 1, 2011).
- Law of the People's Republic of China on the Protection of Cultural Relics (amended on November 5, 2017).
- Forestry Law of the People's Republic of China (amended on December 28, 2019).
- Law of the People's Republic of China on Wildlife Protection (October 26, 2018).
- Law of the People's Republic of China on Work Safety (2014).
- Law of the People's Republic of China on Prevention and Control of Occupational Diseases (2011).
- Labor Law of the People's Republic of China (1995).
- Law of the People's Republic of China on the Protection of Minors (amended in 2020).
- Law of the People's Republic of China on the Protection of Persons with Disabilities (amended in 2018).
- Social Insurance Law of the People's Republic of China (amended in 2018).
- Urban and Rural Planning Law of the People's Republic of China (2015).

2.2 Applicable ES Related Sector Regulations, Policies

- Regulations on Environmental Protection Management of Construction Projects (State Council Decree No. 682, amended on July 16, 2017).
- List of Environmental Impact Assessment Classification

Management of Construction Projects (2021).

- Opinions on Further Strengthening Ecological Protection Work (H.F. [2007] No. 37).
- Notice on the Issuance of Interim Measures for the Review and Management of the Total Emission Indicators of Major Pollutants in Construction Projects (H.F. [2014] No. 197).
- Notice on Further Strengthening the Management of Environmental Impact Assessment to Prevent Environmental Risks" (Ministry of Environmental Protection H.F.[2012] No. 77).
- Notice on the issuance of the Guidelines for the Delineation of Ecological Protection Red Line (H.B.S.T. [2017] No. 48).
- Guidance Catalogue for Industrial Restructuring (2019 version).
- Measures for Public Participation in Environmental Impact Assessment (Order No. 4 of the Ministry of Ecology and Environment).
- Regulations on Labor Protection in Workplaces with Toxic and Hazardous Substances (2002).
- Interim Regulations on Payment of Wages (1995).
- Regulations on the Implementation of the Labour Law (2018).
- Law on the Protection of Women's Rights and Interests (2023)
- Regulations on Environmental Protection of Construction Projects in Henan Province (2016.3.29).
- Regulations on Water Pollution Prevention and Control in Henan Province (2019.10.1).
- Regulations on Prevention and Control of Air Pollution in Henan Province (2018.3.1).
- Henan Province Solid Waste Pollution Prevention and Control Regulations" (2012.1.1).
- Zhengzhou Notice on Further Strengthening the Management of Urban Construction Waste Transport Vehicles (2017).
- Notice on the Issuance of Henan Province's 2021 Atmospheric, Water, and Soil Pollution Prevention and Control Offensive and Agricultural and Rural Pollution Control Offensive Implementation Plan (Y.H.G.J.B. [2021] No. 20).
- Opinions on Strengthening the Construction of Social Stability Risk

Assessment Mechanism for Major Decisions in New Situations (2021)

- Notice on the Issuance of Interim Measures for Social Stability Risk Assessment of Major Fixed Asset Investment Projects of the National Development and Reform Commission (F.G.T.Z. [2012] No. 2492)
- Opinions of the General Office of Henan Provincial People's Government on Regulating the Allocation and Use of Compensation Fees for Land Requisitioned for Collective Ownership by Farmers (Y.Z.B. [2006] No. 50).
- Notice of the People's Government of Henan Province on the Announcement of the Implementation of the Comprehensive Land Price Standard for the Acquired Area in Henan Province (Y.Z. [2016] No. 48).
- Notice on the Implementation of the Regulations on the Expropriation and Compensation of Houses on State-owned Land in Henan Province" (Y.Z. [2012] No. 39).

2.3 Guidelines and Technical Specifications

- Technical Guidelines for Environmental Impact Assessment - General Outline (HJ2.1-2016).
- Technical Guidelines for Environmental Impact Assessment - Atmospheric Environment (HJ2.2-2018).
- Technical Guidelines for Environmental Impact Assessment - Surface Water Environment (HJ2.3-2018)
- Technical Guidelines for Environmental Impact Assessment - Sound Environment (HJ2.4-2021)
- Technical Guidelines for Environmental Impact Assessment - Groundwater Environment (HJ 610-2016).
- Technical Guidelines for Environmental Impact Assessment - Ecological Impact (HJ19-2022).
- Technical Guidelines for Environmental Impact Assessment - Soil Environment (for Trial Implementation) (HJ964-2018).
- Technical Guidelines for Environmental Risk Assessment of Construction Projects (HJ/T169-2018).

2.4 AIIB Environmental and Social Requirements

Since the project will be funded by AIIB, the AIIB Environmental and Social Framework (ESF) will be applied to the project. Its key elements are as follows.

- Environmental and Social Policy (ESP), Environmental and Social Standards (ESSs) and ES Exclusion Checklist. The ESP sets out mandatory requirements for banks and their clients to identify, assess and manage environmental, social risks and impacts associated with AIIB supported projects.
- Environmental and Social Standards 1(ESS 1)： Aims to ensure the ES robustness and sustainability of the project and to integrate ES factors into the project decision-making process and implementation. ESS 1 applies if the project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of ES assessment and management measures is proportional to the risks and impacts of the project. ESS1 provides high-quality ES assessments and risk and impact management through effective mitigation and monitoring measures during project implementation. ESS1 sets out detailed requirements for ES assessments to be carried out on any project the AIIB invests in.
- Environmental and Social Standards 2(ESS 2)： If the screening process of the project indicates that the project involves involuntary resettlement (including recent or foreseeable involuntary resettlement directly related to the project), ESS 2 applies. Involuntary resettlement includes physical displacement (relocation, loss of residential land or loss of housing) and economic displacement (loss of land or access to land and natural resources) as a result of; Assets or acquired assets, loss of sources of income or livelihood) (a) Involuntary acquisition of land; (b) Involuntary restriction of land use or access to legally designated parks and protected areas. It covers such displacement, whether such losses and involuntary restrictions are total or partial, permanent or temporary. ESS2 establishes detailed requirements for project resettlement plan(RP) involving involuntary resettlement.
- Environmental and Social Standards 3(ESS 3): ESS3 applies if there are indigenous people (ethnic minorities) in or with whom the project is proposed and they are likely to be affected by the project.

2.5 Applicable Evaluation and Emission Standards

According to the environmental quality standard execution opinions issued by

the Zhengzhou Ecological Environment Bureau:

- Ambient air to implement the "Ambient Air Quality Standard" (GB3095-2012) level 2 standard and 2018 amendment;
- The surface water environment complies with the class IV standard of Surface Water Environmental Quality Standard (GB3838-2002);
- The quality of acoustic environment complies with the standards of acoustic Environment Quality (GB3096-2008), class 1 and class 2 standards;
- Groundwater environment to comply with the "Groundwater Quality Standards" (GB/T14848-2017) class III standards;
- The atmosphere during the construction period of the project shall comply with the second-level standard of Comprehensive Emission Standard of Air Pollutants (GB16297-1996);
- Noise during construction shall be subject to the environmental Noise Emission Standard for Construction Site Boundary (GB12523-2011);
- Domestic sewage during the construction of the project shall comply with the third level standard in Table 4 of comprehensive Sewage Discharge Standard (GB8978-1996);
- General solid waste shall comply with the pollution Control Standard for Storage and Landfill of General Industrial Solid Waste (GB18599-2020).

The AIIB's ESF (revised in 2021) requires projects to conform to internationally recognized standards such as the World Bank Group's Environmental Health and Safety Guidelines for pollution prevention and control technologies and practices based on international good practices[1]. Therefore, this project is more stringent in the internationally recognized standards and domestic standards. Specific applicable standard values are as follows:

2.5.1 Environmental Quality Standards

1. Air Quality

The Ambient Air Quality Standards (GB3095-2012) classify air quality into two categories. Category 1 standards apply to special areas such as nature reserves, landscape and famous scenery, and other areas that require special protection, and category 2 standards apply to residential areas, commercial traffic and residential mixed areas, cultural areas, industrial areas, and rural areas. The site of this subproject falls within a Class 2 ambient air quality functional area. The World Bank

[1] http://www.ifc.org/ehsguidelines

Group's EHS Guidelines are referenced from the WHO Global Air Quality Guidelines[2]. The Global Air Quality Guidelines provide guidance on thresholds and limit values for key air pollutants that pose health risks. In addition to the guidance values, the WHO Global Air Quality Guidelines provide transition period targets designed to facilitate a gradual shift from high to low concentrations. Table 2-1 compares the Ambient Air Quality Standards (GB 3095-2012) Class 2 standards with the WHO standards. The Class 2 standard limits for 24-hour SO_2 (0.15 mg/m^3) of the Ambient Air Quality Standards (GB 3095-2012) are higher than the upper limit of the World Bank Group interim standard (0.125 mg/m^3); while the 24-hour PM10 (0.15 mg/m^3) and PM2.5 (0.075 mg/m^3), annual average NO_2 (0.04 mg/m^3) and PM2.5 (0.035 mg/m^3) are the same as the upper limit of the WHO transitional standards. In general, the Chinese standards are highly equivalent to the WHO guidelines or interim target values, so this subproject adopts the Ambient Air Quality Standard (GB3095-2012) Class 2 standard and the WHO standard for 24-hour SO_2.

Table2-1Comparison of China GB 3095-2012 and WHO Global Air Quality Guidelines (Unit: mg/m^3)2

	Item	**Average period**	**GB 3095-2012 Category 2**	**WHO Global Air Quality Guidelines**	
				Intermit	**Target**
1	SO_2	1 year	0.06	Not applicable	Not applicable
		24 hours	0.15	0.05-0.125	0.04
		1 hour	0.50	Not applicable	Not applicable
2	PM_{10}	1 year	0.07	0.02-0.07	0.015
		24 hours	0.15	0.05-0.15	0.045
3	$PM_{2.5}$	1 year	0.035	0.01-0.035	0.005
		24 hours	0.075	0.025-0.075	0.015
		1 hour	Not applicable	Not applicable	Not applicable
4	NO_2	1 year	0.04	0.02-0.04	0.010
		24 hours	0.08	0.05-0.12	0.025
		1 hour	0.20	Not applicable	Not applicable
5	Carbon monoxide	24 hours	4.0	7.0	4.0
		1 hour	10.0	Not applicable	Not applicable
6	O_3	Maximum average of 8 hours per day	0.16	0.12-0.16	0.10
		1 hour	0.20	Not applicable	Not applicable

Source: WHO Global Air Quality Guidelines (2021) and GB 3095-2012 of the People's Republic of China.

2. Sound Environment

The Sound Environment Standard (GB 3096-2008) classifies five functional areas according to their tolerance of noise pollution: from Class 0 to Class 4. Class 0 applies to areas where quiet is particularly needed, such as rehabilitation and convalescent areas, and therefore has the most stringent day and night noise

[2] https://www.who.int/zh/news-room/questions-and-answers/item/who-global-air-quality-guidelines

standards. Class 1 applies to residential, medical and health care, cultural education and research and design, administrative offices as the main functions, need to maintain quiet areas. Class 2 applies to areas where commercial and financial or bazaar trade is the primary function, or where there is a mix of residential, commercial, and industrial uses that require the maintenance of residential quiet. Class 3 applies to areas with industrial production, warehousing and logistics as the main functions. Class 4 applies to areas within a certain distance from both sides of the main traffic arteries where it is necessary to prevent serious impacts of traffic noise on the surrounding environment. The area where this project is located is a Class 2 functional area of the acoustic environment, and the Class 2 standard of Sound Environment Quality Standard (GB 3096-2008) is implemented.

Table2-2 Environmental noise limits (equivalent sound level: LAeq: dB)2

Noise functional area category		**GB 3096-2008**	
		Daytime	**Nighttime**
0		50	40
1		55	45
2		60	50
3		65	55
4	4a	70	55
	4b	70	65

3. Surface Water

The surface water body involved in this project is subject to the "Surface Water Environmental Quality Standard" (GB3838-2002) Class IV standard.

Table2-3 Applicable Surface Water Environmental Quality Standards

Indicators	**Unit**	**Limit value**
pH	/	6～9
DO	mg/L	>3
COD	mg/L	<30
BOD_5	mg/L	<6
Ammonia nitrogen	mg/L	<1.5
Total phosphorus	mg/L	<0.3(lake, reservoir 0.1)
Total Nitrogen	mg/L	<1.5
Potassium permanganate index	mg/L	<10
Volatile phenols	mg/L	<0.01
Anionic surfactants	mg/L	<0.3
Sulfide	mg/L	<0.5
Oil	mg/L	<0.5
Copper	mg/L	<1.0

Indicators	Unit	Limit value
Zinc	mg/L	<2.0
Arsenic	mg/L	<0.1
Lead	mg/L	<0.05
Mercury	mg/L	<0.001
Selenium	mg/L	<0.02
Cadmium	mg/L	<0.005
Hexavalent chromium	mg/L	<0.05

4. Soil Environment

The World Bank Group EHS guidelines do not provide reference standards for soil quality.The quality of dredged sediment is determined by referring to the soil pollution risk screening values in China's "Soil Environmental Quality - Agricultural Land Soil Pollution Risk Control Standard (Trial)" (GB15618-2018) and "Soil Environmental Quality - Construction Land Soil Pollution Risk Control Standard (Trial)" (GB36600-2018) to determine whether it can be used as resources.The screening value of soil pollution risk means that if the pollutant content in soil is equal to or lower than this value, the risk to human health can be ignored.If it exceeds this value, there may be a risk to human health, and further detailed investigation and risk assessment should be carried out to determine the specific pollution scope and risk level. The first type of land refers to residential land in urban construction land.The second type of land refers to the industrial land in the urban construction land.

Table 2-4Soil Environmental Quality Standards

Indicators	**Units**	**Risk screening values**			
		Soil Environmental Quality -- Standard for Risk Control of Soil Pollution in Agricultural Land (Trial) (GB15618-2018)		**Soil Environmental Quality- Control Standard for Soil Pollution Risk of Construction Land (GB36600-2018)**	
				Class I land	**Class II land**
pH	Dimensionless	＞7.5	6.5＜pH≤7.5	/	/
Cd	mg/kg	0.6	0.3	20	65
Hg	mg/kg	3.4	2.4	8	38
As	mg/kg	25	30	20a	60a
Pb	mg/kg	170	120	400	800
Cr	mg/kg	250	200	3.0(Cr6+)	5.7(Cr6+)
Cu	mg/kg	100	100	2000	18000
Ni	mg/kg	190	100	150	900
Zn	mg/kg	300	250	/	/

2.5.2 Pollutant Discharge Standards

(1)Atmospheric pollutants

During the construction period, the secondary standard of China's "Comprehensive Emission Standard of Air Pollutants" (GB16297-1996) shall be implemented.

Table 2-5Comprehensive Emission Standards of Air Pollutants

Pollutants	Unorganized emissions monitor concentration limit mg/m^3
Particulate matter	1.0
Nitrogen oxide	0.12
Asphalt flue gas	Production equipment must not have obvious unorganized emissions present

(2)Noise

Operation noise during the construction period shall comply with China's "Construction site boundary Environmental Noise Emission Standard" (GB 12523-2011).In addition, the World Bank EHS guidelines require that the increase in background noise outside the site from the nearest receiving point should not exceed 3 dB.**错误!未找到引用源。**

Table 2-6Noise Limits for Construction Activities (unit: LAeq [dB (A)])2

Period	**Main source of noise**	**Noise limits**	
		Daytime	**Night**
Construction period	Bulldozers, excavators and loaders;Pile drivers;Concrete mixers, vibrators and chainsaws;lift	70	55

(3)Sewage discharge

Construction site sewage discharge shall comply with China's "Comprehensive Sewage Discharge Standard" (GB 8978-1996). The Level 1 standard applies to the discharge discharged into Ⅲ class water body under GB 3838-2002.The Level 2 standard applies to discharges into Ⅳ and Ⅴ class water body under GB 3838-2002. The Level 3 standard applies to discharges into urban drainage systems with secondary sewage treatment plants. The domestic sewage during the construction period of this project is treated in septic tanks and emptied regularly.

Table 2-7Comprehensive Sewage Discharge Standards (Unit: mg/L)

Parameters	**Level 1**	**Level 2**	**Level 3**
	Suitable for discharging into Class 3 bodies of water	**Suitable for discharging into Class 4 and Class 5 water bodies**	**For discharge to municipal sewers**
pH	6–9		
SS	70	150	400

Parameters	Level 1	Level 2	Level 3
	Suitable for discharging into Class 3 bodies of water	Suitable for discharging into Class 4 and Class 5 water bodies	For discharge to municipal sewers
BOD5	20	30	300
COD	100	150	500
Volatile phenol	0.5	0.5	2.0
NH3-N	15	25	---
LAS (= anionic surfactant)	5.0	10	

(4)Solid waste

General industrial solid waste shall implement China's "General Industrial Solid Waste Storage and Landfill Pollution Control Standards" (GB18599-2020) and “Standard for pollution control on hazardous waste storage” (GB18597-2023).

2.6 Domestic EIA Preparation and Approval

According to China's "Environmental Impact Assessment Law" and “Regulations on the Administration of Environmental Protection of Construction Projects”, the project needs to conduct a domestic environmental impact assessment. According to the Classified Management List of Environmental Impact Assessment of Construction Projects (2021), this project belongs to the category of flood control and waterlogging engineering in Article 127 of 51, Water Conservancy. This project was classified as large (2) shape in the FSR, So an environmental impact report needs to be prepared.

In March 2023, PMO entrusted Henan Keren Technology Co., Ltd. to prepare the domestic EIA report of the project. According to the relevant domestic requirements, the EIA unit prepared the EIA Report of Zhengzhou Jinshui River Comprehensive Regulation Project Supplement (Downstream Qilihe Flood Control Improvement Project), which passed the technical review in June 2023 and obtained the approval from Zhengzhou Ecological Environment Bureau (Zheng Huan Audit (2023) No. 30) on July 6, 2023.

3 Project Description

3.1 Project Overview

According to the project FSR, the Project overview is as follows:

Project name: Integrated Jinshui River Management Sub-Project Supplementary (Downstream Qili River Flood Control Improvement and Management Project);

Construction unit: Zhengzhou Municipal Bureau of Water Resources;

Industry category: Construction of River and Lake Management and Flood Control Facilities Engineering (E4822);

Project investment: The total investment of the project is CNY 833.1875 million;

Location: from the downstream of Shangdu Road Xiangjiao Dam (Q14+150) to Wansan Road (Q20+950), mainly in ZEDZ and Zhengdongxin District, the small area at the end of the project involves Zhongmou County, and the project location map is shown in Figure 3-1;

Construction content: The project mainly includes river regulation engineering, flood diversion gate engineering, ecological restoration engineering. The length of the engineering treatment is 6.8km, and the width of the blue line of the river is 260m. After deducting two railway related nodes, the actual governance length is 6.35km;

Land occupation: The permanent land occupation area of the project is 1686127 m^2, and the temporary land use area is 522010 m^2 ;

Construction time: The construction period of this project is 16 months, including 1 month for project preparation, 14 months for main project construction, and 1 month for project completion.

Figure 3-1Location Map of the Project

3.2 Project Task

1. Fundamentally improve the flood control capacity of Qilihe River and ensure urban flood control safety

According to the overall requirements of the Qili River Flood Control Improvement, through the comprehensive management of the downstream section and the implementation of Qili River flood diversion, the flood control capacity and flood control standards of the Qili River will be improved to achieve a 100 year return period, timely dividing and delaying floods in the Qili River Basin, and the main urban areas of Jinshui River, Xiong'er River, Dongfeng Canal, Chao River and other floods will be accelerated to flow into the Qili River for discharge. Create more favorable conditions for the rapid inflow of waterlogged water into the river channel in the main urban area of Zhengzhou, improve the overall flood control and disaster reduction capacity of the Jialu River Basin in Zhengzhou, and form a complete flood control and drainage system.

2. Systematically and comprehensively manage river channels to promote livable and industrial development in urban areas

Systematically organize the river shoreline, connect the ecological, production, and living spaces within the diffraction area of the river, and connect the blue and green spaces of the area; Build an ecological and cultural corridor that serves the Economic Development International Logistics Zone and radiates to the periphery, along with the downstream Jialu River, to serve the three industries, and promote the healthy

development of the city through water city co prosperity.

3.3 Construction Content and Scale

The construction content of this project is shown in Table 3-1. The estimated total investment for engineering construction is CNY 833.1875 million.

Table 3-1Main Construction Content and Scale

Categories	Component	Construction Scale			Remarks
Main work	River regulation engineering	River dredging	The length of the excavated river channel for the section from Shangdu Road Xiangjiao Dam (Q14+150) to Wansan Road (Q20+950) is 6.35km (excluding the railway section, the same below). The bottom width of the river channel will be widened from an average of 60m to an average of 120m, and the distance between embankments will be widened from 100-105m to 180-190m. Synchronous adjustment of shoreline coordination and alignment with major bridges.		The earthwork excavation volume is about 2.2424 million m^3
		Slope protection	Provide lining and revetment protection for the main channel slope, with a total length of 12.8km for slope protection on both sides.		
		Embankment filling	The total length of the embankment arrangement is 13.6km (on both sides), with a railway section length of 0.95km (specifically implemented by the railway) and a new embankment length of 12.65km (on both sides). The embankment level is Level 1, and the width of the embankment top is 10m; The length of the newly built flood prevention road is 1,265km, with a grade of urban branch road and a width of 7m.		
		Supporting buildings	Inverted siphon	Demolition and reconstruction of one inverted siphon in the Yangqiao main canal. The level of the inverted siphon and control water gate is level 1, and the designed flow capacity is 15.6m^3/s	
			Flood control and drainage gate	2 flood control and drainage gates. Newly build one Baishiguntang Ditch flood control and drainage gate, level 1, culvert type water gate, and a designed flow capacity of 129m^3/s; Demolition and reconstruct one Huaxi flood control and drainage gate, level 1, culvert type water gate, with a designed flow capacity of 51.1m^3/s.	
			Water retaining structures	1 site. Level 2, hydraulic lifting dam type, with a dam length of 132m and a dam height of 2.5m	
			Bridge	4 bridges. Among them, three traffic bridges will be demolished and rebuilt, two is at the city level A, and one is at the city level B; Reconstruction and extension of one transportation bridge, city level A	
			Rainwater inlet and	① There are a total of 13 rainwater inlets at present, of which 2 are included	

Categories	Component	Construction Scale			Remarks
			drainage pipe culvert renovation	in special projects and are not included in the evaluation scope of this project; 5 of them will be demolished; The remaining 6 rainwater outlets will be retained, and new outlets and energy dissipation projects will be built. ② Add 7 temporary drainage pipe culverts.	
	Diversion gate engineering	1 new Qili River flood diversion gate, Level 1, with a designed flow rate of 180m^3/s			
	Ecological rehabilitation project	Mainly for the construction of ecological greenways within the project scope. Including earthwork balance, terrain arrangement, green planting, pavement engineering, supporting facilities, and cultural display facilities within the blue-green line. Except for water area and engineering land, the total area of green corridor construction within the blue-green line is approximately 1.329 million m^2. Main quantities: 967,000 m^2 of land plant planting, 71,000 m^2 of aquatic plant planting, and 159,600 m^2 of production crop planting; Colored concrete garden road of 16,700 m^2, permeable brick pavement of 33,300 m^2, parking lot of 2,050m^2, lighting engineering, water supply and drainage engineering, supporting service stations of 8 (2 first-class stations, 4 second-class stations, and 2 mobile public toilets), as well as fitness facilities, various signs, and small art works, etc.			
Temporary works	Construction diversion	This river channel project mainly relies on the current channel of the Qili River for diversion, and no new continuous diversion ditches will be established. Individual individual buildings will be considered separately based on their own situation.			
	Construction camp	Arrange 2 construction campsites (including comprehensive processing plants, storage yards, warehouses, etc.), each covering an area of 1333.4 m^2, totaling 2666.8 m^2, all located within the blue line and the occupied green line.			
	Construction road	The construction road is arranged on both sides of the river, with a total length of 13.6km on both sides and a width of 6m, soil surface.			
Supporting works	Water supply	Relying on regional municipal tap water			
	Power supply	Relying on regional municipal power grid. The specific connection location can be contacted with the local power supply department. For electricity consuming units that are far away, temporary low-voltage lines need to be erected to the construction site.			
Environmental protection	Waste water	Setting up oil separation sedimentation tanks, temporary septic tanks, etc.			
	Discharge gas	Set construction fence and install spray sprinkler head; Watering and wet operations, etc			
	Solid waste	After the classification of construction waste, the recyclable part should be reused. The unusable part needs to obtain a construction waste clearance permit and strictly follow the requirements of relevant departments. It should be regularly transported to the government designated storage area(provisional Zhongmou Construction Waste Collection Center, located in Dameng Sub-district, Zhongmou County) and not discarded arbitrarily; Excavated soil is used for backfilling, and the excess waste soil is located within 5 green spaces adjacent to the river (stakes Q16+000~Q19+700) for ecological landscape micro terrain shaping, without external transportation of soil; 176000 m^3 mud generated during bridge construction is temporarily stored in the mud pit, naturally dried, and then buried in the sedimentation tank; The waste oil sludge generated by the			

Categories	Component	Construction Scale	Remarks
		oil separation sedimentation tank shall be cleaned and treated by qualified units; After the collection of household waste, the sanitation department is responsible for cleaning and transportation.	
	Noise	Select low noise equipment, setting up sound barriers, etc.	

Source: FSR

3.4 Engineering Grades and Standards

According to the "Classification and Flood Standards for Water Resources and Hydropower Engineering" (SL252-2017) 3.0 Article 1 stipulates that the flood control engineering is classified as Class II and the project scale is large (2). The flood control standard for this project is once every 100 years (the current flood control standard is once every 20 years).

3.5 River Regulation Works

3.5.1 River Dredging

The river section and bottom elevation of the Qili River regulation section are connected with the upstream and downstream regulation sections.

The starting point of the treatment is connected to the upstream river channel that has been treated, and the starting point has a bottom elevation of 78.83m. The end point of the governance is connected downstream to the downstream channel of Wansan Road Bridge, with a river bottom elevation of 76.78m. The length of river regulation is 6.8km, with a drop of only 2.05m, the design gradient of the river is basically consistent with the current situation, and the overall gradient is about 1/3320.

This project only carried out dredging in local areas. According to the comparison analysis between the designed riverbed elevation and the current riverbed elevation in the longitudinal section design of the treated section, the dredging section is located in the sections with pile numbers Q16+550~Q16+600, Q19+100~Q19+200, and Q20+700~Q20+850, totaling about 300m.

3.5.2 Embankment Project

The embankment level is Level 1, the starting point of the engineering governance is the Xiangjiao Dam on Shangdu Road, with complete embankments on both sides. The left bank is a combination of embankments and landscape microtopography, while the right bank is a standard cross-section. The starting point of this embankment project layout is connected to the existing embankment, and the end is connected to the Wansan Road roadbed. The embankment is kept continuous in the middle, with a total length of 13.6km. Among them, the new embankment is 13.5km long, and the connection length between the new and old embankments is about 0.1km.

The embankment filling materials should be sourced locally. Priority should be given to selecting qualified soil materials generated from river excavation for the embankment body. According to the recommendations of the engineering geological report, the upper layer of loam is taken for embankment construction, with a soil layer thickness of about 2m.

3.5.3 Embankment Top Flood Prevention Road

In order to meet the traffic needs of flood prevention on both banks of the Qili River, flood prevention roads are built at the top of the embankments on both sides of the river. The total length of the roads on both sides is 12.65km, and the total width of the embankment top is 10m, with a net width of 7m. Use the asphalt pavement. The new bridleway is 12.87 kilometers, 4 meters wide, and adopts pervious concrete pavement.

3.5.4 River Slope Protection Engineering

The current riverbed is mostly composed of heavy silty loam and sandy loam soil. After calculation, the allowable non flushing flow velocity V is 0.8~1.0m/s in most river sections. The average flow velocity of the river under design flood conditions is 1.56~1.93m/s, which is greater than the allowable non flushing flow velocity. In order to prevent erosion of riverbank slopes, it is necessary to protect the riverbank slopes.

This time, based on the current experience in river ecological management, the slope protection type and straight wall type are arranged and combined according to the site terrain, elevation difference, slope and other factors, creating conditions for the ecological and hydrophilic nature of the river.

3.6 Qili River Flood Diversion Gate

This gate belongs to the Qili River Flood Diversion Project and is a canal head control building; As the gate site is within the scope of this embankment project, it is included in the scope of this governance. The flood diversion gate is located on the right bank of the East Qili River in Yuanzhuang Village (stake 19+700), with a designed flood diversion flow of 180m3/s. The building level is Level 1 (the same as the flood control standard and level of Qili River).

3.7 Yangqiao Main Canal Inverted Siphon

The Yangqiao Main Canal inverted siphon will be demolished and reconstructed, with a building level of Level 1. The buildings for the inverted siphon culvert and supporting water gates in this reconstruction project are Level 1, and the stilling pool is Level 2. The current situation and the comparison of relevant technical parameters for this reconstruction are shown in the table below.

3.8 Flood Control and Drainage Gate

Build 1 flood control and drainage gate in Baishiguntan Stream (Long Channel), rebuild 1 flood control and drainage gate in Hua Stream, and connect Huama Stream (Feng River) to Qili River Gate.

3.8.1 Baishiguntan Stream Entering Qili River Gate

New construction, located at stake Q16+063. The flood control standard for the Baishiguntan Stream Gate is once every 100 years, and the project length is 106.5m. The culvert gate is a breast wall type water gate, with structures from upstream to downstream including a blanket section, an inlet stilling pool section, a gate chamber section, a box culvert section, and an outlet stilling pool section.

When the water level of Qili River in front of the gate reaches 83.41m (once in 100 years), the gate should be closed.

3.8.2 Huama Stream Entering Qili River Sluice

This time, the existing Huama Stream (Feng River) gate into Qilihe will remain unchanged. According to the design, the boundary line of the river bottom and the main channel revetment are connected to the octagonal wall at the outlet of the existing water gate; The elevation of the embankment top has been increased from 83.52m to 84.07m, with a width of 10.0m, the width of embankment top road is 7.0m. Protective guardrails will be installed on both sides, with a length of 45m; At the same time, adjust the slope ratio on the upstream side of the newly built embankment to 1:2 and use ecological slope protection profiles for protection.

3.8.3 Hua Stream Entering Qilihe Gate

Reconstruction, located at station Q19+570. There is currently one culvert gate, which is arranged in a combination of gates and pump stations.

In this project, combined with the common needs of river expansion, embankment layout, emergency protection and dredging engineering of Longhai Railway Bridge, as well as the layout of flood diversion outlets and gates for the Qili River Flood Diversion Project, the Hua Stream existing water gate site has an impact on the widening of flood cross-section, coordinated layout of shorelines, and the connection of flood prevention roads, so it has been demolished. The gate site is moved 63m southward and rebuilt according to the original scale, using a culvert style crossing the Qili River embankment to ensure the continuity of the flood prevention road.

The structure of the culvert gate from upstream to downstream includes the inlet apron protection section, inlet stilling pool section, gate chamber section, box culvert section, outlet stilling pool section, and outlet bottom protection section, with a project length of 68.5 meters.

The design flood control standard is once every 100 years. According to the

current elevation of the channel in Hua Stream and the 10-year flood discharge standard, the elevation of the top of the Hua Stream embankment at the gate location is 81.30m. Calculated based on a superelevation of 0.8m, when the water level of Qili River after the gate reaches 79.5m, the gate should be closed. Start the strong drainage pump for drainage, with a designed drainage capacity of 1.2m^3/s.

3.9 Water Retaining Structures

Based on the ecological management experience of rivers in Zhengzhou City, the need to retain ecological water bodies and ensure the continuity of river water surfaces is achieved by arranging river blocking gates and dams at appropriate locations.

This time, in combination with ecological improvement and improvement, the water surface effect of the river should be beautified and meet the requirements of ecological water depth, meeting the layout of wetlands in shallow water areas of the river, and facilitating the formation of landscape effects. A new water retaining and storage building should be built at stake number Q18+400. The dam type is a hydraulic dam, with a height of 2.5m and a length of 132m.

3.10 Current River Related Engineering Treatment

3.10.1 Bridges Current Situation and Disposal Analysis

There are currently 9 river crossing bridges in the Qili River treatment section, including 2 Longhai Railway Bridges; 3 urban transportation trunk highway bridges, namely Qiancheng Avenue Bridge, Shangdu Avenue Bridge, and Wansan Road Bridge; There are 4 low standard transportation bridges, including Yangqiao Canal Bridge, Ranzhuang Bridge, Nansi Bridge, and Fengqi Road Bridge (Ranzhuang Bridge). The disposal measures for the river crossing bridges are shown in the table below:

Table 3-2List of Current Cross River Bridges and Disposal Measures

Bridges	Disposal Measures
Longhai Railway Bridges	2 bridges, commissioned to prepare a special implementation plan, which is not within the scope of this project
Qiancheng Avenue Bridge	Located at the river stake Q16+632, the height and length of the middle and west bridges do not meet the flood control standards for a 100 year return period. Therefore, the east bridge will be retained and it is planned to demolish and rebuild the middle and west bridges.
Shangdu Avenue Bridge	Located at the river stake Q20+350, the length does not meet the flood control standard for a 100 year return period. The existing bridge on Shangdu Road will be retained for this project, and it is planned to renovate and extend its right bank side.
Wansan Road Bridge	Located at the river stake Q20+950, meeting the flood control

Bridges	Disposal Measures
	standard for a 100 year return period, the current status will be retained, and the end is connected to the section at the bridge site in a straight line.
Yangqiao Canal Bridge	Located at the river stake Q15+860, it is preliminarily determined to be a dangerous bridge. The bridge still has transportation needs and is planned to be demolished and rebuilt this time.
Ranzhuang Bridge	Located at the river stake Q17+150, the length and height of the bridge do not meet the requirements of the governance standards. At present, the village groups on both sides of the bridge have basically completed LA and relocation, and there is basically no transportation demand, and there is no planned road network on both sides. This time, it is planned to be demolished.
Nansi Bridge	Located at the river stake Q18+600, the length and height of the bridge do not meet the requirements of the governance standards. At present, the village groups on both sides of the bridge have basically completed LA and relocation, and there is basically no transportation demand, and there is no planned road network on both sides. This time, it is planned to be demolished.
Fengqi Road Bridge (Ranzhuang Bridge)	Located at the river stake Q19+432, the length and height of the bridge do not meet the requirements of the governance standards. At present, there is still traffic demand for this bridge. In combination with the road network planning of the ZEDZ, it is planned to demolish the bridge and rebuild it according to the planned Fengqi Road (urban main road) standard.

Based on the above analysis, the treatments of the existing 9 river crossing bridges are as follows:

(1)Reconstruction and renovation: 4 bridges including Qiancheng Avenue Bridge, Yangqiao Main Canal Bridge, Fengqi Road Bridge, and Shangdu Avenue Bridge; The cost of demolition and reconstruction is included in the investment of this project.

(2)Incorporated into the special handling of emergency rescue and disaster relief projects in Zhengzhou: 2 Longhai railway bridges; Not included in this project investment.

(3)Abandonment and demolition: 2 bridges, including Nansi Bridge and Ranzhuang Bridge; The demolition cost is included in the investment of this project.

3.10.2 Relocation and Construction of Other River Related Specialized Pipelines

In addition to the aforementioned river related bridges, culverts and water gates

within the scope of this project, a large number of relocation and renovation projects along the river, across the river, and across the river pipelines are involved due to the needs of river channel expansion, embankment withdrawal, reconstruction, and building layout.

According to the relevant requirements of engineering construction in Zhengzhou City, the investment estimate for the relocation and renovation of special river related pipelines will be compiled and included in the total estimated investment; Subsequently, with the deepening of the river management design, a special plan and design will be prepared for the relocation of special facilities, and with the construction of this river engineering project. The statistics of river related special pipeline projects and disposal plans are shown in the table below:

Table 3-3 List of River Related Special Pipeline Engineering and Disposal Plan

S/N	Property unit	Item	Type/Specification	Location	Pile number distribution and disposal methods	
1	Zhengzhou Zhengbian Heating Co., Ltd	Heating pipeline	1 truss erection, 1 buried pipeline	Crossing the River Upstream of Yangqiao Main Canal: Yangqiao to the right bank of Qiancheng Avenue	Q15+800 crossing the river; from Q15+800 to Q16+600 along the right bank of the river	Relocation
2	Zhengzhou East China Resources Gas Co., Ltd	Gas pipeline	2 medium pressure pipelines	Qiancheng Road to Nansi Bridge	Q16+580 Crossing the River; Q16+400 to 18+630 along the left bank of the river	Relocation
			1 channel for secondary high voltage and 1 channel for medium voltage	Downstream of Shangdu Avenue	Q20+250 to Q20+600 crossing the river: Q20+600 crossing the river	Relocation
3	Zhengzhou Public Security Bureau Long Distance Transmission Line Bureau	Long-distance optical cable, national defense optical cable	Buried optical cable 5 lines	Upstream and downstream of Shangdu Avenue	Crossing the River from Q20+300 to Q20+450	Relocation
4	Zhengzhou Environmental Protection Monitoring Center Station	Qili River Wansan Road Water Quality Automatic Monitoring Station	1 place	Upstream right bank of Wansan Road	Q20+900 Crossing the River	Relocation
5	Zhengzhou Municipal Bureau of Hydrology and Water Resources	Diliu Hydrological Monitoring Station	1 place	Left bank upstream of Wansan Road	Q20+900 Left Bank	Relocation
6	State Grid Zhengzhou Power Supply Company	High voltage/low voltage power lines	Multi-line	Multiple locations along the line	Multiple locations along and across the river	Compensation for relocation/inclusion of attachments

S/N	Property unit	Item	Type/Specification	Location	Pile number distribution and disposal methods	
7	Mobile, China Unicom, and telecommunications companies; Iron Tower Company	Communication cable	Multi-line	Multiple locations along the line	Multiple locations along and across the river	Relocation
8	Municipal Water Supply Company	Water supply line	Main line 1 place	Upstream of Wansan Road Bridge	Crossing the River near Q20+850	Protection during river construction
9	Yellow River Diversion Office of Zhongmou County Water Resources Bureau	Yangqiao Main Canal	1 inverted siphon;1 water gate	Upstream of Yangqiao Main Canal Bridge	Q15+850 Crossing the River	Renovation (see previous section)
10	Zhengzhou Public Utilities Investment and Development Group	Rainwater pipeline	1 rainwater inlet	Right bank downstream of Hua Stream	Q19+730 right bank	Relocation
11	Zhengzhou Public Utilities Investment and Development Group	Water transmission pipeline of the urban water system	1 underground pipeline	Huama Stream Gate to Wansan Road Section	Q18+830 to 19+970 along the right bank of the river; Crossing the river from Q19+970 to 20+300; Q20+300 to 20+920 along the left bank of the river	Protection during river construction
Note: The fourth item in the table above, the automatic water quality monitoring station for the Qili River Wansan Road, is an automatic station and does not belong to the municipal or national control section. It is a water quality assessment section for the Qili River.						

Based on the above analysis, the inverted siphon and outlet gate of the Yangqiao main canal, which are currently included in the 11 river related special pipelines, will be included in this project for renovation; The water pipe near Q20+850 crossing the river should be preserved and protected during construction; The remaining 9 river related special pipelines need to be relocated.

The pipeline relocation project of this project is a special project and included in the special cost. The project content and investment do not include the pipeline relocation project.

3.11 Ecological Restoration Engineering

This project integrates the construction of urban green spaces, river ecological green corridor, earthwork balance, investment conservation, and soil and water conservation needs. In combination with the urban road network green space planning and ecological green space planning of the ZEDZ, five adjacent river green spaces will be included in the scope of this project's governance, and the construction of the blue green line will be coordinated. Firstly, after completing the

LA and relocation of 5 green spaces, they will be used as soil storage areas for river engineering, and the earthwork balance will be completed nearby; Secondly, according to the standards of urban green space, terrain consolidation, greening, and facility supporting construction will be carried out, forming a riverside green corridor together with the ecological construction of the river.

5 green spaces are planned to be located between the Yangqiao Main Canal and the second Longhai Railway Bridge (Q16+000~Q19+700). Among them, the left bank is a single triangular green space with a distribution length of about 1,250m, the widest point of 470m, and an area of about 259,400m^2. The right bank is a four connected green space with a distribution length of about 4,380m, a width of 18-160m, and an area of about 263,500m^2.

According to the layout of this project, the total construction area of the Blue Green Line Ecological Green Corridor is 1.329 million m^2. Mainly including green land, building land occupation, garden roads and paving sites, and others. The specific situation is shown in the table below:

Table 3-4List of Land Use for Ecological Restoration Projects

Total area	Land type			Remarks
1,329,421m^2	Green land	1,037,537m^2	78.04%	/
	Building land occupation	1,230m^2	0.09%	Mainly including: ① 8 supporting service stations (2 primary stations, 4 secondary stations, and 2 mobile public toilets); ② Fitness facilities, various logos, small art works, etc
	Garden road and pavement site land	131,005m^2	9.85%	/
	Other land	159,649m^2	12.01%	Cultivated land

This project sets up a total of two primary service stations, namely the Yangqiao Main Canal Primary Station and the Hydraulic Dam Primary Station. The primary station functions include a sales office, bathroom, tool room, station management room, hydraulic dam related intelligent control room, duty room, command and dispatch room, pump room, monitoring and control room, diesel generator room, distribution room, etc.

4 secondary post stations, including toilets, self-service spaces, and rest spaces. Two smart and environmentally friendly public toilets, including smart toilets, smart control rooms, and rest and sales spaces.

The scope of ecological restoration project in this project is shown in the following figure.

Figure 3-2Ecological Restoration Project Scope

3.12 Construction Diversion

Diversion method: This project is a linear project with an open site, and construction is carried out in sections and simultaneously; Based on the location of the tributary confluence, flood control during the construction period of the control section should be carried out in sections.

The excavation of riverbank slopes and embankment filling will be carried out independently on both sides of the river. The existing river channel will be used for diversion, and there will be no new continuous diversion ditches. Individual buildings will be considered separately based on their own situation.

(1) Construction diversion of river bank slope and prevention engineering

The excavation of the riverbank slope and embankment filling were carried out independently on both sides of the river. The current river channel was used for diversion, with a bottom width of 60m. According to the calculation of uniform flow in the open channel during the non flood season, the depth of the 10 year flow is 0.41~0.48m.

(2) Main building construction diversion

A. Qili River Flood Diversion Sluice/Baishiguntang Stream Flood Control and Drainage Sluice/ Hua Stream Flood Control and Drainage Sluice

Use the existing Qili River embankment as a cofferdam, without the need for a new construction cofferdam.

B. Hua Stream Flood Control and Drainage Sluice

The reconstruction of the gate site is located 63m south of the existing water gate. A construction cofferdam will be built at the exit of the existing water gate on the side adjacent to the Qili River to block the backwater of the Qili River, and the existing water gate will be demolished simultaneously.

C. Hydraulic dam diversion

The hydraulic dam belongs to the full section building of the river, and it is planned to intercept the entire section at once. The construction method is to excavate a diversion ditch on one side of the river.

D.Yangqiao Main Canal Inverted Siphon

The inverted siphon belongs to the full section building of the river channel, and it is planned to adopt the method of half width diversion and half width cofferdam construction in the river channel, divided into two stages of diversion; The layout of the cofferdam will involve the construction of gas pipelines from upstream and downstream through the river channel, as well as the construction of the Yangqiao Main Canal Bridge.

E. Bridge construction diversion

The single span of the bridge project is 20m/25m, and the method of erecting a double arm steel cofferdam platform is used to solve the diversion problem.

3.13 General Construction Layout

3.13.1 Construction Camp Layout

1.Construction site

This project will arrange 2 construction campsites (including comprehensive processing plants, storage yards, warehouses, etc.) as needed, each covering an area of 1333.4m^2, totaling 2666.8m^2, all located within the blue line and LA green line. The area near the engineering area is already an urban built-up area, and no office area will be set up on this site. It can be solved by renting nearby residential buildings. There is no vehicle parking or maintenance area set up in the engineering area, and nearby social parking areas can be used.

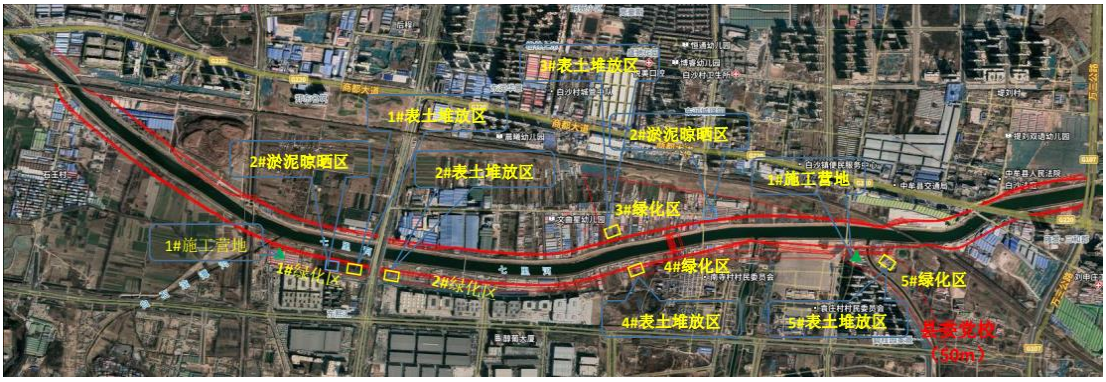


Figure 3-3Construction Camp Layout

2.Off site transportation

The engineering site has convenient external transportation. Building materials and construction machinery can be accessed through urban roads.

3.On site transportation

The transportation within the engineering site is mainly for the use of earthwork construction machinery. The construction roads are arranged on both sides of the river, with a total length of 13.6km on both sides and a width of 6m. The on-site roads are arranged within the design red line range and do not require additional temporary land occupation.

3.13.2 Earthwork Balance

The earthwork excavation volume is about 2.2425 million m^3, mainly including river excavation and dam gate construction excavation; The excavated earthwork is first used for embankment construction, dam gate foundation pit backfilling, etc. The filling volume is about 1.0849 million m^3, and the remaining earthwork (including topsoil and dredging) is about 1.5575 million m^3.

This project only involves dredging in local areas. Based on the comparison and analysis of the designed river bottom elevation and the current river bottom elevation in the longitudinal section design of the treated section, it can be seen that the dredging section is located in the sections with pile numbers Q16+550~Q16+600, Q19+100~Q19+200, and Q20+700~Q20+850, totaling about 300m. The dredging amount is about 40,000 m^3.

The main engineering design involves topsoil stripping of farmland, gardens, forests, and grasslands disturbed by construction in the area, with a stripping area of 29.6555hm^2. Based on the current situation of topsoil resources in the project area, a stripping thickness of 0.3m is designed, with a total topsoil stripping volume of 173,500 m^3, which is transported to the soil storage area for centralized storage. According to the project unified layout, the remaining earthwork is discarded and transported to the nearby 5 green spaces of the adjacent river for ecological landscape micro terrain shaping, with a consumption capacity of approximately 1.8527 million m^3. There is no outward transportation of earthwork, and the transportation distance of earthwork is mainly within the site.

3.14 Scheme Comparison and Selection

The project involves a long river course and complex geological conditions. When determining the river course plan, multiple schemes for river regulation were compared and selected. On the premise of meeting the layout of the embankment protection axis and technical standards, the design of structures along the line and the layout of embankment protection facilities should try to avoid permanent land occupation of collective land and state-owned land, and avoid LA and demolition.

In addition, compared to the original design scheme, the preferred scheme also adopts the following optimization measures:

(1)Pay attention to the comparison and selection of river training plans. The project involves a long river course and complex geological conditions. When

determining the river course plan, multiple schemes should be compared and selected. On the premise of meeting the layout of the embankment protection axis and technical standards, the design of structures along the line and the layout of embankment protection facilities should try to avoid permanent land occupation of collective land and state-owned land(SOL), and avoid LA and demolition.

(2)By further optimizing the setting of the longitudinal section of the river and the cross-sectional design of densely cultivated river sections, the land occupation of embankment projects is reduced and the amount of agricultural land occupied is reduced.

(3)Try to choose land saving design schemes and implementation methods for new embankments, dams, water gates, and other structures.

(4)For high slope river sections, various slope treatment schemes are compared and selected to reduce excavation of soil and rock while ensuring slope stability meets design requirements, saving land for bank protection and soil excavation.

(5)Optimize the design of horizontal and vertical section alignment. The rationality of the design scheme for the horizontal and vertical alignment of river channels directly affects the amount of filling and excavation during the implementation of river engineering. The horizontal and vertical section linear design of the river in this project is based on relevant technical standards and specifications, combined with the site selection and scale of river structures, reasonable selection of technical indicators, and detailed comparison and optimization. At the same time, while meeting functional requirements such as flood control, the design is optimized to select medium and low values as much as possible to achieve the best economic rationality of the project, while reducing the occupation of surrounding land and house demolition.

Table 3-5Measures to Reduce the Resettlement Impact during the Project Preparation

Project impact	Scheme 1	Scheme 2	Preferred scheme	Reduced resettlement impact
Green Line[3] LA	Set up 5 spoil areas within the green line and carry out ecological greening, with a permanent LA area of 52.295 ha.	There are 5 abandoned soil areas set up within the green line. Cultivated land will be reclaimed, while non cultivated land will be used for ecological greening. The temporary land use area is 52.295 ha.	Scheme 2	Reduce permanent LA by 52.295 ha and reduce the number of affected households.

[3] Green line refers to the control line of all kinds of green areas in the city.

Project impact	Scheme 1	Scheme 2	Preferred scheme	Reduced resettlement impact
Concentrated tomb relocation	About 1,500 graves will be relocated in two villages of Baisha Town in Zhengdongxin District.	Fine tune the blue line[4] planning for this section, no longer involving the relocation of a large number of graves.	Scheme 2	Reduce the relocation of about 1,500 centralized graves

Source: FSR

3.15 Associated Facilities

Special Section involving Longhai Railway: According to the three identification criteria of the ESF of the AIIB for Associated Facilities, the Special Section involving Longhai Railway is identified, and a resettlement DDR is required. The implementation of the Special Section will be implemented by relevant railway departments, which is not included in the FSR, design, and construction scope of this Project, and does not use AIIB loan funds. The railway special section only involves state-owned land (land for the Longhai Railway) occupying 123.58 mu, including 79.06 mu in Zhengdongxin District and 44.52 mu in ZEDZ. There are no affected individuals for the use of state-owned railway land. After the construction of the railway special section is completed, the land ownership will only change from state-owned railway land to state-owned land managed by Zhengzhou City, which will not increase the social risk of this project.

[4] Blue line refers to the water system protection scope, that is, the urban river and channel land planning control line at all levels, including the width of the river water body, the green belt on both sides and the dredging road.

4 Environmental and Social Baseline

4.1 Regional Context

4.1.1 Geographic Location and Administrative Divisions

Zhengzhou is the capital of Henan Province and an important transportation hub in China. It is located in the north-central part of Henan Province, in the middle and lower reaches of the Yellow River and the transition zone from Hebei to Huang-Huai Plain in the northeast of Funiu Mountains. It is connected to Kaifeng in the east, Luoyang in the west, Xinxiang and Jiaozuo across the Yellow River in the north, and Xuchang and Pingdingshan in the south. Its geographical position is between 112°42 '~ 114°14' east longitude and 34°16 '~ 34°58' north latitude.

Zhengzhou has jurisdiction over 6 municipal districts (Zhongyuan District, Erqi District, Guancheng District, Jinshui District, Shangjie District and Huiji District, among which Shangjie District is an enclave), 1 county (Zhongmu County), and 5 county-level cities (Gongyi City, Xingyang City, Xinmi City, Xinzheng City, Dengfeng City). The total area of Zhengzhou city is 7,446.2km^2, of which the urban area is 1,010.3km^2. The built-up area of the central city (including the airport Economic Comprehensive Experimental Zone) is 549.3km^2, and the urban built-up area is 830.97km^2, with an urbanization rate of 82%.By the end of 2022, the total population of the city has reached 12.828 million.

The project is located in Zhengzhou City, involving the ZEDZ, Zhengdongxin District and Zhongmou County. According to the "Main Function Zone Planning of Henan Province", the area where the project is located belongs to the national key development area and does not belong to the prohibited development area. The project is a flood control project, and the construction of the project will not damage the main function of the area, which is in line with the requirements of the Main Functional Area Planning of Henan Province.

4.1.2 Landform

Zhengzhou is located in the eastern Qinling residual vein, the transition zone of the second and third geomorphic steps in China. The overall terrain is high in the southwest and low in the northeast, descending in the form of a ladder. From the west and southwest of the structural erosion of the low mountains, gradually descending into structural denudation hills, loess hills, sloping plain and alluvial plain, forming a relatively complete geomorphic sequence. Among them, the middle and low mountains in the west and southwest are composed of Songshan Mountain and Skip Mountain respectively, which spread in the middle zone of the west and the edge of the southwest in an east-west direction nearly parallel. Songshan terrain elevation is 500-1200 meters, the relative elevation difference is 30-600 meters, forming Dengfeng, Xinmi and Gongyi, Xingyang natural boundary, its highest peak Yuzhai Mountain 1512.4 meters above sea level. The mountain terrain elevation is

generally 500-800 meters, the relative elevation difference is 200-400 meters, constituting the southwest boundary of Zhengzhou City; The structural denudation hills are located in the front of the middle and low mountains, with a topographic elevation of 200-500 meters and a relative elevation difference of 100-200 meters. Affected by the formation lithology, the distribution area of limestone and sandstone often forms the positive terrain of the garden mountain, while the distribution area of shale and mudstone mostly forms the relatively low-lying negative terrain. Loess hills are located in the northwestern and north-central areas of the region, with a topographic elevation of 200-300 meters and a relative elevation difference of 30-150 meters. The ground is crisscrossed with gullies and the terrain is fragmented. The sloping plain is located in front of the hills, and the nearly north-south strip spreads in the central region. Terrain elevation of 100-150 meters, from west to east, longitudinal from the front of the hill to the downstream is inclined, the slope is generally 3-10 degrees, from south to north, the horizontal is the wavy undulating shape of alternating posts; Alluvial plain is widely distributed in the eastern region, formed by the Yellow River alluvial, flat terrain, ground elevation 80-100 meters, sloping from northwest to southeast.

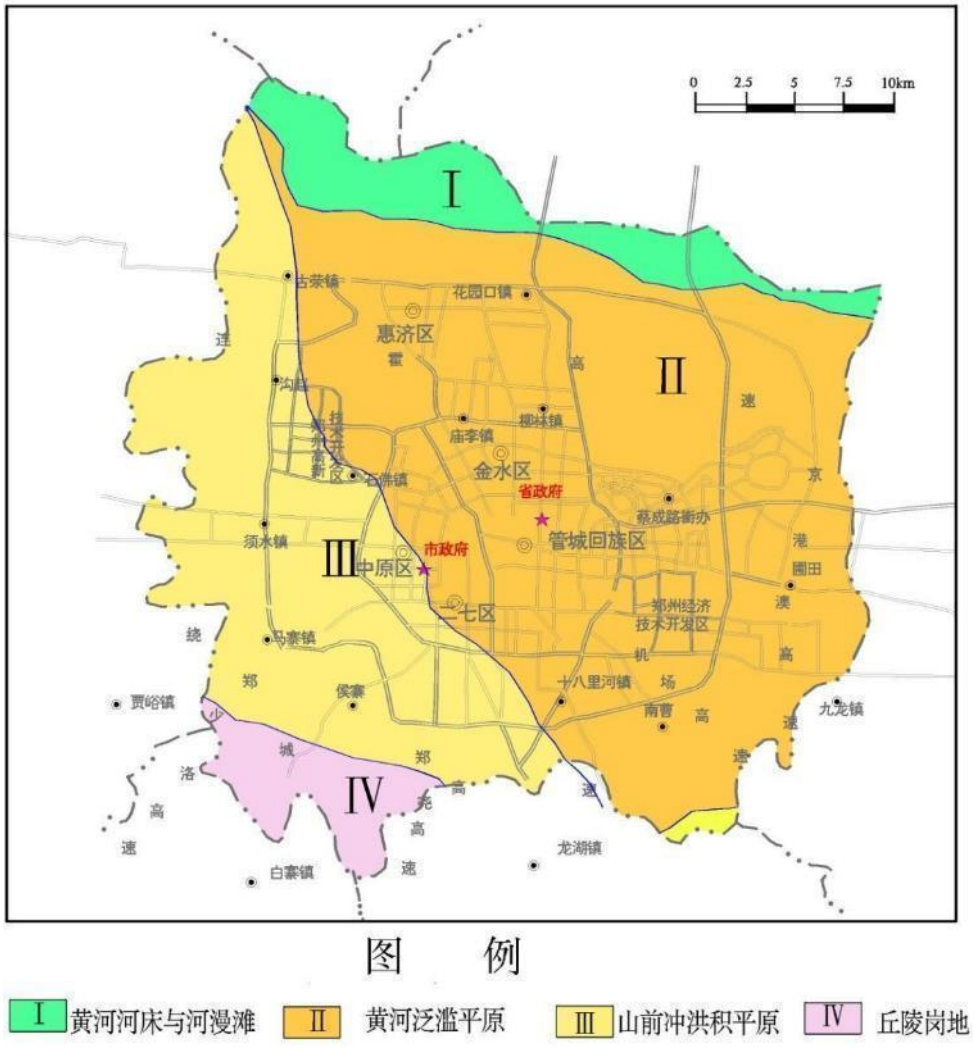


Figure 4-1Geomorphological Map of Zhengzhou

4.1.3 Soil

Zhengzhou soil belongs to warm temperate deciduous broadleaved forest arid forest grassland brown soil brown land belt - hilly loess area in northwest Henan. The land surface is covered with alluvium and alluvium of Quaternary system, and the local area is aeolian. Its soil characteristics are mainly sandy and tidal soil. In the north of Longhai Line, soft and hard plastic subclay and sub sandy soil are dominant. In the south of the Longhai line, it is mainly composed of wet sandy soil, wet and semi-dry hard loess-like sub-sandy soil and sub-clay. Silty sub clay is distributed in local riverbed, floodplain and fish pond. The whole surface soil is loose. The northern and eastern regions are connected with the modern flood plain of the Yellow River. The soil is fertile and the surface is mostly turned into farmland and fish ponds. In the southern region, the soil is relatively poor and the surface is mostly dry land and orchards. In winter, the frozen soil depth is less than 20cm.

4.1.4 Climate

Zhengzhou area is a continental warm tropical monsoon climate, the temperature changes greatly. Summer is hot and rainy, winter is cold and dry, four distinct seasons. The average annual temperature is 14.9℃, the average temperature in July is 27.8℃, and the extreme maximum temperature is 43.3℃.The average temperature in January is minus 0.3℃, and the extreme minimum temperature is minus 17.9℃.The average annual rainfall is 640mm.Most of the rainfall is in the summer. The maximum annual rainfall is 866.8mm and the minimum annual rainfall is 439.3mm.The maximum snowfall thickness is 150mm and the maximum snowfall thickness is 230mm.Maximum freezing depth 270mm in previous years. The average annual evaporation is 2048.8mm, with the highest being 341.4mm in June and the lowest being 80.5mm in January. Frost-free period is from October to April, but in plain areas, frost-free period can last for more than 200 days. The northeast wind and southeast wind are the most frequent throughout the year, with an average wind speed of 2.5m/s and a maximum wind speed of 24m/s. The annual sunshine hours are 4430.7h, and the average sunshine hours are 2189.5~2352.2h.

The annual average rainfall is 644.55mm, and the maximum precipitation is 990.6mm (1983). The annual rainfall mainly concentrates in June to September, accounting for about 60% of the annual rainfall. Spatial precipitation distribution is not uneven, the general trend is from southwest to northeast decreasing year by year; The average annual evaporation is about 1850mm.

4.1.5 Geological Structure and Earthquake

The project area is located in the southwest of the Huang-Huai-Hai Depression (I2) of the North China quasi-platform (I). The neotectonic zone belongs to the Henan - Anhui uplift - depression zone (III), and the direction of the main tectonic line is northwest or nearly east-west. The main fault structures in the site include: Jiangang fault, Zhengzhou-Kaifeng fault, Laojiaochen fault and Xushui fault zone.

4.1.6 Hydrology

There are 35 big and small rivers in Zhengzhou, which belong to the Yellow River and the Huai River. Among them, the Yellow River system includes Yiluo River, Sishui River, Gu River, etc., covering an area of 1,878.6 km^2, accounting for 25.2% of the total area of the whole territory; The Huaihe River system has Yinghe, Shuangji River, Jia Lu River, Suoxu River, Qili River, Chaohe, Xiaoqing River, Jinshui River, Xiong Ear River and Dongfeng Canal and other rivers, the basin area of 5567.6 km2, accounting for 74.8% of the total area of the entire territory.

The Qili River is located in the southeast of the main city of Zhengzhou, and is the largest tributary on the right bank of the Jialu River in the city. It belongs to the Shaing River system in the Huaihe River basin, and is called the Qili River after the confluence of the Eighteen Mile River and the Seventeen Mile River in the south side of the Bai Zhuang community in Zhengdong New District, flowing through the Zhengzhou Economic Development Zone, Zhengdong New District and Zhongmou County, and merging into the Jialu River on the east side of the Wan San Highway. There are 9 main tributaries, including the Seventeen Mile River, Eighteen Mile River, Dongfeng Ditch, Jinshui River, Xiong'er River, Chao River, Baishiguntan Ditch (Long Ditch), Huamagou (Feng River), and Huaxi.

There are 2 small (1) type reservoirs along the river of tributary seventeen miles: Luo Pangong Reservoir and Lin Jindian Reservoir; 3 small (1) type reservoirs along the river of tributary eighteen miles: Shan Hou Du, Gucheng, Liuwan Reservoir, 1 medium-sized reservoir: Hou Hu Reservoir; 3 small (1) type reservoirs along the river of tributary Chao River: Xiao Fanzhuang, Xiao Wei Zhuang, Cao Gusi Reservoir.

Qili River Basin parameters are detailed in Table 4-1, and the summary information of medium and small reservoirs in the basin is detailed in Table 4-2.

Table 4-1 Qili River Basin Parameters Table

River	Area	Watershed area (km^2)	Inter-district River Manager (km)
Qili River	The confluence of the Shiqili River and the Shibali River	202.9	
	Under the mouth of Dongfeng Drainage	389.4	8.8
	Below the mouth of the Chao River	583.8	3.9
	Below the mouth of Baishiguntan Gully	638.7	3.35
	Below the mouth of the Huama Gully	697.7	2.8
	Below the mouth of Huaxi	730.3	0.65
	On the mouth of the Jalu	737	2.55

River	Area	Watershed area (km^2)	Inter-district River Manager (km)
	River		
	Total	737	22.1

Table 4-2 Summary of Information on Medium and Small Reservoirs in the Basin

Water system	River	Reservoir	Category	Basin characteristics	
				Area (km^2)	Length of river (km)
Qili River	Jinshui River	Guojiazui	Small (1)	13.15	5.8
	Shibali River	Houhu	Medium	37.1	8.93
		Liuwan	Small (1)	12.4	6.93
	Shiqili River	Luodong	Small (1)	33.5	10.13
		Linjindian	Small (1)	6.5	2.21
	Chao River	Xiaofanzhuang	Small (1)	31.2	11.73
		Xiaoweizhuang	Small (1)	46.2	9.77

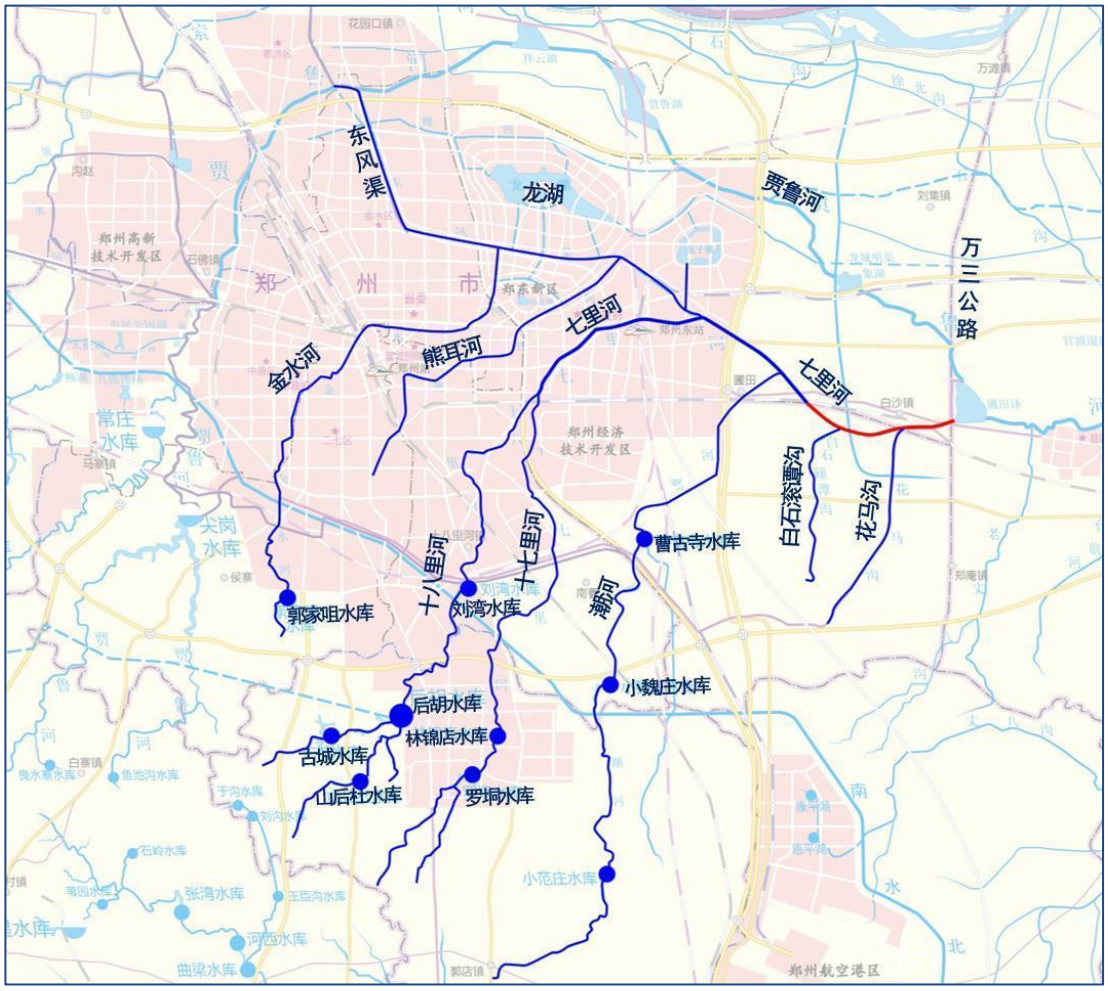


Figure 4-2Water System Map of Jinshui River in Zhengzhou

4.1.7 Water Resources Situation

According to the Water Resources Bulletin of Zhengzhou 2020, the total water resources of Zhengzhou will be 859.12 million meters in 2020^3, including surface water resources of 527.36 million meters^3, groundwater resources are 543.72 million m^3, the double calculation of surface water and groundwater is 211.96 million m^3.In 2020, Zhengzhou's total water supply will be 2.07365 billion m^3, of which surface water supply is 1,093.15 million m^3, groundwater supply is 583.51 million m^3, the water supply of other sources (sewage reuse and rainwater utilization) is 396.98 million m^3.The total amount of water used in 2020 is 2.0736.65 billion m^{3}Of which domestic water consumption is 734.1 million m^3, agricultural water consumption was 391.04 million m^3, industrial water consumption was 439.32 million m^3, and the water consumption for ecological environment was 509.18 million m^3.

4.1.8 Cultural relics and historic sites

Zhengzhou is an important birthplace of Chinese civilization, a national historical and cultural city, one of the eight ancient capitals of China and one of the six national Great Heritage Relics. Zhengzhou has been the ancient capital of five Dynasties, and is the hometown of Huangdi Xuanyuan, the ancestor of Chinese culture. It has nearly 10,000 immovable cultural relics, and 72 key cultural relics are under national protection. There are more than 10 national cultural relics in Zhengzhou city, such as the ruins of Xiaoshuangqiao, the ruins of Grandma Temple, the ruins of the mall, and the twin towers of the Temple. Provincial-level protected cultural relics include Baizhai remains, Baoji Zhai, Ye Wang site, Dazhai site, school cemetery and so on.

The project is located in the economic development District of Zhengzhou City, Zhengdong New District, the end of the project involves a small range of Zhongmou County. According to the site investigation, no cultural relics exist within 500 meters around the project.

4.2 Socioeconomic Baseline

4.2.1 Socioeconomic Overview of the Project Area

Zhengzhou: Located at the east foot of Songshan Mountain and on the bank of the Yellow River, Zhengzhou is a national central city explicitly supported by the state and a core growth pole of high-quality development region. It has jurisdiction over 6 districts, 5 cities and 1 county, Zhengzhou airport Economic Comprehensive Experimental Zone, Zhengzhou Economic and Technological Development Zone, Zhengzhou High Tech Industrial Development Zone and other national functional zones and Zhengdongxin District. The total area of the city is 7,567 square kilometers, with a built-up area of 744.15 square kilometers in the central urban area and 1,342.11 square kilometers in the urban area. At the end of 2022, the permanent population of the city was 12.828 million, with an urbanization rate of 79.4%.

In 2022, Zhengzhou achieved a GDP of CNY 1,293.47 billion, an increase of 1.0% compared to the previous year at constant prices. Among them, the added value of

the primary industry was CNY 18.56 billion, an increase of 3.7%; The added value of the secondary industry was CNY 517.46 billion, an increase of 2.0%; The added value of the tertiary industry was CNY 757.45 billion, an increase of 0.2%. The tertiary industrial structure is 1.4:40.0:58.6. The PCDI of residents for the year was CNY 41,049, an increase of 3.9% compared to the previous year; Among them, the PCDI of urban residents was CNY 46,287, an increase of 2.3%; The PCDI of rural residents was CNY 28,237, an increase of 5.4%.

According to the project FSR, the construction content of the project involves ZEDZ, Zhengdongxin District, and Zhongmou County. The following is the social and economic overview of the three districts/counties:

(1)ZEDZ Socioeconomic Overview

ZEDZ was established in 1993 and was approved as the first national level economic and technological development zone in Henan Province in 2000. The planned control area extends to New 107 National Highway in the east, Airport Expressway in the west, Fushan Road in the south, and Longhai Railway in the north, covering an area of 158.7 square kilometers. Manage two county-level professional parks, namely the Economic Development Comprehensive Bonded Zone and the International Logistics Park, with 6 sub-districts and 78 villages (communities) under its jurisdiction. As of the end of 2021, there were 342,600 permanent residents.

In 2021, the regional GDP reached CNY 123.45 billion, a year-on-year increase of 5.7%; The added value of industries above designated size reached CNY 60.85 billion, a year-on-year increase of 4.4%; Fixed assets investment reached CNY 48.33 billion, up 0.8% year on year; The total retail sales of consumer goods reached CNY 48.26 billion, a year-on-year increase of 4.0%; The general public budget revenue reached CNY 10.135 billion, a year-on-year increase of 1.03%.

(2)Zhongmou County Socioeconomic Overview

Zhongmou County is located in the central eastern part of Henan Province, with a total area of 917 square kilometers and jurisdiction over 10 townships, 4 sub-districts, and 274 administrative villages. At the end of 2021, the permanent population of the entire county was 708,000, an increase of 5,300 compared to the end of the previous year, including 439,200 urban permanent residents; The urbanization rate of the permanent population is 62.03%.

In 2021, the county's grain planting area was 457,000 acres. According to preliminary calculations, the total regional GDP of the entire county for the year was CNY 44.82 billion, an increase of 1.8% compared to the previous year, and an average increase of 1.4% over the past two years. Among them, the added value of the primary industry was CNY 3 billion, an increase of 3.1% compared to the previous year; The added value of the secondary industry is CNY 11.54 billion, a decrease of 9.5% compared to the previous year; The added value of the tertiary industry is CNY 30.28 billion, an increase of 6.5% compared to the previous year.

The tertiary industrial structure is 6.7:25.7:67.6. The PCDI of residents in the entire county for the year was CNY 29,271.0, an increase of 6.5% compared to the previous year. According to permanent residence, the PCDI of urban residents is CNY 35,825.7, an increase of 6.0%; The PCDI of rural residents was CNY 24,186.0, an increase of 8.3%.

(3)Zhengdongxin District Socioeconomic Overview

Zhengdongxin District is located in the eastern part of Zhengzhou City and started construction in January 2003. At present, it has a jurisdiction area of 260 square kilometers and a planned control area of 370 square kilometers. It has jurisdiction over 12 towns/townships/sub-districts and 3 parks (Zhongyuan Science and Technology City, Central Business District, and Baisha Park), with a built-up area of over 113 square kilometers. At the end of 2021, there were 960,200 permanent residents.

In 2021, the total regional GDP reached CNY 127.03 billion, a year-on-year increase of 4.8%, ranking second in the city in total; Fixed assets investment reached CNY 57.5 billion, down 17.5% year on year; The general public budget revenue was CNY 12.454 billion, a year-on-year increase of 0.28%, tax revenue was CNY 11.29 billion, and the total retail sales of consumer goods were CNY 60.07 billion, a year-on-year increase of 6.9%.

Table 4-3List of the Main Indicators of the Socioeconomic Development of the Project Districts and counties(2021)

Statistical indicators	Zhengzhou City	Zhengdongxin District	ZEDZ	Zhongmou County
Area (km^2)	7,567	370	158.7	917
Permanent resident population at the end of the year (ten thousand people)	1,274.2	96.02	34.26	70.8
Female population (ten thousand people)	620.23	48.16	15.11	33.58
The urbanization rate of permanent residents(%)	79.1	86.31	87.49	62.03
Urban and rural residents enjoy the MLS (person)	49,000	1,336	474	2,436
PCDI(CNY / person)	39,511	43,130	44,424	29,271
Regional GDP(100 million)	12,691	1,270.3	1,234.5	448.2
GDP speed increase(%)	4.7	4.8	5.7	1.8
Three industrial structure	1.4 : 39.7 : 58.9	/	/	6.7:25.7:67.6

Source: 2021 Zhengzhou Population Development Report, Statistical Bulletin on National Economic and Social Development of Each Project Area, and Gender Composition of the Population from the Seventh National Population Census Bulletin of Zhengzhou City

Table 4-4List of Main Indicators for the Socioeconomic Development of Towns/Sub-districts Affected by the Project(2022)

Districts /counties	Town / sub-district	Area (km^2)	Number of villages / communities	Permanent resident population (ten thousand people)	Cultivated land area (mu)	PCDI of urban residents (CNY/person)	PCDI of rural residents(CNY/person)
Zhengdongxin District	Baisha	64	28	17.8	9,200	51,514	32,881
ZEDZ	Qiancheng	36	18	3.7	8,646	48,300	27,800
	Jinghang	26	9	3.4	4,686	49,120	28,400
Zhongmou County	Guanghui	39	18	13.2	7,945	36,650	25,492

Source: Towns / sub-districts

Table 4-5List of Main Indicators of Socioeconomic Development of Villages / communities(2022)

Districts /counties	Town / sub-district	Villages	Total number of HHs	Total population	Female population	CL area (mu)	Per capita CL(mu)	PCDI(CNY/person)
Zhengdongxin District	Baisha	Kangzhuang	742	3,305	1,581	1,719	0.52	32,800
		Dayong	608	2,840	1,368	1,221	0.43	32,000
		Qiancheng	900	3,500	1,640	1,575	0.45	26,000
		Baisha	1604	6,412	3,045	4,168	0.65	29,300
		Diliu	630	2,726	1,348	1,445	0.53	31,570
ZEDZ	Qiancheng	Hanzhuang	582	3,771	1,752	1,659	0.44	32,800
		Ranzhuang	663	2,336	1,406	1,215	0.52	26,500
		Nansi	603	2,213	1,040	3,319	1.5	28,000
		Yuanzhuang	418	2,638	1,316	1,715	0.65	29,500
	Jinghang	Shiwang	213	1,862	910	987	0.53	26,700
		Jiangchong	950	6,600	3,210	4,092	0.62	28,000
Zhongmou County	Guanghui	Liushenzhuang	610	2,807	1,380	730	0.26	26,000

Source: Towns / sub-districts
Note:CL=Cultivated land

4.2.2 Population Situation

According to the 2021 Zhengzhou Population Development Report, the city's permanent population at the end of 2021 was 12.742 million, an increase of 125

thousand people compared to the end of 2020. In 2021, the permanent population of the city accounted for 12.89% of the total permanent population in the province, an increase of 0.20 percentage points compared to the end of 2020. The total number of permanent residents in the city ranks 11th in the country. At the end of 2021, among the permanent population in the city, the population living in urban areas was 10.079 million, accounting for 79.10% of the permanent population. The proportion of urban population increased by 0.70%, which is 14.38% and 22.65% higher than the national 64.72% and the provincial 56.45%, respectively.

At the end of 2021, the permanent population of Zhengzhou City aged 0-14, 15-64, and 65 and above were 2.356 million, 9.225 million, and 1.161 million, respectively, accounting for 18.49%, 72.40%, and 9.11% of the permanent population. In 2021, the per capita education period for permanent residents aged 15 and above in the city reached 11.83 years.

According to the results of the 7th National Population Census, on November 1, 2020 at 0:00, out of the 12.606 million permanent residents in the city, the male population was 6.4672 million, accounting for 51.32%; The female population is 6.1334 million, accounting for 48.68%. The sex ratio of the total population was 105.44, slightly higher than 105.17 of the 6th national population census in 2010.

According to the statistical bulletin of Zhengzhou City and various districts and counties, as of the end of 2021, the basic population situation of each project district and county is shown in the table below.

Table 4-6List of the Population Conditions of the Project Area(2021)

Demographic indicators	Zhengzhou City	Zhengdongxin District	ZEDZ	Zhongmou County
Total population at the end of the year (ten thousand people)	1,274.20	96.02	34.26	70.8
Sex ratio of the permanent resident population	105.44	99.37	126.8	110.87
Rural population (ten thousand people)	266.3	13.15	4.29	26.88
Urban population (ten thousand people)	1,007.9	82.87	29.97	43.92
The urbanization rate of permanent residents(%)	79.10	86.31	87.49	62.03

Source: 2021 Zhengzhou Population Development Report, Statistical Bulletin on National Economic and Social Development of Each Project Area, and Gender Composition of the Population from the Seventh National Population Census Bulletin of Zhengzhou City

4.2.3 Population Situation of EM

Zhengzhou is a typical city with scattered ethnic minorities and is the third batch of demonstration cities for the service and management of ethnic minority floating population in China. As of the end of 2021, there are 53 ethnic minorities in the city, including Hui, Manchu, Mongolian, Zhuang, and Tujia. The permanent population of ethnic minorities is 155 thousand, including 109 thousand urban residents. There are 6 counties (cities, districts) with a population of over 10000 ethnic minorities, and 51

townships (towns, offices) with a population of over 1000 people. There are 14 ethnic primary and secondary schools. These are not within the project area.

With the cooperation of Zhengzhou Water Resources Bureau, sub-district offices/township governments, village committees, etc., the ESIA preparation unit conducted an on-site survey in March 2023, in accordance with the identification standards determined in the ESF of the AIIB's ESS3- Guidelines for Ethnic Minorities, to obtain a detailed understanding of the population and ethnic composition of each project area, the identification of ethnic minority villages, and to confirm whether ethnic minorities are living together.

This project involves 12 villages/communities in 4 towns/sub-districts of 3 districts and counties, including ZEDZ, Zhengdongxin District, and Zhongmou County. The total population of the 12 villages/communities along the river is about 41 thousand, including 13 ethnic minority populations. The EMs along the project are scattered and mixed Hui ethnic groups, accounting for 0.03% of the total population. There are no EM populations living in the project area. The EM population is small and scattered, with most of them settling in the project area due to marriage and job transfer.

EMs and Han people in the project area enjoy equal social and public services. In terms of social welfare, rights, security, cultural customs, and living habits, there is no difference from the mainstream group of Han people in the project area. The proposed project will not have any negative impact on the EM population.

Table 4-7List of EM Population in the Project Area

Project area	Town / sub-district	Villages	Total population	EM population	The proportion of the EM population(%)	Population composition of EM
Zhengdongxin District	Baisha	Diliu	2,726	1	0.04%	Hui
ZEDZ	Qiancheng	Ranzhuang	2,336	1	0.04%	Hui
	Jinghang	Jiangchong	6,600	11	0.17%	Hui
12 project villages / communities	/	/	41,010	13	0.03%	Hui

Source: Provided by each village/community, except for the three villages/communities listed in the table above, there are no ethnic minority populations in the other 9 project villages/communities.

The identification survey of ethnic minorities found that:

(1)There are no EM groups that trigger the ESS3 criteria in this project.

(2)The population of EMs within the scope of project construction is very small, without EM traditional territories, languages and cultures, and there are no EMs who consider themselves to be integrated.

Therefore, there is no need to prepare a EMDP for this project.

Table 4-8Identification of EM(ESS3)

Criterion of Identification	Yes	No	Remarks
1.Self identification as a member of a unique indigenous cultural group and recognized by others?		X	All respondents, including EMs and Han, believe that there is no difference between local EMs and Han, and they are fully integrated with Han people.
2.Collective attachment to geographically different habitats or ancestral territories within the project area, as well as the natural resources of these habitats and territories?		X	
3. A customary cultural, economic, social, or political system that differs from mainstream society and culture.		X	
4. A unique language, usually different from the official language of a country or region.		X	They speak local dialects and Mandarin Chinese, fully integrated with the Han people.

4.2.4 Socioeconomic Sampling Survey

During the socioeconomic survey process, the ESIA preparation unit completed a total of 261 HH sampling survey questionnaires. In 261 survey samples, the male to female ratio was 56.7:43.3, with 148 and 113 individuals respectively; The total population of 261 sample HHs is 1,186, with an average HH population of 4.54.

Table 4-9 Survey Sample Distribution

Districts /counties	Zhengdongxin District	ZEDZ	Zhongmou County	Total	Total number of project villages	Sampling ratio
Sampling number of villages	3	3	1	7	12	58.33%
Number of sample HHs	111	98	32	261	8,523	3.06%
Sample HH population (person)	499	470	157	1,186	41,010	2.89%
Average HH population (person)	4.50	4.80	4.91	4.54	4.60	/

Source: field survey

Among the 261 survey samples, there are 259 Han people, accounting for 99.23%, and 2 Hui people, accounting for 0.77%; There are 34 low-income HHs, accounting for 13.03%.

The basic information of the sample HHs is as follows:

Table 4-10 Basic Information of the Sample Family

Index		Zhengdongxin District		ZEDZ		Zhongmou County		Total	
		Quantity	Proportion	Quantity	Proportion	Quantity	Proportion	Quantity	Proportion
Sex	Male	59	53.15%	61	56.48%	28	66.67%	148	56.70%
	Female	52	46.85%	47	43.52%	14	33.33%	113	43.30%
Age	Average	51.2	/	52.4	/	54.1	/	52.2	/
	20-39	11	9.91%	6	5.56%	9	21.43%	26	9.96%
	40-59	68	61.26%	59	54.63%	23	54.76%	150	57.47%
	60 And above	32	28.83%	43	39.81%	10	23.81%	85	32.57%
Education level	Primary school and below	15	13.51%	19	17.59%	10	23.81%	44	16.86%
	Junior high school	40	36.04%	33	30.56%	15	35.71%	88	33.72%
	Senior high school	37	33.33%	39	36.11%	13	30.95%	89	34.10%
	College degree or above	19	17.12%	17	15.74%	4	9.52%	40	15.33%
Occupation	Farmer	15	13.51%	16	14.81%	18	42.86%	49	18.77%
	Enterprise employees	41	36.94%	32	29.63%	12	28.57%	85	32.57%
	Business	11	9.91%	8	7.41%	2	4.76%	21	8.05%
	Work in government agencies and institutions	16	14.41%	12	11.11%	3	7.14%	31	11.88%
	Others	28	25.23%	40	37.04%	7	16.67%	75	28.74%
Per capita income (CNY)	Under 10,000	0	0.00%	1	0.93%	3	7.14%	4	1.53%
	10,000-20,000	12	10.81%	15	13.89%	19	45.24%	46	17.62%
	20,000-40,000	47	42.34%	41	37.96%	14	33.33%	102	39.08%
	40,000-60,000	34	30.63%	38	35.19%	4	9.52%	76	29.12%
	More than 80,000	18	16.22%	13	12.04%	2	4.76%	33	12.64%

Source: field survey
Note: "Others" professions include retirement, freelance employment, and flexible employment.

From the on-site investigation, it can be seen that due to the fact that the project area is mainly located around the urban area, only 49 people (18.77%) of the respondents are engaged in agricultural production activities, and the average proportion of agricultural income to total household income is only 7.5%. Local residents no longer rely on land for livelihood, and labor, business, and other non agricultural income have become their main sources of income. The PCDI of 261 sample HHs is about CNY 32,849.

4.3 Baseline of Environmental Quality

The baseline environmental quality data mainly come from surface water, substrate, sound environment and air quality monitoring conducted by Henan Borui Chengcheng Testing Service Co., Ltd. from April 8 to April 10, 2023. The monitoring points are shown in the figure below.

Figure 4-3The Project Monitoring Point Map

4.3.1 Status M&E of Surface Water Environmental Quality

In accordance with the requirements of Technical Guidelines for Environmental Impact Assessment - Surface Water Environment (HJ2.3-2018), Henan Borui Chengcheng Testing Service Co., Ltd. has set control section and control section respectively on the Qili River from April 8 to April 9, 2023. A total of 3 sections have been sampled and monitored (see sections 1#, 2# and 3# in Table 4-11). Monitoring factors include pH value, dissolved oxygen, chemical oxygen demand, five-day biochemical oxygen demand, total phosphorus, total nitrogen, ammonia nitrogen, permanganate index, volatile phenols, anionic surfactants, sulfides, petroleum, copper, zinc, lead, mercury, arsenic, selenium, cadmium, hexavalent chromium.

Table 4-11List of Monitoring Section Locations

Surface wate	Section name	Location	Function
Qili River	1# Section	1# 100m downstream of Qili River flood control and improvement project	Control section of upper reaches
	2# Section	2# The middle section of Qili River flood control and improvement project	Control section
	3# Section	3# 500m upstream of Qili River flood control and improvement project	Control section of lower reaches

Table 4-12Monitoring Results of Surface Water

Unit: mg/L (except pH)

Detection factor	Section name	Results		Standard limits
		2023-04-08	2023-04-09	
pH	1# Section	8.5	8.6	6~9
	2# Section	8.7	8.7	
	3# Section	8.9	8.9	
DO	1# Section	8.7	8.5	≥3
	2# Section	8.3	8.6	
	3# Section	8.5	8.4	
COD	1# Section	16	18	≤30
	2# Section	12	15	
	3# Section	18	17	
BOD_5	1# Section	3.8	3.7	≤6
	2# Section	3.5	3.3	
	3# Section	3.3	3.2	
Ammonia nitrogen	1# Section	0.325	0.345	≤ 1.5
	2# Section	0.310	0.284	
	3# Section	0.234	0.260	
Total nitrogen	1# Section	0.80	0.76	≤ 1.5
	2# Section	0.72	0.66	
	3# Section	0.52	0.56	
Total phosphorus	1# Section	0.14	0.15	≤0.3
	2# Section	0.12	0.11	
	3# Section	0.11	0.10	
Permanganate index	1# Section	4.8	4.6	≤ 10
	2# Section	3.8	3.7	
	3# Section	3.3	3.1	
Volatile phenols	1# Section	Not Detected	Not Detected	≤0.01
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Anionic surfactant	1# Section	Not Detected	Not Detected	≤0.3
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Sulfide	1# Section	Not Detected	Not Detected	≤0.5
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Oil class	1# Section	Not Detected	Not Detected	≤0.5
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Copper	1# Section	Not Detected	Not Detected	≤ 1.0
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Zinc	1# Section	Not Detected	Not Detected	≤2.0
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Lead	1# Section	Not Detected	Not Detected	≤0.05
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Mercury	1# Section	Not Detected	Not Detected	≤0.001
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Arsenic	1# Section	0.0124	0.0090	≤0. 1
	2# Section	0.0106	0.0077	
	3# Section	0.0101	0.0086	
Selenium	1# Section	Not Detected	Not Detected	≤0.02

Detection factor	Section name	Results		Standard limits
		2023-04-08	2023-04-09	
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Cadmium	1# Section	Not Detected	Not Detected	≤0.005
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	
Hexavalent chromium	1# Section	Not Detected	Not Detected	≤0.05
	2# Section	Not Detected	Not Detected	
	3# Section	Not Detected	Not Detected	

It can be seen from Table 4-12, the monitoring of each monitoring factor at the three cross-sections set up in Qili River shows that the current water quality of Qili River can meet the requirements of "Surface Water Environmental Quality Standard" (GB3838-2002) Ⅳ standard limit.

4.3.2 Current M&E of Ambient Air Quality

According to the functional zoning of ambient air quality, the project area belongs to the second class functional area, and the second class standard of Table 1 of Ambient air quality standards (GB3095-2012) shall be implemented. This evaluation quotes the relevant data from Zhengzhou Environmental Quality Status Bulletin in 2022, and the current status of regional air quality in 2022 is shown in the table below.

Table 4-13Evaluation of Ambient Air Quality Status in Zhengzhou City in 2022

Pollutant	Evaluation indicators for the year	Status quo concentrations (μg/m³)	Standard limits (μg/m³)	Attainment of standards
$PM_{2.5}$	Annual average mass concentration	45μg/m³	35μg/m³	below target
PM_{10}	Annual average mass concentration	77μg/m³	70μg/m³	below target
SO_2	Annual average mass concentration	8μg/m³	60μg/m³	on target
NO_2	Annual average mass concentration	27μg/m³	40μg/m³	on target
CO	24-hour average 95th percentile	1.3mg/m³	4mg/m³	on target
O_3	8-hour average 90th percentile	178μg/m³	160μg/m³	below target

Henan Keren Technology Co., Ltd. 0371-66857887

As can be seen from the above table, among the six basic pollutants in Zhengzhou City, except for the annual average concentrations of SO2 and NO2 and the 95th percentile concentration of CO, the annual average concentrations of PM2.5 and PM10 and the 90th percentile concentration of O3 exceed the secondary ambient air quality standard. Therefore, according to the "Technical Guidelines for Environmental Impact Assessment-

Atmospheric Environment" (HJ2.2-2018), the area where this project is located is a non-attainment area.

According to the "Zhengzhou Municipal People's Government Office on the issuance of Zhengzhou City "14th Five-Year" ecological environmental protection planning notice" Zheng Zheng Zhengban [2022] 42, during the 14th Five-Year Plan period, the "control of greenhouse gas emissions, and actively respond to climate change, strengthen the synergistic control, improve the quality of the atmospheric environment "and other measures will be taken to achieve the following major goals: by 2025, the ecological environment will continue to improve, structural adjustment will be promoted, the level of green and low-carbon development and green life will be significantly enhanced, the ecosystem will be more stable, the awareness of ecological civilization in the whole society will be significantly enhanced, the modernization of ecological environmental governance system and governance capacity will be initially realized, ecological environmental protection will be taken to a new level, and the construction of beautiful Zhengzhou will have made significant progress. The construction of beautiful Zhengzhou has made obvious progress. The process of attaining air quality standards has been accelerated, the annual average concentration of PM2.5 has been reduced to 40 micrograms per cubic meter, and heavily polluted weather has been basically eliminated.

The ambient air monitoring factors are 24-hour average TSP and PM2.5. According to the geographical environment condition and the characteristics of the project, three points were set up, which were monitored by Henan Borui Chengcheng Testing Service Co., Ltd. from April 8 to April 10, 2023, for 3 consecutive days.

Table 4-14Monitoring Locations of Ambient Air Status

Project	Monitoring point	Bearing and distance
Ambient air	1#	500m upwind of the project site
	2#	Side wind direction of the project site (Jindi Mingyue)
	3#	500m downwind of the project site

Table 4-15List of Meteorological Parameters

Date	Weather	Wind Direction	Wind speed (m/s)	Temperature(℃)	Barometric pressure
2023-04-08	Sunny	no sustained wind direction	2.7	17.1	100.3
2023-04-09	Sunny	no sustained wind direction	3.0	20.5	100.0
2023-04-10	Sunny	no sustained	1.8	21.2	99.9

		wind direction			

Table 4-16Results of Evaluation of Ambient Air Status

Section name	Detection factor	Monitoring period	Results			Standard limits (μg/m^3)
			2023-4-8	2023-4-9	2023-4-10	
1# 500m upwind of the project site	TSP	24h average	129	132	125	300
	$PM_{2.5}$		45	45	49	75
2# Side wind direction of the project site (Jindi Mingyue)	TSP	24h average	144	136	135	300
	$PM_{2.5}$		50	48	40	75
3# 500m downwind of the project site	TSP	24h average	138	150	131	300
	$PM_{2.5}$		46	52	44	75

From the above table, it can be seen that the daily average concentrations of TSP and PM2.5 at each monitoring point in the evaluation area meet the requirements of the secondary standard limit value of Ambient Air Quality Standard (GB3095-2012).

4.3.3 Status M&E of Acoustic Environmental Quality

According to the project situation and the sensitive points of the surrounding acoustic environment, the monitoring of the acoustic environment status in this evaluation consists of four points, whose specific points and functions are shown in the table below. Noise monitoring was conducted from April 8 to 9, 2023, for 2 consecutive days, once day and night. According to "Zoning Plan of Zhengzhou Acoustic Environment Functional Zone (2011)", the project site area shall implement the second-class standard of "Standard of Acoustic Environment Quality" (GB3096-2008).

Table 4-17List of Monitoring Sites for Sound Environmental Quality Status

Number of monitoring sites	Name of monitoring site	Bearing	Distance	Remarks
1#	Shiwang Village	South side of the	300m	Background

Number of monitoring sites	Name of monitoring site	Bearing	Distance	Remarks
		Qili River		monitoring site
2#	Dayong Village	North side of the Seven Mile River	250m	Background monitoring site
3#	Jindi Mingyue	South side of the Qili River	130m	Background monitoring site

Table 4-18Monitoring Results of Acoustic Environment Status

Unit: dB(A)

Monitoring point bit	Monitoring time	Monitoring results LAeq		Evaluation criteria		Compliance	
		Day	Night	Day	Night	Day	Night
Shiwang Village	2023.4.8	55	44	60	50	Yes	Yes
	2023.4.9	53	45			Yes	Yes
Dayong Village	2023.4.8	52	47			Yes	Yes
	2023.4.9	55	45			Yes	Yes
Jindi Mingyue	2023.4.8	53	45			Yes	Yes
	2023.4.9	52	44			Yes	Yes

As can be seen from the table above, the day and night equivalent sound level values of the 3 monitored points in the evaluation area can all meet the standard limit requirements of Category 2 area in the Standards for Sound Environmental Quality (GB3096-2008).

4.3.4 M&E of River Sediment Status

The sediment monitoring locations were 100m upstream of 1# Qili River flood control and upgrading project; 2# Qili River flood control and upgrading project; 500m downstream of 3# Qili River flood control and upgrading project. monitoring factors included: pH, organic matter, heavy metals (Cu, Zn, Pb, Cr, Cd, Ni, As, Hg), hexadecane (total), DDT (total), benzopyrene. The monitoring results of the river sediment are shown in Table 4-20.

Table 4-19Sample Status List

Sampling points	Sample Description	Sampling time
1# Qili River Flood Control and Enhancement Project Upstream 100m	Dark, extremely damp and smelly	2023-04-08
2# Qili River Flood Control and Enhancement Project Middle Section	Dark, extremely damp and smelly	2023-04-08
3# Qili River Flood Control and	Dark, extremely damp and	2023-04-08

Improvement Project downstream 500m	smelly	

Table 4-20Soil Monitoring Results

Monitoring facto Point position	1# Qili River Flood Control and Enhancement Project Upstream 100m	2# Qili River Flood Control and Enhancement Project Middle Section	3# Qili River Flood Control and Improvement Project downstream 500m	Unit
pH	8.14	8.09	8.45	Dimensionless
Organic matter	18.9	5.7	4.6	g/kg
Copper	19	16	11	mg/kg
Zinc	94	85	51	mg/kg
Lead	20.3	31.9	41.4	mg/kg
Chromium	26	18	32	mg/kg
Cadmium	0.26	0.21	0.12	mg/kg
Nickel	26	33	29	mg/kg
Arsenic	5.04	4.41	4.10	mg/kg
Mercury	0.172	0.226	0.019	mg/kg
Hexadecane (total)	Not Detected	Not Detected	Not Detected	mg/kg
DDT (total)	Not Detected	Not Detected	Not Detected	mg/kg
Benzopyrene	Not Detected	Not Detected	Not Detected	mg/kg

According to the substrate monitoring results, all factors of the regional status quo substrate meet the risk screening value standard of "Soil Environmental Quality - Risk Control Standards for Soil Contamination of Agricultural Land (Trial)" (GB15618-2018).

4.3.5 M&E of Groundwater Status

This project involves Zhengzhou Jingkai District, Zhengdong New District, Zhongmou County, and the main project is located in the Jingkai District, this evaluation quotes "Zhengzhou Economic and Technological Development Zone, three core boards and unallocated industrial land area environmental assessment report" of the current status of the groundwater monitoring information, monitoring time for the April 6 ~7,2022, the monitoring unit for the Henan Bori Chengcheng Inspection Services Co. The cited groundwater points and their relationship with the location of the project are shown in the following table:

Table 4-21 Relationship of groundwater monitoring sites to the Project location

Number	Monitoring Point	Monitoring Content	Monitoring Factors	Position
1	Hualiang New Material Well	Water quality Water level	K^+、Na^+、Ca^{2+}、Mg^{2+}、CO_3^{2-}、HCO_3^{2-}、SO_4^{2-}、Cl^-、pH、ammonia nitrogen、nitrate、nitrite、volatile phenols、cyanide、As、Hg、Cr^{6+}、total hardness、Pb、fluoride、Cd、Fe、Mn、TDS、oxygen consumption、sulfate-free、chloride、total coliforms、total number of bacteria,etc, and monitoring the well depth and the water level	7100m southwest side
2	Wuzhuang Village Well	Water quality Water level		750m south side
3	Xiaohan Village Well	Water quality Water level		1300m south side
4	Ruijin Subdivision Well	Water level	monitoring the well depth and the water level	6300m southwest side
5	Liezi Well	Water level		6100m southwest side
6	Jiulong Resettlement Area Well	Water level		350m south side

According to the above table cited points and the location of the project and monitoring time comprehensive analysis, this evaluation cited "Zhengzhou Economic and Technological Development Zone three core boards and unleased industrial land area environmental assessment report" in the groundwater status quo monitoring information has the reasonableness and validity.

The monitoring results are shown in Table 4-22.

Table 4-22 Groundwater Monitoring Results

Monitoring item	Unit	Standard Limit	Monitoring Results								
			D3 Hualiang New Material Well			D9 Wuzhuang Village Well			D12 Xiaohan Village Well		
			Detection range	standardized index	Attainment of standards	Detection range	standardized index	Attainment of standards	Detection range	standardized index	Attainment of standards
pH	/	6.5-8.5	7.3- 7.4	0.2-0.27	Yes	7.3- 7.4	0.2-0.27	Yes	7.2- 7.3	0.1-0.15	Yes
oxygen consumption	mg/L	≤3.0	0. 76-0.89	0.25-0.30	Yes	0.66-0. 77	0.220.257	Yes	0.81-0.85	0.405-0.425	Yes
total hardness	mg/L	≤450	130-152	0.29-0.34	Yes	180-195	0.4-0.43	Yes	283-292	0.63-0.65	Yes
ammonia nitrogen	mg/L	≤0.5	0.048-0.051	0.096-0.102	Yes	0.048-0.051	0.096-0.102	Yes	0.026-0.037	0.052-0.074	Yes
fluoride	mg/L	≤1.0	0.40-0.44	040-0.44	Yes	0.29-0.33	0.29-0.33	Yes	0.21	0.21	Yes
chloride	mg/L	≤250	7.1- 7.8	0.0284-0.031	Yes	11-13	0.044-0.052	Yes	13-19	0.052-0.076	Yes
Nitrate (N)	mg/L	≤20	1.3-1.4	0.065-0.07	No	1.5-1. 7	0.075-0.085	Yes	14.2-13.6	0. 71-0.68	Yes
sulfate-free	mg/L	≤250	10-12	0.04-0.048	Yes	26	0.104	Yes	44-45	0.176-0.18	Yes
cyanide	mg/L	≤0.05	ND	/	Yes	ND	/	Yes	ND	/	Yes
Nitrite (N)	mg/L	≤1.0	ND	/	Yes	ND	/	Yes	ND	/	Yes
volatile phenol	mg/L	≤0.002	ND	/	Yes	ND	/	Yes	ND	/	Yes

Monitoring item	Unit	Standard Limit	Monitoring Results								
			D3 Hualiang New Material Well			D9 Wuzhuang Village Well			D12 Xiaohan Village Well		
			Detection range	standardized index	Attainment of standards	Detection range	standardized index	Attainment of standards	Detection range	standardized index	Attainment of standards
TDS	mg/L	≤1000	208-224	0.208-0.224	Yes	294-308	0.294-0.308	Yes	322-358	0.322-0.258	Yes
K^+	mg/L	/	0.89-0.94	/	Yes	1.20-1.22	/	Yes	1.11-1.14	/	Yes
Na^+	mg/L	/	4.31-4.33	/	Yes	62.8-63.9	/	Yes	15.6	/	Yes
Ca^{2+}	mg/L	/	51.6-51.9	/	Yes	36.0-38.1	/	Yes	86. 7-92.2	/	Yes
Mg^{2+}	mg/L	/	1.85-1.91	/	Yes	20.2-20.3	/	Yes	16.3-16.4	/	Yes
CO_3^{2-}	mg/L	/	ND	/	Yes	ND	/	Yes	ND	/	Yes
HCO^{3-}	mg/L	/	139-143	/	Yes	279-305	/	Yes	243-254	/	Yes
SO_4^{2-}	mg/L	/	10.1-10.1	/	Yes	23.3	/	Yes	41.4-42.0	/	Yes
Cl^-	mg/L	/	5.02-5.08	/	Yes	8.05- 7.98	/	Yes	17.2-17.5	/	Yes
Cr^{6+}	mg/L	≤0.05	ND	/	Yes	ND	/	Yes	ND	/	Yes
Pb	μg/L	≤0.01	ND	/	Yes	ND	/	Yes	ND	/	Yes
Cd	μg/L	≤0.005	ND	/	Yes	ND	/	Yes	ND	/	Yes
Hg	μg/L	≤0.001	ND	/	Yes	ND	/	Yes	ND	/	Yes
As	μg/L	≤0.01	ND	/	Yes	ND	/	Yes	ND	/	Yes
Fe	mg/L	≤0.3	ND	/	Yes	ND	/	Yes	ND	/	Yes

Monitoring item	Unit	Standard Limit	Monitoring Results								
			D3 Hualiang New Material Well			D9 Wuzhuang Village Well			D12 Xiaohan Village Well		
			Detection range	standardized index	Attainment of standards	Detection range	standardized index	Attainment of standards	Detection range	standardized index	Attainment of standards
Mn	mg/L	≤0.1	ND	/	Yes	ND	/	Yes	ND	/	Yes
total number of bacterial colonies	CFU/mL	≤100	8-12	0.08-0.12	Yes	12-18	0.12-0.18	Yes	17-19	0.17-0.19	Yes
total coliforms	MPN/100mL	≤3.0	ND	/	Yes	ND	/	Yes	ND	/	Yes
benzene	μg/L	≤10.0	ND	/	Yes	ND	/	Yes	ND	/	Yes
toluene	μg/L	≤ 700.0	ND	/	Yes	ND	/	Yes	ND	/	Yes
xylene	μg/L	≤500.0	ND	/	Yes	ND	/	Yes	ND	/	Yes
petroleum	mg/L	≤0.3	ND	/	Yes	ND	/	Yes	未检出	/	Yes

4.3.6 M&E of the Ecological Environment Status

(1)Status survey of Terrestrial Ecological Environment

According to the site investigation, the vegetation within the project evaluation area mainly consists of poplar, willow, tree, dogbane, artemisia, reed, pandanus, dog's tail, humulus, etc. The types of terrestrial ecosystems include urban ecosystems, forest ecosystems, grassland ecosystems, agricultural ecosystems, etc. The ecological conditions and characteristics of each ecosystem are summarized in Table 423 below. The ecological conditions and characteristics of each ecosystem are shown in Table 4-23 below.

Table 4-23 Characterization of Ecosystems in the Project Area

Number	Ecosystem	Main ecological characteristics
1	Urban ecosystem	Mainly distributed in the project starting point to the end of the section, both sides of the urban industrial areas, residential areas, subject to strong interference from human activities, the surrounding vegetation is mostly planted green trees, wild grass, etc.
2	Forest ecosystem	The forest ecosystem is mainly distributed on both sides of the project, with artificially planted poplars, willows and trees, as well as companion plants such as dog's-tail grass, dog's-toothed root and artemisia, etc., which are distributed in a piecemeal manner, and there are not many wild animals, with forest birds and small animals being the main species.
3	Grassland ecosystem	Mainly found on both sides of the river, under the forest, etc., dominated by common grasses.
4	Agro-ecosystem	Mainly in the section from the start of the project to Qiancheng Avenue

A. Status survey of terrestrial plants

According to the vegetation zoning in China Vegetation, the evaluation area belongs to the warm-temperate deciduous broad-leaved forest area, warm-temperate southern deciduous oak forest area, and yellow and Huaihe River plain cultivated vegetation area. Trees within the evaluation area of this project are mainly planted with poplar, willow and tree, and herbaceous plants are mainly dogweed, double-spike bird's nest, dog's tooth root, artemisia, rape, etc., which are mainly distributed in the form of sheet.

On May 14-15, 2023, a sample was set up to investigate the project area. Through site investigation and relevant information collected, the vegetation types of the river bank in the project area are mainly meadow and woodland, which are cultivated vegetation. The dominant herbaceous species are dog's tooth root, humming grass, oxalis, small poncho grass, rape, etc. The dominant tree species are

poplar, and the dominant tree species are poplar. The dominant species of trees are poplar trees, and there are artificial planted poplar trees on the periphery of the beaches on both sides of the Chili River. On the whole, the vegetation species in the river section involved in the project are all local common species, artificial crops and local wild herbs, no protected plants, and no specific vegetation habitats where precious and endangered plants, old and valuable trees, important wild animals or birds are concentrated or breeding are found.

Through on-site investigation, the project area involves about 11 families and 22 species of vegetation, and the plant list is detailed in Table 4-24.

Table 4-24 Plant List

Number	Scientific Name	Habitat
I. Salicaceae		
1	Populus	Both sides of the river
2	Salix matsudana	Both sides of the river
II. Moraceae		
3	Broussonetia papyrifera	Strand of river
III. Cannabaceae		
4	Humulus scandens	Strand of river
IV. Gramineae		
5	Eleusine indica	Strand of river
6	Polypogon fugax	Strand of river
7	Cynodon dactylon	Strand of river
8	Elymus kamoji	Strand of river
9	Beckmannia syzigachne	Strand of river
10	Bambusoideae	Strand of river
11	Brachypodium sylvaticum	Strand of river
12	Digitaria sanguinalis	Strand of river
13	Phragmites australis	Strand of river
V. Polygonaceae		
14	Rumex crispus	Strand of river
15	Rumex obtusifolius	Strand of river
VI. Asteraceae		
16	Erigeron canadensis	Strand of river
VII. Amaranthaceae		
17	Chenopodium ficifolium	Strand of river
18	Alternanthera philoxeroides	Strand of river
VIII. Pre-vehicle Section		
19	Veronica polita	Strand of river
IX. Salicaceae		
20	Bolboschoenus planiculmis	Strand of river
X. Solanaceae		
21	Lycium chinense	Strand of river

Number	Scientific Name	Habitat
I. Salicaceae		
XI. Cruciferae		
22	Brassica napus	Strand of river

B. Status survey of terrestrial animals

According to the "Zoological Geography of China" (Zhang Rongzu, 1999), Henan Province straddles the Eastern Oceanic Boundary and the Palaearctic Boundary, and is the transition zone between Central China and North China, and the demarcation line of the transition zone in Henan roughly starts from the crest of the Founou Mountains at about 34°N latitude southwest of Lushi in the western part of Henan Province, and then slopes downward to the southeast along the line of the Founou Mountains' main peaks, passing through the main peaks of the Mumiaoling, Laojun Mountain, Yuhuangding, Longchiman, and Shirensan Mountains, and then passing through the southern part of Yexian, Muyang, and Cheshan counties to the line of the main stream of the Huaihe River, with the north of the line as the northern part of North China at the Palaearctic Boundary, and the south of the line as the Central China area at the Eastern Oceanic Boundary.

The evaluation area is located in the northeastern part of Zhengzhou city, and belongs to the Palaearctic-Northeastern Asia-North China-Huanghuai Plain subregion in terms of zoogeography. Through field investigation, visiting people in the neighborhood, and consulting relevant information, the original wildlife in the evaluation area has been greatly affected by human production and living activities. Because the evaluation area has been greatly affected by human production and living activities, the original wildlife habitat has been basically lost. Terrestrial animals mainly include voles, weasels, hares and other small beasts. Due to the development of the evaluation area and the impact of production and living activities, the number of bird populations in the current location is relatively small, and the birds are all common species, including sparrows, magpies, crows, turtledoves, owls, ducks and so on. According to the survey, there are no national and provincial rare and endangered protected animal species in the evaluation area, and no wild protected animals were found during the survey.

(2) Survey of aquatic ecological status

This project involves the Qili River and its tributary South Main Drainage Canal. Henan Normal University set up one survey section in each of the Qili River and the South Main Drainage Canal on June 19-20, 2023, to carry out on-site surveys, and used analogous surveys, combing statistics and other methods. Surveys were conducted for phytoplankton, zooplankton, benthic organisms, aquatic vascular plant species, fish and their habitats. The methods used for aquatic ecological surveys are shown in Table 4-25.

Table 4-25 Methodology for Surveying the Status of Biological Resources

Content of the survey	Methodology of the survey
Fish community	Guidelines for Aquatic Biological Surveys of Rivers, Science Publishing House
Fish stocks	HJ710.7-2014 Technical Guidelines for Biodiversity Observations Inland Waters Fish SC/T
Phytoplankton	SC/T 9402-2010 Technical Specification for Freshwater Plankton Surveys
Zooplankton	SC/T 9102.3-2007 Specification for monitoring the ecological environment of fisheries Part 3: Freshwater
Benthos	SCT9429-2019 Specification for Freshwater Fisheries Resource Surveys Rivers
Higher aquatic plants	SCT9429-2019 Specification for Freshwater Fisheries Resource Surveys Rivers

According to the scope of possible impacts of the project, the project set up two monitoring sections for investigation of aquatic ecological survey, 1# section was set up 200m upstream of the designed storage dam of Qili River, and 2# section was set up in the south trunk canal on the west side of Wan-San Highway. Specific monitoring cross-section information is shown in Table 4-26. Fish are randomly sampled within 500m upstream and downstream of the cross-section; other aquatic organisms are collected in 3 parallel sample points on the survey cross-section.

Table 4-26 Aquatic Life Survey Transect Information

Location	Latitude	Longitude	Conductivity us/cm	DO mg/L	Flow rate m/s	Substrate
Section 1# Qili River	34.7254094	113.8876117	688	16.51	0.1	ooze
Section 2# Nangan Drainage	34.7151056	113.9095363	439	17.82	0	ooze

A.Phytoplankton

A total of 54 genera (species) of planktonic algae were identified in the water samples of this aquatic ecological survey. belongs to six phyla: Diatoms, Cyanobacteria, Chlorophyta, Nudibranchs, Cryptophyta, and Methanophyta. Among them, Chlorophyceae dominated the species composition, with 26 genera (species), accounting for 48%; 11 species of diatoms, each accounting for 20%; and the fewest number of Methanophyceae, with only one species, accounting for 2%. The distribution of planktonic algae in each sample site is shown in Table 4-27.

Table 4-27 Distribution of planktonic algae in the evaluation area

Row label	Latin name	1# section	2# section
Flatworm	*Phacus sp.*	—	++

Row label	Latin name	1# section	2# section
Chlamydomonas reinhardtii	*Melosira varians*		
parallel algae	*Quadrigula sp.*		+++
paniculata	*Oscillatoria sp.*	++	+++
Tetraspermum macrorrhizum Lindl.	*Tetraëdron bifurcatum*	+	
echinoderm, a type of algae	*Lagerheimiella sp.*	++	+
Phyllostachys edulis (botany)	*Golenkinia radiata*	+	
Dictyostelium discoideum (biology)	*Pediastrum duplex*		
bowlegs	*Schroederia sp.*	++	
ditchwort	*Aulacoseira sp.*	++	
Rhodophyta glutinosa	*Nitzschia palea*		++
False Fish Algae	*Pseudanabaena sp.*	+++	+++
cusp-shaped algae	*Dichothrix sp.*		++
Cyanocryptophyta (blue-green algae)	*Chroomonas acuta*	+++	
Spinifex (suborder of herbaceous plants)	*Scenedesmus acuminatus*		
pinniped algae	*Synedra acus Kutzing*	++	
chlorella (biology)	*Phacotus lenticularis*	++	
Streptococcus granarius	*Aulacoseira granulate*		
vacuole alga	*Eudorina sp.*	++	+++
oriental green algae	*Coelastrum sp.*	++	+++
Rhododendron (genus of algae)	*Nitzschia sp.*	+++	+++
Oncorhynchus oryzae (taxonomic class)	*Oocystis sp.*	++	+++
Cryptotaenia ovata	*Cryptomonas ovata*	+++	+++
dinoflagellate	*Chromulina sp.*	++	++
bare alga	*Euglena sp.*		++
chlorella	*Chlorococcum sp.*	++	

Row label	Latin name	1# section	2# section
Cystic Nudibranchia	*Trachelomonas sp.*	++	+++
chemosynthetic filamentous algae	*Planktothricoides sp.*		++
a rodent-like cryptobacteria (geology)	*Cryptomonas erosa*		
plankton	*Tabellaria sp.*		+
dinoflagellate	*Merismopedia sp.*	+++	+++
Phyllostachys edulis (botany)	*Tetraedron trigonum*		
real coccolithophore (genus Pseudococcus)	*Pandorina sp.*	+++	
two-browed algae	*Amphora sp.*		++
Tetraspermum parvum (botany)	*Palmellococcus sp.*		++
tetragonal algae	*Tetraëdron gracile*	++	+
Tetraodontophora (taxonomic class including jellyfish and sessile polyps)	*Scenedesmus quadricauda*	+++	++
clostridial nudibranch (botany)	*Euglena acus*		++
horseshoe-shaped algae	*Kirchneriella sp.*	++	
algae	*Carteria multifilis*		++
microcystin	*Microcystis sp.*	+++	+++
cyanobacteria	*Euglena spirogyra*		++
fibrous algae	*Ankistrodesmus sp.*	++	
Cyclophyllum	*Cyclotella sp.*	+++	+++
chlorella	*Chlorella sp.*	++	++
crescent-shaped algae	*Closterium sp.*		
Rotating Single Needle Algae	*Monoraphidium contortum*		++
algae	*Chamydomonas sp.*		
alga	*Gomphonema sp.*		+
cryptobacteria	*Cryptomonas sp.*	++	+++
Cyclophyllum (hard bowed algae)	*Schroederia robusta*	+	

Row label	Latin name	1# section	2# section
echinacea	*Limnothrix sp.*		
algae	*Scenedesmus sp.*	+++	++
navicular algae	*Navicula sp.*	++	++

++: 104cells/L**; **++105cells/L**; **+++**: **106cells/L

The survey results showed that the population density was 3668.25×10^4 cells/L , and the main contributing species were cyanobacteria. The survey results showed that the biomass of section #1 was 16.714 mg/L and the biomass of planktonic algae in section #2 was 38.8622 mg/L, and the main contributing species to the biomass were diatoms.

B. Zooplankton

According to the zooplankton survey, using the traditional taxonomic identification method and referring to Aquatic Biology for classification, the zooplankton specimens in this survey belong to 16 species in 13 genera of 3 phyla. In terms of species composition, the zooplankton resources in the region were dominated by rotifers (43.75%), followed by branchiopods (18.75%), copepods (18.75%) and protozoa (18.75%). In terms of species composition, rotifers were more dominant. The list of zooplankton in the sampling site is shown in Table 4-28.

Table 4-28 List of zooplankton at sampling sites

Phylum	Species	Latin Name
Protozoa	Long Round Sand Shellfish	*Difflugia oblonga*
	Crowned Sand Shellfish	*Difflugia corona*
	Planktonic Graptolites	*Epistylis rotans*
Rotifera, the phylum of rotifers	Calyx flower arm-tailed rotifer	*Brachionus calyciflorus*
	Potted Arm-tailed Rotifer	*Brachionus urceus*
	Poda arm-tailed rotifer	*Brachionus budapestiensis*
	Curved-legged tortoise beetle rotifer	*Keratella valga*
	Large-bellied whisker-footed rotifer	*Euchlanis dilalata*
	Small dark heterotrophic rotifer	*Trichocercapusilla*
	Red-eyed rotifer	*Philodina erythrophthalma*
Artiodactyla (phylum of arthropods)	Long-fronted weevil	*Bosmina longirostris*
	Long-limbed staghorn beetle	*Diaphanosoma leuchtenbergianum*
	Ctenophora minor	*Daphnia cristata*

C.Benthos

A total of 11 species of macrofauna were collected in this survey, belonging to two major groups of arthropods and mollusks (Table 4-29), including 7 species of

arthropods and 4 species of mollusks. The density of macrofauna in section 1 was as high as 37.5ind/m2 , and the density in the sample site of section 2 was 12.50ind/m2 . The benthic diversity index of these two sections was higher overall, and the structure of communities was more stable and more resistant to environmental disturbances. The benthic diversity index of the two transects was high, and the community structure was stable and the ability to resist environmental disturbances was strong.

Table 4-29 Distribution of macrobenthic species at different sites

Typology	Species	Latin Name	1# section	2# section
arthropod	Chironomus youshimatusi	*Chironomus youshimatusi*	++	-
	Chironomuspallidivittatus	*Chironomuspallidivittatus*	+	-
	Glyptotendipes sp.	*Glyptotendipes sp.*	-	+
	Micronecta guttata	*Micronecta guttata*	-	+
	Stratiomyia sp.	*Stratiomyia sp.*	+	-
	Ischnura senegalensis	*Ischnura senegalensis*	++	-
	Aciagrion hisopa	*Aciagrion hisopa*	-	-
	Libellulidae sp.	*Libellulidae sp.*	+	-
mollusk	Bellamya purificata	*Bellamya purificata*	+	-
	Planorbidae sp.	*Planorbidae sp.*	-	+
	Physafontinalis	*Physafontinalis*	-	-
	Parafossarulus striatulus	*Parafossarulus striatulus*	-	+
	Radix swinhoei	*Radix swinhoei*	-	-
	Corbicula fluminea	*Corbicula fluminea*	-	+
annelid	Tubificiidae sp.	*Tubificiidae sp.*	-	-

Note: +++ , means a lot; ++ , means more; + , means less; - , means not present.

D. Aquatic plants

A total of 5 species of aquatic vascular plants were collected from 2 sections.

Table 4-30 Distribution of Aquatic Vascular Plants

Loci	Kind	Weight (g/m^2)	Total (g/m^2)
1#	Swamp grass	82	728
	Groundnut	527	
	Typha orientalis	119	
2#	Reeds	302	670
	Arrowhead	45	
	Typha orientalis	323	

E. Fish

The results of this survey showed that a total of 11 species of fish were identified, belonging to 3 orders and 5 families, of which 8 species (72.73%), 2 species of perch and 1 species of catfish accounted for the majority. The fish survey was conducted in summer, when the temperature was high and fish activities were more active. Therefore, no larger fish were caught in this survey, and no rare and nationally protected fish were found, and fish miniaturization was more serious, and the water quality of sample point 1 (Qili River) and sample point 2 (South Main Drainage Canal) were more seriously affected by human life in the city.

Table 4-31 Fish Species Composition of the Surveyed Watersheds

Order	Family	Genus	Species	1#	2#
order Cypriniformes	Carpidae	Crucian carp	*Carassius auratus*	4	2
		carp	*Cyprinus carpio*	2	--
		McFish	*Pseudorasborapava*	3	6
		Rhodeus sinensis	*Rhodeus sinensis*	6	3
		Bleak	*Chanodichthys erythropterus*	2	--
		saury fish	*Gobio gobio rivuloipes*	1	--
		genus of meals	*Hemiculter leucisculus*	3	5
	Loachidae	loach	*Paramisgurnus dabryanus*	6	--
Parasilurus, an order of catfish	sturgeon	Pelteobagrus fulvidraco	*Pseudobagrusfulvidraco*	2	--
Perciformes, order of perch	Gobiidae	Gobiidae	*Rhinogbius giurinus*	8	1
	Lates calcarifer	fighting fish	*Macropodus chinensis*	2	--

5 Environmental Impact Assessment and Mitigating Measures

5.1 Environmental Protection Objectives

The scope of this project is Shangdu Road rubber dam (pile number 14+150) to Wansan Road (pile number 20+950), river length 6.8km, both banks to the river blue line and 5 urban green areas adjacent to the river. After analyzing and investigating the project characteristics and the surrounding environment of the site, combined with the local environmental protection requirements and environmental function zoning, the environmental protection objectives are shown in Table 5-1, Figure 5-1 and Figure 5-2.

Table 5-1Environmental Protection Objectives of the Project

Environmental Elements	Scope of evaluation	Name of sensitive point	Scale	Relationship with the location of the project	Protection object	Environmental functions
Atmosphere Environment	500m outside the scope of permanent occupation	Jindi Mingyue Neighborhood	About 1400 households, 5600 people	130m Right of Qili River	Households	Ambient Air Quality Standards (GB3095-2012) Class II
		Dayong Jiayuan (under construction) (Dayong Village Resettlement Area)	/	200m Left of Qili River		
		County Party School (10m high)	/	50m Left of Qili River	Relevant Person	
		Shiwang Village (6m)	About 270 households, 1300 people	300m Right of Qili River	Households	
Sound Environment	200m outside the scope of permanent occupation	Jindi Mingyue Neighborhood (95m high)	About 1400 households, 5600 people	130m Right of Qili River	Households	Sound Environment Quality Standard (GB3096-2008) Class II
		Dayong Jiayuan (under construction) (Dayong Village Resettlement Area)	/	200m Left of Qili River		
		County Party School (10m high)	/	50m South of Qili River	Relevant Person	
Water Environment	The starting point of the river treatment	Qili River		/	Surface Water	Surface Water Environmental Quality Standard (GB3838-2002) Ⅳ
		Jalu River Zhongmou Chenqiao section		Located at the lower reaches of the Chili River,		

Environmental Elements	Scope of evaluation	Name of sensitive point	Scale	Relationship with the location of the project	Protection object	Environmental functions
	Shangdu Road rubber dam to Wan San Road			27km from the mouth of the Jialu River.		
Ecological Environment	Scope of permanent and temporary occupation of the project	Flora and fauna, soil erosion, etc. in the areas permanently and temporarily occupied by the project.				

Figure 5-1Environmental Protection Target Distribution Diagram

5.2 Analysis of Environmental Impact During Construction Period

5.2.1 Atmospheric Impact Analysis

The main air quality influences during the construction of the project are dust, asphalt smoke, transport vehicles and construction machinery waste gas and bottom mud stinks. During the construction period, the construction personnel dine with outsourced meals, and the construction living area is not set up a restaurant.

5.2.1.1 Dust

The dust mainly comes from the construction site dust and road dust generated by the transportation process of transportation vehicles. Construction site dust is mainly generated by excavation of earth and stone, temporary storage of earth and stone, and construction work. Dust generated

by road traffic transportation, this project has a large amount of excavation and filling. The earth is mainly transported by on-site roads, and sand, gravel, concrete, etc., in addition to on-site traffic, also need to use off-site traffic, some need to go through villages and towns. This project has a large amount of earth and concrete transportation, and road transportation dust pollution will be an important factor in polluting the ambient air, especially during the dry and windy hours, the dust generated will be more serious.

5.2.1.2 Asphalt flue gas

In this project, asphalt concrete pavement is used on the road surface of the gate. In addition to dust, the air pollution of asphalt pavement during the construction stage also produces a certain amount of asphalt smoke. This project uses commercial asphalt, does not set up on-site asphalt mixing station, with closed professional vehicles transported to the construction site for mechanized paving, to avoid the impact of asphalt preparation process. The asphalt paving process will produce a certain amount of asphalt fumes, asphalt paving process, asphalt melting release benzo［a］pyrene, phenol and THC. asphalt paving process of asphalt fumes impact distance is generally within 60m, the asphalt paving operation is required to try to avoid early in the morning, evening, and other major power diffusion conditions of the time period is relatively bad, in order to mitigate the impact of the paving operation of the surrounding sensitive points. The paving machinery should have good sealing and dust removal devices, and the maximum permitted emission concentration and maximum permitted emission rate should meet the corresponding requirements of the "Comprehensive Emission Standards for Air Pollutants" (GB16297- 1996), and there should not be any obvious disorganized emission from the production equipment; and the construction personnel should be equipped with various labor protection articles, such as masks and windscreen, etc., in the process of construction. At the same time, the new construction and hardening of the road at the top of the embankment of this project is a segmented construction, with short construction time, high terrain, flat and open site, and good diffusion conditions, so the evaluation considers that after taking the above measures, the impact of asphalt smoke on the nearby sensitive points is relatively small. The main air quality influences during the construction of the project are dust, asphalt smoke, transport vehicles and construction machinery waste gas, a small amount of wood processing waste gas in the processing plant, a small amount of welding smoke on the construction site. During the construction period, the construction personnel dine with outsourced meals, and the construction living area is not set up a restaurant.

5.2.1.3 Transport vehicle and construction machinery exhaust gas

The pollutants contained in the exhaust gas produced by transport vehicles and the fuel exhaust gas produced by construction machinery are

similar, mainly SO2, CO, NOx, etc., will have an adverse effect on the downwind and the area along the transportation. Construction units should pay attention to the maintenance of transport vehicles and non-road mobile machinery, regularly carry out exhaust monitoring to ensure that exhaust emissions meet the standards, mechanical vehicles exceeding the standards are prohibited from entering the yard area, transport vehicles are prohibited from overload; Inferior fuel shall not be used.

This project excavator, bulldozer and other non-road mobile machinery should meet the requirements of national emission standards,priority to choose National 4 and above emission standard or new energy non-road mobile machinery. The mechanical exhaust gas of transport vehicles belongs to the nature of unorganized emission, which has the characteristics of discontinuity, small production volume, relatively dispersed production point, easy to be diluted and diffused. In addition, the scope of construction is relatively large and the atmospheric diffusion conditions are relatively good. Under normal circumstances, transport vehicles and machinery produced by the exhaust gas in the air after natural diffusion and dilution, the impact on regional environmental air quality is small.

5.2.1.4 The river bottom mud excavation odor

River construction dredging process will produce a small amount of odor, the main pollutant of odor is a mixture of H2S, ammonia and other substances. After construction diversion, the river construction drying for several days, using dry operation method of mechanical excavation, near the river on both sides of the drying. The bad odor is mainly generated from the construction dredging site and drying process. Construction site by analogy with other similar projects, the data experience, the intensity of malodor is generally 2-3 levels, no wind conditions, the impact of the range of 50 meters, downwind when the wind will slightly increase the distance affected, but are less than 100 meters. Through on-site investigation, it can be seen that there is no sensitive point distribution within 200m around the silt drying area of this project, and the impact of silt drying process on the surrounding residents is relatively small.

To summarize, the scope and time of the impact of ambient air pollution during the construction period of this project are small and short, and will disappear with the end of the construction period, and there will be no cumulative pollution impact. The evaluation considers that the environmental impact is acceptable under the premise of adopting the pollution prevention measures proposed in this EIA.

5.2.2 Surface Water Environmental Impact Analysis

During construction, waste water mainly includes domestic sewage and construction wastewater. Production wastewater mainly comes from

construction machinery and vehicles flushing wastewater, mud wastewater, pit drainage. The main pollution sources of wastewater in engineering construction are shown in the following table.

Table 5-2 Waste Water Pollution Sources During Construction

Pollution source		Source of pollution	Major pollutants
Construction domestic sewage		Construction personnel	COD, ammonia nitrogen
Construction production wastewater	Mechanical vehicles flush waste water	Construction machinery and transport vehicles	SS, petroleum class
	Mud wastewater	Continuous wall, anti-impact wall, grouting pile engineering drilling, hole cleaning	SS
	Pit drainage	Water, underground seepage	SS

5.2.2.1 Construction personnel domestic sewage

The construction sewage mainly comes from the living drainage of the management personnel and construction personnel who enter the site during the construction period, and the main pollutants of wastewater are COD and ammonia nitrogen, etc. The wastewater will not enter the surface water body. As there is no supporting municipal sewage network near the construction camps of this project, temporary septic tanks are set up in the construction camps to deal with the domestic sewage, which is regularly emptied and treated, and no wastewater basically will not enter the surface water bodies during the construction period.

5.2.2.2 Construction production waste water

It is mainly mechanical vehicle washing wastewater. The main pollutants are suspended solids (concentration of about 2000 mg/L) and petroleum species (concentration of about 10-30 mg/L). Due to the long time and penetration ability of oil pollution, there is a danger of pollution to the nearby water bodies, which must be strictly managed. 2 construction camps are required to set up cleaning areas for construction vehicles and build oil separation sedimentation tanks. The collected waste oil sludge is classified as HW08 hazardous waste. The construction unit is required to verify the approved operating category and scale of the unit's hazardous waste operating license based on the hazardous waste category, in accordance with the "Zhengzhou Hazardous Waste Operating License Information Disclosure" published by the Zhengzhou Ecological Environment Protection Bureau After considering factors such as transportation distance, entrust qualified units to handle it, and the wastewater will be reused for vehicle rinsing and dust reduction, without external discharge.

5.2.2.3 Drainage of pits

Pit drainage is divided into initial drainage and regular drainage, initial pit involves earth excavation, SS concentration in drainage is relatively high; regular pit drainage mainly includes pit seepage, rainfall catchment, etc. Drainage trenches and appropriate amount of catchment wells are set up within the scope of the pit, and pumped out to the outside of the pit through submersible pumps. The content of suspended solids in the drainage water is relatively high, comparing with the monitoring results of similar projects, the concentration of suspended solids in the regular drainage water is about 2000mg/L. The project involves pit drainage works. The works involving pit drainage in this project mainly adopt cofferdam construction, such as Huaxi de-flooding gate, Yangqiao dry canal inverted siphon and hydraulic dam project. According to the experience of water conservancy project, the initial drainage water of pit is relatively large, and the water quality is basically the same as that of river, which will not increase the pollution of the water quality of the river. However, the seepage of pit water and rainwater collection will lead to the increase of SS concentration and pH value of drainage water from the construction pit, so it is necessary to take measures of sedimentation and dosing, and the drainage water from the pit can be used for sprinkling and dust reduction in the construction area after sedimentation treatment without external discharge.

The evaluation suggests that the project should set up one neutralization sedimentation tank at each construction cofferdam, and the drainage water from the pit should be used for watering and dust reduction at the site after being treated in the sedimentation tank.

The Project's pit drainage will have a less than significant impact on the surface water environment of the Chili River.

5.2.2.4 Water seepage from silt drying sites

This project is mainly for river channel expansion and excavation, only part of the river section involves local dredging, seepage water will be generated in the process of drying, the main pollutant in seepage water is SS, seepage water will be discharged into the river after sedimentation. According to the status quo monitoring, the surface water environment meets the requirements of water quality objectives, and seepage water is discharged into the river, so the impact on the surface water environment is very small.

5.2.2.5 Analysis of bridge construction impacts on the river

This project involves 4 bridges, 3 of which are demolished and reconstructed and 1 of which is lengthened. The bridges are constructed on pile foundations with construction platforms filled in the river channel.

① The impact of bridge superstructure construction on the water environment

Three bridges across the river in this project adopt prefabricated assembled box girders, and one adopts reinforced concrete arch bridge. Reinforced concrete arch bridge is purchased commercial concrete transported to the construction site for pouring; box girder is prefabricated in prefabrication plant and transported to the construction site for assembling; the construction site strengthens the management of construction personnel, strictly prohibits littering waste, and the pavement garbage of the bridge surface should be centrally piled up and transported to the designated place, so as to minimize the impact on the water quality of the river. After taking the above measures, the construction of the bridge superstructure will not cause any obvious impact on the water quality of the river.

② The impact of bridge substructure construction on the water environment

The construction of the bridge across the river may have an impact on surface water. The pollution of surface water during the bridge construction period mainly comes from the production effluent of the construction operation. The production effluent caused by construction operations includes contaminated water from drilling and oily sewage during bridge construction, and the impact of bridge pier construction is more obvious. The construction process of bridge piers involving water is cofferdam, drilling, hole cleaning, rebar cage placement and concrete filling.

A.Cofferdam

When installing the trestle bridge, the substructure of the trestle bridge needs to be driven into the steel pipe piles and the foundation of the bored piles, which will disturb the bottom of the river at the driving place; when using the steel sheet piles cofferdam construction, the process of inserting the steel sheet piles one by one to the stabilizing depth and the design depth will disturb the bottom of the river at the driving place of the steel sheets, which will increase the turbidity of the local water area (mainly SS). However, this effect will be eliminated once the trestle construction is completed and the cofferdam process is finished.

B.Drilling and hole cleaning

Drilling mud consists of water, clay (or bentonite) and additives (such as sodium carbonate, 0.1-0.4%; carboxycellulose, <0.1%), and a small amount of mud-containing wastewater will be generated during construction. According to the analogous investigation of Baishazhou Yangtze River Bridge in Wuhan, the SS concentration of mud-containing wastewater was reduced from 1690mg/L before treatment to 66mg/L after treatment by using a mud separator to meet the first-class standard in the Comprehensive Discharge Standard of Wastewater (GB8978-1996). All the waste mud water is sealed and transported to the nearby mud sedimentation tank. After precipitation, the

supernatant is used for greening and dust suppression, and the remaining mud is naturally dried and landfilled in the sedimentation pond, and the waste mud is forbidden to be piled up in the construction site or discharged to the water body directly, which has little impact on the water environment.

C.Concrete infusion

The bridge pier construction uses rigid conduit for concrete filling, which may produce overflow and leakage during the filling process, but the concrete filling is also carried out in the cofferdam, so it will not cause pollution to the water body.

D.Cofferdam removal

The impact of cofferdam removal on the water environment is similar to that of cofferdam construction, which will disturb the bottom sediment of the river and increase the concentration of suspended matter in local waters, but the impact is limited in scope and short in time.

In conclusion, the drilling, hole cleaning and filling processes are carried out inside the cofferdam, which separates the water inside and outside, and will not cause pollution to the water quality along the route.

To sum up, all the wastewater generated during the construction period of this project will be comprehensively used or reasonably disposed after treatment, and there will be no external discharge, so it will not have obvious impact on the quality of surrounding water environment, and the measures are feasible.

5.2.2.6 Analysis of the impact of water related engineering construction on surface water

According to engineering analysis and construction plan analysis, the water related engineering content of this project mainly includes: local dredging engineering (dredging section is about 300m in total), construction diversion and the impact of construction cofferdam. The main construction content of this project includes Yangqiao Main Canal inverted siphon, hydraulic dam construction, Hua Stream Flood Control and Drainage Sluice, inverted siphon of Yangqiao Main Canal, hydraulic dam engineering supporting diversion cofferdam engineering, and 4 bridge construction cofferdam engineering.

The construction of water related projects can cause turbidity in the water body, leading to an increase in the concentration of suspended solids in the water. The natural sedimentation of suspended solids on the bottom mud surface needs to consider the comprehensive effects of factors such as suspended settling rate, lateral and longitudinal flow rates, turbulence, adsorption in the fluid, and surface shape of suspended solids. The construction of water related projects is similar to the monitoring data of

Hongru River construction. After 5 minutes of excavation, the dredging suspension concentration is generally less than 170mg/L. The SS value of the water quality can be reduced to below 60mg/L after the suspended solids have naturally settled at 1,500m from the construction site. Analogy analysis shows that the construction of the Qili River wading project has an impact on the SS value of downstream river water quality and the suspended solids in the 1.5km downstream area. Due to the fact that the construction of water related projects is mainly carried out during the dry season and the flow rate is relatively small, dredging and disturbing the sediment of the river channel will only cause the suspended solids in 1.5km downstream water body to exceed the standard in the short term, and will not have a significant adverse impact on the water quality.

The monitoring results of the dredged river sediment during construction indicate that there is no problem of excessive heavy metals in the dredged sediment. Therefore, the water pollution caused by the disturbance of the sediment during river dredging is mainly manifested in the chromaticity and turbidity (SS value) indicators, and the formation of certain adverse effects is only intermittent and temporary. It will quickly recover to the pre dredging level with the completion of the project, and will not have a long-term continuous impact on the water quality of the Qili River channel, It will not reduce the water function of the dredged river section.

In addition, relevant studies have shown that wading and dredging disturb the sediment of river channels, causing the passive release of pollutants (TP, TN, etc.) in the sediment, disrupting the nitrogen and phosphorus balance of the water body, which may increase or even exceed the water quality TP and TN in local river channels in the short term. This type of water quality impact has a certain degree of uncertainty and is one of the water environmental protection issues that need to be paid attention to in dredging projects. Dynamic water quality monitoring during construction is necessary for monitoring, And take necessary protective measures based on the monitoring results.

5.2.2.7 Analysis of the impact on hydrological conditions

According to the information provided by the feasibility study unit, the river bottom gradient and elevation were controlled according to the flood control plan during the dredging treatment of this section in 2013. The determination of the river bottom gradient fully considers the inheritance and connection of the flood control plan, and smoothly connects with the elevation of the upstream and downstream river bottom. Through the calculation of the river channel topographic survey map, the amount of earthwork excavation is minimized as much as possible, and the design gradient of the river channel is determined to be basically consistent with the current situation. This project only involves dredging local areas, with a total dredging section of about

300m.

The hydrological situation during the construction period of this project is mainly affected by local dredging projects, construction diversion, and construction cofferdams. The main construction content of this project includes Yangqiao Main Canal Inverted Siphon, hydraulic dam construction, Hua Stream Flood Control and Drainage Sluice, hydraulic dam engineering supporting diversion cofferdam, and 4 bridge construction cofferdams.

(1)Analysis of the Impact of Hydraulic Dam Engineering on Hydrological Situation

There is one hydraulic dam project in this project. The hydraulic dam of this project is a full section building, and the construction adopts the method of one-time interception of the main channel and diversion of open channels on the beach. The hydraulic dam will be completed during a non flood season.

Due to the use of a full section cofferdam to block the main channel and open channels for diversion in the hydraulic dam of this project, the hydrological situation of the river has changed significantly during the construction period. The diversion standard is based on the 10-year non flood season standard, with a high safety factor; The water flow in the main channel is interrupted, and the river flows downstream through a diversion channel; The flow direction follows the direction of the diversion channel and deviates partially from the main channel; The river flow in the original channel is basically none. Diversion is a temporary construction measure. The diversion period of this project is from November to April of the following year. After the completion of the project, the impact can be restored to the condition before the diversion. Therefore, the construction diversion impact is mainly reflected in the construction period, and the impact can be relieved after the construction is completed.

(2)Dredging river channels

The dredging section is located at stake Q16+550~Q16+600, Q19+100~Q19+200, and Q20+700~Q20+850, totaling about 300m. The dredging amount is approximately 40,000 m^3. The average width of the dredging channel bottom is 60m, and the dredging depth is about 1m. The dredging of the river channel project section adopts the method of divided construction diversion and construction cofferdam. During the construction period, the river flow and water level will be affected to a certain extent, and the impact can be eliminated after the construction is completed.

(3)Analysis of the impact of other water related engineering cofferdams on hydrological conditions

Hua Stream Flood Control and Drainage Sluice, Yangqiao Main Canal Inverted Siphon, Hydraulic Dam Project Supporting Diversion Cofferdam

Project. The diversion is carried out by filling a U-shaped cofferdam in the river channel. The outer side of the U-shaped cofferdam passes through water, and the inner side is pumped and drained before dry construction. The construction of a cofferdam narrows the main channel locally, reduces the water flow area, and increases the flow velocity. The above projects were all completed during a non flood season, with a relatively short construction time and minimal impact on the hydrological situation.

Through analysis of construction methods, diversion methods, and diversion time periods, the main impact of the hydrological situation during the construction period of this project is the impact of construction diversion and construction cofferdams. Construction diversion will have a certain impact on the hydrological situation of the river channel, which is local, temporary, and reversible. The overall impact is relatively small, and can be eliminated after the completion of construction.

5.2.3 Groundwater Environmental Impact Analysis

According to the project FSR, during the construction of the river channel slope protection and bank retaining wall projects, the excavation depth was below the buried depth of the groundwater level, and precipitation must be carried out. It is planned to use a combination of water pump drainage of open water and pipe well drainage of groundwater to reduce the water level in the construction site. The construction period has a certain impact on the regional groundwater level, which is local and temporary, and the overall impact is relatively small. The impact can be eliminated after the construction is completed.

During the construction period, improper treatment of construction wastewater and domestic sewage may cause pollution to the groundwater in the area. The pollution to the groundwater is mainly caused by the migration of pollutants in the wastewater through the aeration zone and into the aquifer. The aeration zone refers to the zone between the surface and the phreatic surface, which is the natural protective layer of the underground aquifer and the vertical transition zone where surface pollutants enter the aquifer. When pollutants enter the aeration zone, they undergo physical, chemical, and biochemical reactions with the surrounding media. The longer the reaction time, the more sufficient it is, and the stronger the purification ability of the aeration zone. According to the analysis of the impact on the surface water environment during the construction period, the domestic sewage generated during the construction period is regularly cleaned and treated in septic tanks. The construction production wastewater is treated and reused in the construction area, and neither production wastewater nor domestic sewage is discharged in the construction area, which will not cause deterioration of groundwater quality.

5.2.4 Acoustic Environmental Impact Analysis

The noise during the construction period of this project mainly comes from two aspects: the noise generated by the operation of construction machinery and equipment, and the noise generated by motor vehicle driving. At the same time, 1 # construction camp is equipped with a steel bar processing plant, which mainly generates noise from steel bar straightening machines, steel bar cutting machines, and steel bar bending machines.

The noise sources of construction machinery in each construction area are shown in Table 5-3.

Table 5-3 Source Intensity and Noise Level of Main Construction Machinery

S/N	Mechanical type	Model specifications	Maximum sound level	Characteristics of sound source
1	Dump truck	8t	80	Unstable flow source
2	Excavator	$1m^3$	85	Unstable flow source
3	Bulldozer	/	85	Unstable flow source
4	Frog compactor	/	95	Unstable flow source
5	Vibrating roller	/	80	Unstable flow source
6	Sprinkler	/	80	Unstable flow source
7	Steel bar straightening machine	/	80	Stationary Source
8	Steel bar cutting machine	/	85	Stationary Source
9	Steel bar bending machine	/	80	Stationary Source

5.2.4.1 Prediction model

According to the sound source characteristics of the equipment in the proposed project and the characteristics of the surrounding acoustic environment, the sound source of each equipment can be regarded as a continuous steady-state point sound source, and the sound field is a semi-free sound field. The geometric divergence attenuation mode of the non-directional point sound source recommended in the Technical Guidelines for Environmental Impact Assessment Sound Environment (HJ 2.4-2021) is selected as the prediction mode. The prediction formula is as follows:

$L_p(r)= L_p(r_0)-20\lg(r/r_0)$

Lp(r)— Sound pressure level at the predicted point, dB (A);

Lp(r0)—Sound pressure level at reference position r0, dB (A);

r—The distance of the predicted point from the sound source, m.

r0—The distance from the reference position to the sound source, m.

Noise source superposition formula:

$$L_n = 10\log\left[\sum_{i=1}^{n} 10^{0.1L_i}\right]$$

L_n—Total sound pressure level, dB;

L_i—The sound pressure level of the i equipment noise source, dB.

5.2.4.2 Impact prediction

A. Boundary noise prediction

According to Table 5-3, the intensity of various mechanical noise sources during the construction period, considering the most unfavorable situation, the construction machinery noise is calculated at 95dB (A). Based on the noise point source attenuation calculation formula, the impact of construction machinery noise on the surrounding environment is calculated. The predicted results are shown in Table 5-4.

According to the "Emission Standard for Environmental Noise at the Boundary of Construction Sites" (GB12523-2011), the daytime noise limit at the boundary of construction sites is 70dB (A) and the nighttime noise limit is 55dB (A). The results in Table 5-4 indicate that construction machinery can reach the standard limit values at a distance of 10 meters from the construction site during the day, and at night, it can reach the standard limit values at a distance of 100 meters. From Table 5-4, it can be seen that the impact range of nighttime construction is relatively large, so it is recommended to prohibit nighttime construction.

Table 5-4 Prediction results of fixed sources at different distances in the construction area Unit: dB(A)

Distance	10m	20m	30m	50m	80m	100m	200m	300m
Contribution value of construction machinery	75	69	65.5	61.0	56.9	55	49	45.5
After stacking the current situation (daytime)	75	69. 1	65.7	61.4	57.9	56.4	53. 1	52
After stacking the current situation (at night)	75	69	65.7	61	57.0	55. 1	49.5	46.5

B. Prediction of the impact on sensitive points

According to on-site investigation, the sensitive points distributed within 200m outside the construction boundary of this project are mainly the Jindi Mingyue Community located 130m south of the Hua Stream Flood Control Sluice Project, the County Party School located about 50m north of Shangdu Avenue, and other residents located within 200m.

This noise prediction for sensitive points mainly focuses on the above two sensitive points. According to the analysis of project content and layout, the construction content that has a significant impact on Jindi Mingyue Community due to noise during the construction period mainly includes 2 # construction camp, Hua Stream flood control gate project, and flood diversion gate project; The main construction content that has a significant impact on the county party school is the river dredging project.

According to the analysis of construction processes and equipment involved in each project, it can be seen that the high noise equipment involved in the construction period of the 2# construction camp, Hua Stream flood control gate project, and flood diversion gate project mainly includes construction machinery for flood control gates and flood diversion gates, including excavators, bulldozers, and cranes.

The construction of this project is only carried out during the day. Based on the distribution of sensitive points along the project, the noise prediction of sensitive points is mainly aimed at Jindi Mingyue Community. The prediction results are shown in the table below:

Table 5-5Prediction Results of Influence of Construction Machinery Noise on Noise at Sensitive Points

Sensitive spots	Construction area	Construction Machinery	Noise source intensity (superimposed)	Distance from construction area (m)	Contribution value dB(A)	Background value dB(A)	Forecast value dB(A)	Standard value dB(A)	Compliance analysis
Jindi Mingyue	2# construction camp	Excavators, bulldozers, cranes	95.8	130	42.5	53	53.4	60	Compliance
County Party School	River expansion excavation	Excavators, bulldozers,	95	50	61	53	61	60	Exceeding

According to the prediction results in the table above, the party school of the county party committee slightly exceeds the standard. In order to reduce the impact of construction on it, it is recommended to set a mobile sound barrier at the party school of the county party committee. According to relevant information, the noise reduction effect of a 3m high vertical sound barrier can reach 15-20dB (A) or more. Therefore, the evaluation requires the installation of a 3m high vertical sound barrier at the county party school, with each end at least 15m beyond the sensitive point. After taking measures, all sensitive points can meet the Class 2 standard requirements of the "Acoustic Environmental Quality Standard" (GB3096-2008).

5.2.5 Analysis of Soil Environmental Impact

The influence of the construction period on the soil environment is mainly

manifested in two aspects: (1) the excavation and stripping of the topsoil during the construction period cause the destruction of the surface soil and the movement and loss of the soil material. This project peeling topsoil after transportation, mechanical turning, storage, soil structure, porosity, etc., have changed. According to the construction organization design of the project, the temporary topsoil generated during the construction period is stored temporarily for the restoration of shoreline vegetation in the later period.(2) During the construction period, the loss of production materials, the leakage of production and living sewage treatment facilities, oil storage facilities, refueling areas and other facilities, and the leakage of machinery and equipment lead to the entry of COD, ammonia nitrogen, total phosphorus, petroleum and oil materials into the soil surface, which mainly occurs in the part of the construction production and living area.

Through strengthening the management of construction materials and measures to prevent loss, the seepage prevention of sedimentation tank body, oil trap body, oil storage ground and apron, fixed refueling area and sewage treatment facilities, maintenance and correct use of machinery and equipment, the above shallow surface soil pollution caused by construction and production can be reduced

5.2.6 Impact Analysis of Solid Waste

The solid waste produced by this project mainly includes construction waste, household waste of construction personnel, spoil and sedimentation tank mud, etc..

5.2.6.1 Construction waste

According to the FSR, some buildings within the construction scope need to be demolished during the construction period. The demolition area along the line is approximately 147,075.3m^2 (including 38,000m^2 in Zhengdongxin District and 109,075.3m^2 in ZEDZ). The demolition of buildings will generate a certain amount of construction waste. Based on empirical calculations, the amount of construction waste generated is 0.45m^3/m^2. Based on this calculation, the amount of construction waste demolished in this project is 66,183.885m^3. After the classification of construction waste, the recyclable part should be reused. The unusable part needs to obtain a construction waste clearance permit and strictly follow the requirements of relevant departments. Construction waste should be transported as soon as it is produced and transported to the government designated storage area, and should not be discarded arbitrarily.

A small amount of waste steel bars will be produced by the steel bar processing plant in the construction camp 1#, which is approximately 0. 5% of the usage amount 1%, the production of waste steel bars is 8.6t, and waste steel bars can be sold as resources.

5.2.6.2 Spoil earth

According to engineering analysis, the remaining earthwork volume after earthwork balance in this project is about 1,157,500 m^3 (including dredging and topsoil). This project only conducts dredging in local areas. According to the comparison analysis of the designed river bottom elevation and the current river bottom elevation in the longitudinal section design of the treated section, the dredging section is mainly located in the sections Q16+550~Q16+600, Q19+100~Q19+200, Q20+700~Q20+850, totaling about 300m. The dredging amount is about 40,000 m^3.

According to the engineering design, all excess earthwork in this project will be transported to the nearby 5 green spaces of the adjacent river (stakes Q16+000~Q19+700) for ecological landscape micro terrain shaping, without any outward transportation of earthwork. The dredged sludge is turned over and sun dried in the soil storage area, with a moisture content of less than 60%. It is then stored in the soil storage area to shape the ecological landscape micro terrain of the green space project.

According to the results of this monitoring and testing, all detection factors of dredging sludge meet the requirements of Table 1 of the "Soil Environmental Quality Standard for Soil Pollution Risk Control of Agricultural Land (Trial)" (GB15618-2018). The dredging sludge of the project is used to shape the ecological landscape micro terrain of the green space project, and the measures are feasible.

5.2.6.3 Topsoil stripping

In order to effectively protect the topsoil resources, the surface humus soil should be stripped from the forestland in the project area before construction. A total of 7500 square meters were stripped, and the stripped topsoil was concentrated in the temporary storage area, and measures such as straw bag blocking and temporary covering were taken for the temporary soil pile. After the completion of construction, the peeled topsoil is used for greening and covering the project area.

5.2.6.4 Household waste

The number of construction workers in the peak period of this project is about 630 persons, according to the "Prediction Method for Calculation of Municipal Domestic Waste Production" (CJ/T106-1999), the daily production of domestic waste is 0.5kg per person, the construction period is 16 months, the total amount of domestic waste generated during the construction period is about 151.2t. The project construction unit and the project contractor should contact with the local sanitation department to clean up the domestic waste at the construction site in time. The domestic garbage will be collected and transported by the local sanitation department regularly.

5.2.7 Environmental Risk Analysis

This project involves river engineering projects such as river dredging, water gate construction, and bridge construction. There are many vehicles entering and exiting the construction area and on the roads arranged along the river, which may cause traffic accidents such as vehicle collisions and rollovers, resulting in fuel leakage and pollution of the river water body. Once a traffic accident occurs, resulting in fuel leakage into the water body, it will have a significant impact on water quality, aquatic organisms, and fish. It is necessary to prevent oil spills from polluting the water body. According to data inquiries and investigations of similar projects, the probability of oil leakage and water pollution caused by vehicle collisions and rollovers during construction is relatively low. Under the premise of strengthening construction management and maintaining construction machinery and vehicles, such risks can be avoided and the impact on groundwater pollution is relatively small.

5.2.8 Ecological Impact

5.2.8.1 Ecological environment impact pathways during construction period

The main types of land occupied by this project include water areas, water conservancy facilities, construction land, and agricultural land. The ways in which the project construction period affects and damages the ecological environment mainly include the following aspects:

(1) River dredging, embankment filling, and excavation of flood control road projects will destroy surface vegetation and existing terrain, cause soil erosion, and change soil fertility and particle structure in a certain period of time and in a certain area;

(2) The engineering activities may damage the original natural ecology and environment, which will have a certain adverse impact on the growth, distribution, habitat, and activities of animals and plants in the evaluation area.

5.2.8.2 Aquatic Ecological Impacts

The water related projects mainly include Yangqiao Main Canal inverted siphon, hydraulic dam project, construction of 4 bridges, and supporting diversion cofferdam project. The main impact on aquatic ecology is the disturbance caused by the construction of diversion cofferdam. The main types of aquatic vascular vegetation in the evaluation area of this project are local common species such as Potamogeton crispus, cattail, and aquatic flowers. The dredging of the river during the construction period is carried out during the dry water period, so the impact of the construction dredging on the aquatic vegetation is relatively small, and can be compensated by artificial planting after the project is put into operation, so the impact of the project on the regional aquatic vegetation is within the acceptable range.

This project adopts a diversion construction plan, mainly relying on the existing channel of Qili River for diversion, without adding any temporary land occupation. Before the dredging of the project, the ecological system at the bottom of the river is basically stable, and the proportion of water related construction content is small. Compared to the overall project, it belongs to a point distribution project. At present, there are no protected species of benthic organisms, and the short-term reduction of benthic animal species in the river section of the construction area will not have a significant impact on the fish species in the area. And with the passage of time, the improvement of the aquatic ecological substrate environment after construction operations will form a new benthic animal community and a new dynamic balance in a relatively short period of time.

During the construction period, wastewater, solid waste, dust, and soil erosion may pollute water bodies, leading to a decrease in the biomass of zooplankton. But with the end of the treatment project, the water flow returns to its natural form, and the improved water quality is conducive to the reproduction of rotifers and planktonic crustaceans, thereby increasing the species and biomass of planktonic animals.

At present, the main fish species in the evaluation area include catfish, carp, crucian carp, and red fin culter. No migratory fish have been found, nor have any nationally protected or endemic rare fish been found. During the construction period, the expansion of the river channel will change the habitat along the riverbank and have a certain negative impact on the survival of fish. After the construction is completed, the ecological habitat of the river water will be better than the water quality conditions required by fish, and the bait organisms will gradually become better than the current situation due to the ecological improvement project. These small fish have strong adaptability to the environment and low requirements for living conditions, and will gradually recover to the original level within 0.5-1 years. Therefore, the impact on fish resources is reversible.

In summary, the original biomass and net production of rivers are not high, and these aquatic organisms are common species in the aquatic environment of rivers, without any protected or endangered species. Therefore, the loss of aquatic community biomass and net production during the construction period is not significant, and the biodiversity loss caused is within an acceptable range, and can gradually recover to the original level after the construction is completed.

5.2.8.3 Effects on Terrestrial Plants

According to on-site investigation, the vegetation types of the riverbank in the area where this project is located are mainly grassland and forest land. The dominant herbaceous species include dogtooth root, humulus, cowpea grass, and small grass. The dominant tree species is poplar, with artificially

planted bank protection forests and poplar trees on the outskirts of the beaches on both sides of the Qili River. The trees and weeds in the temporary land occupation area of the project will be damaged by a series of man-made engineering actions such as eradication, landfill and trampling. During the implementation of the project, the plants removed within the permanent land occupation area are mainly local artificially planted vegetation and common local species, and the impact of the project on the diversity of regional vegetation is within an acceptable range. The vegetation within the temporary land occupation area of the project is mainly crops, and the planning function is urban green space. In the later stage, the urban greening function is achieved through soil covering. The impact of the project on the crops within the temporary land occupation area is temporary, and after achieving a balance between occupation and compensation, the impact is acceptable.

In summary, although the construction period of the project has a certain degree of impact on biomass, distribution pattern, and biodiversity, artificial planting of green tree species and protective forests after the completion of the project can effectively compensate for the impact of the project on regional vegetation, compensate for ecological function losses caused by vegetation damage, and consider the rationality and integrity of vegetation structure when reconstructing vegetation. Attention should be paid to the combination of trees, shrubs, and herbs, More local tree species are used for greening construction, and various plants with ornamental value can be planted. The vegetation reconstructed on the project site will achieve a more complete community structure, more species, greater ecological and environmental benefits, and beautification benefits.

5.2.8.4 Effects on Terrestrial Animals

The evaluation area is disturbed by human activities and the environmental heterogeneity is low, so the animal populations are characterized by a paucity of species, with a high number of widespread species among reptiles. Birds include tree sparrows, titmice, magpies and burrowers, etc.; animal resources of veterinary species are relatively poor. Due to the interference of human activities, the distribution of animal populations and numbers is extremely unstable, and it is difficult to form stable populations. Meanwhile, due to the frequent human activities in the evaluation area, the number of animals is low as a result of long-term human interference, especially the large animals are almost extinct.

Therefore, under the influence of construction noise, a certain area along the project line and near the temporary facilities will not be suitable for animal habitat and foraging. The construction machinery and vehicles, construction excavators and construction workers will drive some animals with sensitive hearing and vision to a certain extent, forcing them to turn to other areas to avoid, and their living space will be compressed. Animals have certain

migration ability, especially birds and beasts, and there are more similar habitats around, so they can easily find other suitable habitats nearby. Therefore, the scope of such impact is limited, mostly confined to the construction area, and will not cause changes in animal populations, and such impact will disappear with the end of construction activities.

5.2.8.5 Soil Erosion Impact

The project area is located in the northern earth rock mountainous area - North China Plain - Yellow River flood plain sandy farmland protection area. The type of soil erosion is mainly hydraulic erosion, and the main form of soil erosion is gully erosion. The soil erosion modulus after project disturbance is determined through a combination of on-site investigation and data analysis. Based on natural factors such as precipitation, hydrology, meteorology, soil, terrain, slope, and vegetation conditions in the project area, combined with the "Zhengzhou Water and Soil Conservation Plan (2016-2030)" and comprehensive analysis of local water and soil conservation technical data, the background value of the average soil erosion modulus for the project area over the years is determined to be 360t/km^2·a, with a construction period of 3000t/km^2·a, and a natural recovery period of 200t/km^2·a.

The area where this project is located belongs to a plain terrain type, with a warm tropical monsoon climate. The spatiotemporal distribution of precipitation in the project area is uneven, with significant interannual changes, characterized by high intensity and concentration. Soil erosion is mainly caused by mild hydraulic erosion.

Water and soil loss in this project mainly occurs during the construction process. During the construction process of river dredging, a large amount of earthwork excavation, earthwork backfilling and temporary storage of micro terrain shaping projects will disturb the original landform, damage the surface soil layer and original landform, and induce water and soil loss. If the soil erosion caused by engineering construction cannot be effectively prevented and controlled, it will inevitably exacerbate the existing level of soil erosion in the construction area, not only bringing adverse effects to the surrounding environment of the construction area, but also bringing a negative image of engineering construction in society, affecting the further development of the local economy and indirectly causing socio-economic losses.

5.2.9 Traffic Impact

Construction units do a good job of construction site traffic organization, to avoid traffic congestion caused by construction, but also to reduce emissions from idling transport vehicles. The construction site is cleaned and sanitized by a dedicated person, and the dust is sprinkled regularly with watering equipment to ensure a neat and tidy appearance.

5.2.10 Physical Cultural Resources

According to the verification of the physical quantity of the impact of this construction content, no known cultural heritage or archaeological sites were found within the project area. However, construction activities may disturb unknown subsurface cultural remains. To address this issue, the project implementation unit and contractor shall establish incidental discovery handling procedures for the discovery of material cultural resources: if any cultural relics are discovered during the construction process, in accordance with Article 32 of the PRC Cultural Relics Protection Law, (1) stop construction; (2) protect the site and immediately report to the cultural relics management department of Xinxiang City; (3) according to the opinion of the cultural relics management department of Zhengzhou City, adjust the construction plan; (4) to be approved by the cultural relics management department before resuming construction.

5.2.11 Health and Safety During Construction

5.2.11.1 Occupational Health and Safety

Occupational health and safety hazards during construction are mainly from: use for overshooting, slipping, falling, being hit by objects, temporary hazards that may be caused by vehicle traffic on the project construction site and the use of moving equipment and materials, and risk of slope instability during river expansion. Risks can be prevented and controlled by taking the following measures:

1. Wear appropriate personal protective equipment (e.g., protective goggles, masks, safety helmets, safety shoes, etc.).
2. Train workers in proper handling and handling of materials during project construction and demolition work, including setting a weight limit for one person (after which mechanical assistance or two people are required to work together);
3. Reasonable working hours.
4. Implement a good site clearance system, such as sorting scattered building materials and demolition items;
5. Training workers in the use and practical use of fall prevention devices;
6. And post warning signs in areas where safety risks are present.
7. Use temporary fall protection measures, such as handrails and foot baffles, at the edges of scaffolding and other high working surfaces to prevent material from slipping off;
8. Planning and zoning vehicle traffic, machinery operations, walking

areas, controlling vehicle traffic through one-way traffic rules, imposing speed limits, and directing traffic on site by trained signalmen (wearing smart vests or coats);

9. Ensure that personnel wear a statement vest or coat for increased visibility while working or walking in heavy machinery operation areas;
10. Ensure that mobile devices are fitted with astern alarms;
11. Excavate layer by layer according to the designed slope ratio when the river reaming, and pay attention to strengthen the support when working on site.
12. The construction of cable lines shall be operated in strict accordance with the Construction and Acceptance Standard of Cable Lines of Electrical Device Installation Engineering (GB 50168-2018);
13. Develop a potential safty hazard reporting system so that project workers can report unsafe or unhealthy working conditions in time and stay away from danger.

5.2.11.2 Health and Safety of Workers and Communities

Employ local labor as much as possible during the construction of the project to avoid the influx of labor. Foreign workers settled in the project area for long-term operations, the communication and interaction intensity with local residents will increase to a certain extent, At the same time, migrant workers will flow and consume in the communities near the construction site and related street shops. In order to mitigate the risks of Labour influx, appropriate procedures for the management of worker camps need to be put in place:

1. Regularly assess the health and safety risks to Project workers and Project-affected communities. Formulate risk response plan and measures for possible risks;
2. Provide regular training to workers and affected communities to avoid or minimize adverse risks and effects of the project on their health and safety;
3. Document and report on accidents, diseases and incidents.

5.2.11.3 Traffic and Road Safety

In the construction stage, construction vehicles will have an impact on local traffic and residents' safety. The following measures are required:

1. During the construction period, carefully implement the traffic

rules and obey the uniform management by the local traffic authority eliminate traffic safety hazards, and prevent traffic accidents.

2. Assign one dedicated person to command the vehicles to enter and exit the construction site and maintain traffic order. As soon as problems affecting traffic are found, rectify them immediately.

3. Provide appropriate training to Project workers on driver and vehicle safety, and regularly maintain all Project vehicles.

5.2.12 Construction Camp Management

Two construction camps will be set up during the construction period. The following conditions should be met for construction camps:

1. The construction site should provide necessary living facilities for the construction personnel, including offices, dormitories, dining halls, toilets, showers, etc.

2. The passage and stairs of the living area and office area shall be equipped with emergency evacuation, escape indication signs and emergency lights, which shall comply with the provisions of "Technical Specifications for Fire Safety on Construction Site" (GB50720-2011) and fire safety signs (GB13495-92);

3. Closed refuse containers should be set up in offices and living areas. Keep household garbage sorted and transported in time to reduce mosquito breeding;

4. The construction site shall be equipped with common medicines, bandages, tourniquets and other first aid equipment;

5. The necessary living space shall be guaranteed in the dormitory. The indoor net height shall not be less than 2.5 meters, and the width of the passage shall not be less than 0.9 meters, so as to facilitate normal activities and evacuation in case of emergency. The per capita area of the dormitory shall not be less than 2.5 square meters.

6. The dormitory on the construction site shall be equipped with heat prevention and cooling facilities such as air conditioning or electric fans;

7. Grease trap in canteen facilities should be cleaned regularly;

8. Flush or mobile toilets shall be set up in dormitories and office areas on the construction site. The toilet floor shall be hardened,

with complete doors and Windows and good ventilation. Special personnel shall be responsible for cleaning and disinfecting the toilets regularly. Domestic sewage is connected to the municipal sewage network nearby.

5.3 Environmental Impact Analysis During Operation Period

5.3.1 Atmospheric Impact Analysis

The proposed project is an ecological project and no air pollutants will be emitted during the operation period.

5.3.2 Acoustic Environmental Impact Analysis

The operation of this project does not involve the operation of noisy equipment, and there is no noise generation, which will not affect the surrounding acoustic environment.

5.3.3 Solid Waste Impact Analysis

The solid waste generated during the project operation period is mainly domestic waste generated by tourists. If the daily tourist capacity is 800 persons and the amount of domestic waste generated is 0.1kg/person, the amount of domestic waste generated is 0.08t/d. Domestic waste is collected in garbage bins set up in the engineering area and promptly transported by the environmental sanitation department to the local waste transfer station. The impact on the surrounding environment is within an acceptable range.

5.3.4 Ecological Impact Analysis

The changes in hydrological conditions during the operation period of this project are mainly manifested as: the widening of the entire water storage surface of the river during the flood period will lead to a decrease in the average water level and flow velocity during the flood period. The widening of the main river channel expands the effective living space for aquatic organisms, which is conducive to their growth and reproduction.

5.3.4.1 Impacts on phytoplankton

The phytoplankton in the Qili River mainly include various diatoms and green algae. The number and abundance of phytoplankton species in the river will decrease during a certain period after treatment compared to the construction period. However, due to frequent human activities on both sides of the river, the rainy season is conducive to the accumulation of organic matter in the river. Therefore, the types and abundance of floating plants in the water will increase after the implementation of the project, Especially suitable for river ecological habitat conditions and nitrogen loving algae in the phylum Chlorophyta and diatoms, some algae will rapidly reproduce.

5.3.4.2 Impact on zooplankton

During the operation period of the project, as the biomass of phytoplankton continues to increase, the abundance of zooplankton will gradually recover. Especially, the number of protozoa will significantly increase, and the types of rotifers will also increase. The population structure of zooplankton is gradually transforming into a river type, and the species will also undergo seasonal changes. After operation, there will be more diversity of zooplankton and an increase in species that prefer to flow.

5.3.4.3 Impact on benthic organisms in rivers

After the operation of the treated river, the water flow speed will increase, and larger water disturbances will reduce the abundance of filter feeders. However, an increase in the water flow speed of the river will increase the transparency of the water body, promote the growth of aquatic plants, and provide more habitat for benthic animals, thereby increasing the diversity and quantity of benthic animals, especially the species and quantity of gastropods, However, areas with abundant water plants are not conducive to the life and reproduction of bivalves, and their numbers will decrease.

5.3.4.4 Impact on river fish

After river management, the water storage capacity of the river increases, ensuring a certain water level during dry seasons. The turbidity of the water decreases, transparency increases, nutrients increase, and water temperature increases, creating good conditions for fish breeding, feeding, and overwintering. At the same time, the widening of the river and the deepening of the water body also provide a good foundation for the breeding, survival, and development of large fish. But changes in hydrological conditions can also cause some fish to lose a suitable environment for survival. Overall analysis shows that the impact of the operating period on fish is generally favorable, with some fish benefiting from the changed environment and also causing some fish to lose a suitable environment for survival. But the swimming ability of fish and their ability to adapt to environmental changes can enable them to rediscover suitable living environments. After a certain period of time, the aquatic ecosystem of rivers will regain a state of balance.

5.3.5 Environmental Risk Analysis

This project involves rebuilding 3 bridges and extending 1 bridge. The main risk during the operation period after the completion of the bridge is the impact of accidents caused by vehicles transporting hazardous materials, such as the dumping and leakage of hazardous materials into river water bodies. According to similar projects, the probability of hazardous material dumping and leakage caused by vehicle accidents transporting hazardous

materials is relatively low. By adopting corresponding road management measures and initial rainwater collection measures, this risk is within a controllable range.

5.3.6 Occupational Health and Safety During Operation

5.3.6.1 Fall protection

Fixed protective railings shall be set up for working platforms and pedestrian passages (parts) with a height above 2.00m.Fixed protective railings are arranged on the side of the falling surface at the gate groove of the hydraulic structure. The height of the protective balustrade is 1.05 ~ 1.2m, the spacing of the vertical or transverse bar is not more than 0.25m, and there is enough strength, the bearing capacity of the protective balustrade is designed according to 500N/m. Where the fall height may be formed during maintenance at 2.00m or more holes and pits should be set up to fix temporary protective railings with slot holes and other measures. Anti-skid measures shall be taken for stairs and platforms.

All protective railings, vent Wells, hoist hooks and swivel arms shall be marked with safety signs as specified in Safety Signs.

5.3.6.2 Anti-noise and vibration

The noise and vibration source of the project mainly comes from the motor, fan, water pump and transformer on all kinds of equipment. In the equipment bidding for this equipment, the manufacturer is required to provide equipment that meets the noise and vibration standards stipulated by the state.

The noise limit value of each place is controlled according to the noise limit value of each work place of water conservancy and hydropower project. The design of each place of production and operation requires that natural ventilation can be ensured as well as noise caused by vibration of ventilation equipment can be reduced.

To take personal protection for the operators, the use of anti-sound appliances such as anti-sound earplugs, protective ear muffs, etc. In addition, for employees working in a high-noise environment, they should take turns to shorten working hours.

5.3.6.3 Prevention of mechanical injury

Equipment purchasing manufacturers should have qualified professional manufacturing certificate, mechanical equipment operators must be trained, passed the examination to obtain a post qualification certificate before Posting, it is strictly prohibited to operate without a license.

The arrangement of the equipment ensures that the parts or cutting materials are not thrown out of the wounding, and the orientation of the arrangement is conducive to lighting. During the repair, various necessary protective tools should be equipped, such as goggles, glasses, welding masks, protective clothes, etc. The machine repair personnel must operate in accordance with the relevant operating procedures.

5.3.6.4 Prevent electrical damage

Power equipment is grounded reliably according to the code requirements. All electrical equipment shell and metal structure, underwater steel mesh of hydraulic buildings are required to be welded together into an electrical path. The roof of each building is set up with lightning arrester to prevent the invasion of direct lightning. The total grounding resistance should meet the specification requirements.

Switch cabinet with anti-misoperation function should be selected, and electrical equipment should be equipped with electric locking device to prevent accidents.

In the external striking part of the electrical equipment, indicate the live mark, such as grounding sign, danger sign, operation sign, etc. The operation handle of the secondary component or the screen of the equipment are provided with a marking frame, so that the electrical operation personnel is easy to identify, as far as possible to prevent misoperation.

The voltage of electrical equipment at all levels is equipped with insulation monitoring devices, and equipped with an appropriate number of electrical testing equipment and insulation tools in line with national regulations, such as insulation gloves, insulation boots, electric test rods, portable work lights, etc. Electrical operation and maintenance personnel must strictly abide by the operating procedures and use these tools according to regulations when working, test tools and insulation equipment must be checked regularly, if there is damage must be removed immediately must not be used to ensure safety.

5.4 Environmental Benefits

First, the project has improved the overall image of the region. It has played a decisive role in the process of industrial agglomeration and supporting the adjustment of productivity layout, strongly promoting the transformation and development of the local tourism industry, supporting and backing the construction and development of new industrial bases, and providing a strong basic support for the sustainable, rapid and healthy development of the regional economy.

Secondly, the project enhances the environmental value of the waterfront

land The ecological landscape environment of the river has been significantly improved, greatly enhancing the value of the coastal land, living areas, office areas, etc., while also providing a place for fitness and leisure for the surrounding residents. It has improved the quality of coastal habitat environment and brought considerable economic benefits.

In summary, this project is a public welfare water conservancy infrastructure project. On the one hand, the implementation of the project guarantees the safety of flooding in Qili River, solves the safety risks, eliminates the safety hazards, ensures the safety of urban flood control in the main city and the safety of flooding in the river, and greatly improves the ability of flood control and drainage in Zhengzhou city. On the other hand, it has taken into account the demand for water from economic and social development and ecological environment construction, and has built a beautiful city with harmonious, environmentally friendly and ecologically natural water in line with regional characteristics, which has economic, social and great ecological benefits.

6 Social Impact Assessment and Mitigating Measures

6.1 Purpose of SIA

According to the ESF of the AIIB and the ESMPF published in November 2021, the objective of SIA is to avoid or minimize adverse ES risks and impacts; In unavoidable circumstances, in accordance with relevant Chinese laws and regulations and the ESP of the AIIB, identify these risks and impacts, and develop and implement necessary mitigation measures.

Therefore, the SIA of this project aims to identify the positive and negative impacts of the Project through social participatory methods such as literature collection, field survey, questionnaire survey, symposium, in-depth interview, and institutional interview, and to avoid the potential social risks of the project through SMP, improve the project design, safeguard the basic rights and interests of all stakeholders, and promote the fair participation of all stakeholders in the Project. Based on the characteristics of this Project and the identified risks, the main tasks of this SIA are:

(1)Identify the main stakeholders of the Project, understand the interests and needs of each stakeholder through extensive participation;

(2)Understand the potential social impacts of the Project, including positive and negative impacts, and identify potential social risks of the project in accordance with the relevant requirements of the ESF of the AIIB and the ESMPF reviewed and published by the AIIB in November 2021;

(3)Understand the attitudes of women, low-income groups, and others towards the Project, and identify the impact of the Project on them;

(4)Strengthen broad public participation, propose project optimization design suggestions, and establish information disclosure and GRM;

(5)Develop SMP to avoid project risks and promote the realization of project objectives.

In addition, during the consultation process with the general public in the project area, public awareness of the project background, objectives, and activities is enhanced through dissemination of project information, experience sharing, and selection of pros and cons, expanding the scope of public participation.

6.2 Objects and Scope

6.2.1 Objects

The objects of the SIA of the Project are the main stakeholders and the secondary stakeholders of the Project.

The main stakeholders of the Project are the direct beneficiaries within the scope

of project influence and the groups negatively affected by the project construction, including residents, vulnerable groups, and those affected by LA and demolition within the project areas of ZEDZ, Zhengdongxin District, and Zhongmou County.

Table 6-1 List of Direct Beneficial Population of Project Engineering

Districts /counties	Town / sub-district	Villages / communities benefiting directly	Direct beneficiary population (ten thousand people)	Female population (ten thousand people)	Low-income population[5] (people)
Zhengdongxin District	Baisha	28	17.8	8.4	124
ZEDZ	Qiancheng	18	3.7	1.9	42
	Jinghang	9	3.4	1.6	44
Zhongmou County	Guanghui	18	13.2	6.5	169
Total	4	73	38.1	18.4	379

Source: provided by each project town/sub-district

Secondary stakeholders include indirect beneficiaries, project owners, government and its relevant functional departments, design units, construction units, supervision units, etc. The indirect beneficiaries of the project refer to the residents of the entire project area and county, excluding the direct beneficiaries, including residents of Zhengdong New Area, Zhengzhou Economic and Technological Development Zone, and Zhongmou County. This group has little negative impact from the project and indirectly benefits from the project construction results to varying degrees. The project owner is Zhengzhou Water Resources Bureau. The government and its relevant functional departments refer to the people's government of the project area/county, the Zhengzhou Housing Acquisition Affairs Center, the Zhengzhou Natural Resources and Planning Bureau Acquisition Department, the District and County Housing and Urban Rural Development Bureau Relocation Office, the Ecological Environment Bureau, the Emergency Bureau, the Statistics Bureau, the Human Resources and Social Security Bureau, the Rural Revitalization Bureau, the People's Committee, the Women's Federation, the Civil Affairs Bureau, the Transportation Management Bureau, and the town government and street offices in the project area.

In the SIA of the Project, the affected situation, livelihood restoration and public participation of vulnerable groups and women will be focused.

6.2.2 Scope

The implementation area of the Project includes 12 villages/communities in 4 towns/sub-districts of 3 districts/counties, including ZEDZ, Zhengdongxin District, and Zhongmou County.

[5] Including the urban and rural MLS, urban and rural poverty-stricken individuals, and poverty alleviation monitoring households.

6.3 Social Impact Analysis

In March 2023, the ESIA preparation unit conducted a comprehensive screening of social risks that may arise from various project activities through methods such as second-hand data collection and organization, on-site investigation, institutional interviews, insider interviews, symposiums, and questionnaire surveys. The ESIA preparation unit understood the basic situation and economic development status of residents in the project area, and conducted a survey and analysis of residents' awareness, support, and opinions and suggestions on the Project.

6.3.1 Social Benefit

The construction impact scope of this project involves 3 districts/counties, and 4 towns/sub-districts. The direct beneficiary population of the project is about 381 thousand people, of which about 184 thousand are women, accounting for 48.29%; The low-income population is 379, accounting for 0.1%. The statistical table of direct beneficiaries of the Project is shown in Table 6-1. The total permanent population of the district and county where the Project is located is about 2.0108 million, which can indirectly benefit from the project construction. Among them, there are about 968.5 thousand women, accounting for 48.16%; The low-income population is 52 thousand, accounting for 0.26%.

Through on-site surveys, symposiums, interviews, and questionnaire surveys, the screening results of the ESIA preparation unit on the positive impact of the Project are as follows:

Table 6-2 Positive Impact of the Project

SN	Component	Positive impact	Impact scope	Direct benefit Population (ten thousand people)
1	River regulation works	1)Enhancing the flood discharge capacity of river channels 2) Improve the flood control capacity and standards of the lower reaches of the Qili River 3) Repair the damaged embankments along the Qili River, improve the supporting facilities of the river, and enhance the safety of the river along the line 4) Improve the overall flood control and disaster reduction capacity of the Jialu River Basin in Zhengzhou City, and form a complete flood control and drainage system	4 towns/sub-districts	38.1
2	Diversion gate engineering	1) Improve river flood control standards and reduce the impact of flood disasters 2) Balancing upstream and downstream flood control and ensuring	4 towns/sub-districts	38.1

SN	Component	Positive impact	Impact scope	Direct benefit Population (ten thousand people)
		downstream flood control safety 3)Protecting the embankment engineering system along the line and reducing flood hazards in this river sections		
3	Ecological restoration engineering	1) Improving the ecological environment along rivers 2) Reduce soil erosion along rivers 3) Forming a river ecological corridor with multiple composite functions 4)Improving the living environment of surrounding residents	4 towns/sub-districts	38.1
4	All the components	1) Increase temporary or long-term employment positions, increase residents' income, especially increase employment opportunities for women and low-income groups, and increase their economic income 2) Promoting local economic development 3) Promote social equity and share development achievements with vulnerable groups 4) Encourage women's participation and promote their own development 5) Enhance the flood control awareness and ability of residents along the line, and reduce the impact of flood disasters	Project implementation areas in the 3 districts /counties	/

(1)Improve river flood control standards and reduce the impact of flood disasters

Coordinate the flood control requirements of the Jialu River Basin, follow the overall idea of "upper storage, middle detention, and lower discharge", improve the layout of regional flood control projects, and enhance the flood control capacity of the Jialu River Basin in Zhengzhou City. Raise the flood control standards for the main urban section of the Jialu River to a 200 year return period, and for the Qili River and Jinshui River to a 100 year return period.

The 7.20 catastrophic flood caused serious losses to the lives and property of residents in Zhengzhou. During on-site discussions and interviews, the ESIA preparation unit found that residents along the Qili River reported that there were few occurrences of flood disasters, usually once a year (accounting for 33% of the sampled villages), or even every few years (accounting for 66% of the sampled villages). The most recent one was the 7.20 catastrophic flood, with 58.2% of respondents indicating that they or their families were affected by the 7.20 catastrophic flood, including one or more negative impacts such as agricultural losses, property losses, transportation problems, environmental issues or

infrastructure damage; The flood control standard for the section from Shangdu Road to Wansan Road in the lower reaches of Qili River is low (once every 20 years), which restricts the flood discharge capacity of the Jinshui River channel. With the completion of this project, the flood control standards for Qili River will be effectively improved, thereby reducing the negative impact caused by flood disasters.

(2)Improve the supporting facilities of river channels and enhance the safety of river channels along the line

The flood control facilities and related supporting facilities along the Qili River are not sound. The survey results show that 68.7% of respondents believe that the embankments along the line need to be newly built or reinforced, 31.9% of respondents believe that the slopes on both sides of the local river channel need to be reinforced, and 24.6% of respondents believe that the supporting and water blocking buildings in the river channel need to be renovated. The supporting facilities along the river urgently need to be improved. The relevant content has been incorporated into the design of this project, fully considering the construction needs of supporting facilities along the Qili River. After the Project is completed, it will effectively improve the supporting facilities along the line, enhance the flood control function of the river channel, and ensure the safety of the river channel along the line.

(3)Improve the ecological environment and living environment along rivers

The current river channel has not undergone systematic management, and the original river ecosystem has disappeared. The overall ecological effect is poor, and the river channel is silting up year by year. The scale of the water body is small, and the self purification capacity is poor. Parks along the river and nearby are the preferred leisure and entertainment destinations for local residents. At present, the river cannot meet the needs of residents due to problems such as riverbed sedimentation, poor water quality, limited greenery, and lack of planned walkways.

The ecological restoration project of this project will comprehensively meet the needs of urban green space, river ecological green corridor construction, soil and water conservation, and combine with the urban road network green space planning and ecological green space planning. Five adjacent river green spaces will be included in the scope of this project's governance, and the construction of the blue green line will be coordinated to improve the ecological environment along the river, enhance the regional environmental quality, and improve the living environment along the line, providing local residents with a good landscape experience and leisure place.

Figure 6-1 Facilities along the river and the current situation of the riverbank (partial)

(4)Increase temporary or long-term employment opportunities and increase residents' income

During the construction and operation period of the Project, there will be some technical and non-technical positions, it is expected to provide a total of 281 positions for the local area. Among them, non-technical positions, such as transportation of construction materials, houses and catering services for construction teams. The employment threshold is low and can absorb local surplus labor; After the completion of the Project, the positions of management and service personnel within each Jinshui River management station, such as cleaning and security, river clearing and maintenance, can also provide employment opportunities for local people. Through discussions and consultations with the PMO, the PMO and IA will urge the construction unit and operation management department to prioritize providing such employment opportunities to the project area and surrounding residents, especially those with labor capabilities, including women and low-income populations, to help low-income groups increase their income.

(5)Enhance the flood control awareness and ability of residents along the line, and reduce the flood disaster impact

During the preparation, implementation, and operation of the Project, special lectures on flood prevention and disaster relief knowledge, flood safety education and training, and flood prevention drills will be given to enhance residents' awareness of flood prevention and safety. When conducting education and training related to flood control and drainage, special attention will be paid to the participation ratio of women, the elderly, and children. In order to further reduce the potential impact of floods and

ensure the safety of the lives and property of residents along the river.

6.3.2 Social Risk

The ESIA preparation unit conducted a comprehensive screening of the social risks that may arise from various project activities through methods such as second-hand data collection and organization, on-site investigation, institutional interviews, insider interviews and symposiums, and questionnaire surveys. The preliminary screening results are summarized as follows:

Table 6-3 Summary of Project Social Risk Screening Results

Component	Social risks that may arise	Impact situation	Impact scope	Impact stage
River regulation works	LA	The impact on agricultural income is small, and compensation and resettlement will be carried out according to standards. The impact of LA on the income of PAP is not significant	Permanent LA affecting 1,427.28 mu of collective land, affecting 12 villages in 3 sub-district offices and Baisha Town, 96 HHs with 431 persons.	Preparation, implementation, and operation
	Residential HD	The demolition of houses or shops will cause the affected people to lose their existing residences or business premises. If the resettlement transition period is too long, it may cause social conflicts	Residential HD involving a total of 1075.3 m^2, affectng 1 village, 3 HHs with 13 people; Non residential HD involving 146,000 m^2, among them, residents' non-residential demolition 19,440 ㎡, affecting 88 HHs with 282 persons in 11 villages; enterprises' non-residential demolition 126,560 ㎡, affecting 5 enterprises 91 persons	Preparation, implementation, and operation
River regulation engineering Diversion gate engineering Ecological restoration engineering	Negative natural and social environmental impacts during construction	A. The dust, debris, and accumulated sludge generated during the construction process have caused inconvenience to the residents' lives, patients' medical treatment, and travel in the surrounding communities B. The noise, dust, and exhaust emissions caused by construction machinery and material transportation vehicles, as well as the discharge of domestic sewage and garbage during the construction period, affect the community landscape of residential areas along the line and affect residents' rest	3 districts/ counties, 4 towns / sub-districts around the project implementation area	Implementation

Component	Social risks that may arise	Impact situation	Impact scope	Impact stage
		C. Due to construction needs, there may be temporary impacts on traffic. The construction unit should prepare a traffic diversion plan based on the actual situation to avoid traffic congestion		
	Influence of migrant workers	A. Health and hygiene risks, such as AIDS, COVID-19, influenza, etc., and the construction of foreign personnel is likely to bring greater pressure on community epidemic prevention B. Conflicts between different social and cultural customs (including religious beliefs, tombs, temples, wedding and funeral customs, etc.)		
	Gender impact	Gender inequality may occur during the construction process and in the daily affairs of the construction site, such as discrimination against women during working hours, resulting in physical, mental or sexual harm to women; GBV such as threats, coercion, or arbitrary deprivation of liberty.		
	Temporary Land Use	Small impact per household, short duration, and can be restored for planting	Temporary land use involving 783.03 mu, affecting 79 HHs, with 334 people in 11 villages	Implementation

Source: Project FSR, RP, and on-site investigation

(1)The potential impact of LA and HD caused by project construction

According to the identification survey and statistics of the project's resettlement impact, the project resettlement is mainly caused by LA and HD involved in the river regulation works. The LA and HD of the Project will involve 4 sub-districts/towns in 3 districts/Counties in Zhengzhou City, with a total population of 200 HHs and 846 people. Among them, 431 people from 96 HHs are rural residents will be affected by collective land acquisition; 13 rural residents from 3 HHs will be affected by HD; 79 HHs, 334 people will be affected by temporary land use; Non-residential demolition will affect 93 HHs/enterprises with 373 people(including 88 rural HH with 282 persons, 5 enterprises with 91 persons). The specific impact of resettlement can be found in the RP of this project.

(2)Possible natural and social environmental impacts during project construction and operation

The EIA during the construction and operation periods is detailed in Sections 5.2 and 5.3 of this report.

The possible social impacts during the construction period include:

1)Improper disposal methods or stacking locations for abandoned soil and other waste may have a certain impact on the living and production of residents around the project area; Therefore, the construction site needs to be as far away from residential areas as possible, arranged within the construction river range of the project, and avoid involving new temporary land occupation.

2)During the construction period, during the transportation of construction vehicles, they may pass through residential communities and internal roads in the project area, interfering with residents' daily traffic and potentially increasing traffic safety risks. It is necessary to urge the construction unit to strengthen vehicle management, set up notices and warning signs at the main intersections leading to the construction site, warn pedestrians and vehicles to avoid the construction section in advance, and indicate detours or directions.

3)During the project construction period, after the construction unit enters the construction site, more outsiders will enter the construction area in the short term, which may increase the risk of infectious diseases (including AIDS, COVID-19, influenza, etc.), or cause public security disputes, GBV and other social risks. At the same time, if external personnel lack understanding of the social culture and traditional customs of the project area, it may cause unintentional violations of local social and cultural customs (including religious beliefs, tombs, temples, wedding and funeral customs, etc.), which will lead to potential crises and troubles. In order to mitigate the risks caused by labor influx, appropriate management measures need to be developed.

4)The project is constructed along the river, with a long construction route. Some areas may not be fully enclosed, and there may be safety hazards caused by surrounding residents mistakenly entering the construction site. It is necessary to urge the construction unit to strengthen management and standardize construction to ensure that the risk is always within a controllable range. Set up notices and warning signs at the main intersections leading to the construction site, warning pedestrians and vehicles to avoid the construction area in advance.

In the statistical analysis of 261 questionnaires, residents in the project area believe that the implementation process of this project may have negative impacts, as shown in Tables 6-4.

Table 6-4List of Residents' Cognition of Negative Impacts during Project Construction

SN	Possible negative impacts during project implementation	Sample size	Proportion(%)
1	Traffic inconvenience caused by increased construction vehicles	62	23.75%
2	Increase safety hazards in construction machinery and construction sites	19	7.28%
3	Environmental pollution such as exhaust gas, wastewater, noise and vibration, and solid waste during construction	138	52.87%
4	Construction causes soil erosion and damages the surrounding	121	46.36%

SN	Possible negative impacts during project implementation	Sample size	Proportion(%)
	ecological environment		
5	The impact caused by LA, HD, pipeline demolition, etc	69	26.44%
6	A large number of construction workers may lead to the prevalence of AIDS and infectious diseases	43	16.48%

Source: field survey

Interview records 6-2：Ms. Wang, Shiwang Village, Jinghang District, ZEDZ (59 years old)

Most of the construction should be carried out by the river, which is relatively far from our home and may not have any impact. However, some vehicles carrying materials or soil may pass through the village, while some drivers may drive fast, which is particularly unsafe. It is best for them to take a separate road outside the village and not pass through the village.

(4)Labor situation and impact during project construction and operation

This project will require the organization of professional construction teams for construction. Once the professional construction teams cannot meet the qualifications and construction requirements locally, it will be necessary to import a certain amount of labor from other places (provinces, cities, counties). It is expected that about 387 labor will be imported from other places, with about 310 male and 77 female workers; Approximately 243 people (approximately 194 male and 49 female) will be recruited from the local workforce. The total number of workers in the peak construction period is about 630(including railway sections involved). Among them, male labor force mainly works as skilled workers, while female labor force mainly works as unskilled workers. Special attention should be paid to GBV during the construction process and daily affairs on the construction site. Discrimination against women during working hours should be avoided, and physical, mental, or sexual harm to women should be avoided, including GBV such as threats, coercion, or arbitrary deprivation of freedom. During the construction process, special attention should be paid to the issue of the proportion of male and female workers, and the proportion of female workers should reach 20%.

Table 6-5List of Expected Personnel Composition and Types of Work During Construction

Period	Sex	Labor from other places (person)	Mainly engaged in work	Local Labor (person)	Mainly engaged in work	Total
Construction	Male	310	Project management, financial management, contract management, large machinery operation, steel worker, rack worker, etc	194	Construction workers, material transportation, kitchen workers, cleaners, steel workers, scaffolders, etc	504
	Female	77	Project management, financial management, contract	49	Construction workers, miscellaneous workers,	126

Period	Sex	Labor from other places (person)	Mainly engaged in work	Local Labor (person)	Mainly engaged in work	Total
			management, documenter, etc		cleaners, kitchen assistants, green chemicals, etc	
	Subtotal	387		243		630
Operation	Male	/	/	30	Database/platform operation management, facility / equipment maintenance, river inspection, greening maintenance, river garbage salvage, etc	30
	Female	/	/	8	Data organization and file management, daily management of central control room, river inspection, greening maintenance, cleaning, etc	8
	Subtotal	/		38		38
Total		387		281		668

Data source: Reference to similar local project estimates

Labor and working conditions:

During the project construction process, potential risks or impacts on labor include: 1) working conditions related to occupational health and safety, such as unhealthy working environments, high-altitude operations, operating hazardous equipment, or handling overweight items; 2) Discrimination or unfair treatment, such as gender discrimination, disability discrimination, etc; 3) Delayed salary and overtime.

The existing Chinese legal framework is in line with and consistent with the key requirements of the AIIB's ESS1. By comparing and analyzing China's legal framework on labor security with the key requirements of the ESF ESS1 labor and working conditions standard of the AIIB, it was found that China's legal framework on labor security is consistent with the requirements of the AIIB, and even more stringent, such as the legal age requirement for child labor.

1)Protecting women's rights and interests: The project construction will protect women's rights and interests from three aspects. Firstly, during the construction process of the project, the proportion of female workers seeking employment should strive to reach 20%; Secondly, sign labor contracts and use legal and policy measures to protect women's wages from labor that match their labor; Finally, ensure that women receive appropriate and reasonable dining and rest services in the construction environment.

2) Occupational health and safety protection: In accordance with the Environmental, Health and Safety(EHS) Guidelines and applicable occupational health and safety laws and regulations in the project area, please refer to the Environmental Management Plan of this project for details.

3)Suggestions for better ensuring the working conditions of labor: It is recommended that the construction unit meet the following 5 requirements:

A.Based on the principles of equal opportunity and fair treatment, hiring project staff shall not discriminate against specific groups such as women, people with disabilities, migrant workers, and youth of legal age.

B.Provide appropriate protection and assistance measures to cater to specific groups of workers, such as women, people with disabilities, migrant workers, and youth of legal age.

C.According to national laws and regulations, workers have the right to establish and join workers' organizations of their choice and ensure that their collective bargaining is not interfered with.

D.To prevent the occurrence of sexual harassment incidents, the contractor will set up sufficient facilities for male and female sharing in temporary toilets on the construction site based on the number of female staff members; Develop relevant regulations to prevent sexual harassment and assign dedicated personnel to be responsible, clearly informing all personnel of relevant requirements; Contractors' daily management training will include relevant content on preventing sexual harassment.

E.Establish and clarify a GRM for handling labor complaints, clarify the labor protection supervision mechanism, and protect personal privacy in accordance with the law when handling sexual harassment complaints. The labor GRM is consistent with the Project GRM, as described in Chapter 8 of this report.

6.4 Poverty (Low-income) Analysis

6.4.1 Low Income Status Quo

As of the end of 2021, there are no poverty-stricken villages in the project area, and there are no poverty-stricken HHs or population under current standards. However, poverty still manifests in various forms such as relative poverty and low-income population. The impoverished population is equivalent to the low-income population, mainly referring to those who enjoy the MLS in urban and rural areas[6], urban and rural poverty-stricken individuals and poverty alleviation monitoring households[7].

[6] Residents holding local permanent household registration can apply for the MLS if the per capita income of family members living together is lower than the local MLS standard, and their family property status meets the conditions set by the local people's government.

[7] Poverty alleviation monitoring households refer to registered poverty-stricken households that have already been lifted out of poverty. As these households have not been lifted out of poverty for a long

(1)Zhengzhou City: There are a total of 181 poverty alleviation villages in Zhengzhou, with 11,928 poverty alleviation households and 44,892 people. The Zhengzhou Municipal Government promotes the effective connection between poverty alleviation and rural revitalization, firmly holding the bottom line of not experiencing large-scale poverty return, further consolidating the achievements of poverty alleviation, and achieving rapid growth in the income of poverty alleviation households. At the beginning of 2021, the 13th Five Year Plan for Poverty Alleviation in Zhengzhou City was successfully concluded. In 2021, urban residents in Zhengzhou City enjoyed the government's MLS of 12 thousand people and receive a MLS of CNY 101.482 million; Rural residents enjoyed a MLS of 37 thousand people and receive a MLS fund of CNY 187.798 million. As of the end of 2021, the PCDI of impoverished farmers reached CNY 15,035.19, a year-on-year increase of 10.71%. Starting from July 1, 2022, the urban and rural MLS standard in Zhengzhou City was uniformly adjusted and increased to CNY 750 per person per month. The basic living guarantee standard for the assistance and support of extremely poor individuals was implemented at 1.5 times the MLS standard, and was uniformly adjusted and increased to no less than CNY 13,500 per person per year.

(2)Zhengdongxin District: As of the end of 2021, the permanent population of Zhengdongxin District is 960,200, including 1,336 minimal assurance people, accounting for 0.14%.

(3)ZEDZ: As of the end of 2021, there were 342,600 permanent residents in the entire region, including 474 minimal assurance people, accounting for 0.14%.

(4)Zhongmou County: As of the end of 2021, the county has a permanent population of 708,000, of which 2,436 are low-income people, accounting for 0.34%.

(5)According to on-site investigations, there are a total of 41,010 permanent residents in 12 villages of 4 project towns/sub-districts, including 164 low-income people, accounting for 0.4%. Please refer to Tables 6-6 for details.

Table 6-6Statistical Table of Low Income Population in the Project Villages

Districts /counties	Town / sub-district	Number of project villages	Total population (person)	Low-income population (person)	Proportion of Low-income population(%)
Zhengdongxin District	Baisha	5	18,783	103	0.55%
ZEDZ	Qiancheng	4	10,958	4	0.04%
	Jinghang	2	8,462	12	0.14%
Zhongmou County	Guanghui	1	2,807	45	1.60%
Total	4	12	41,010	164	0.40%

Data source: provided by each project town/sub-district, project village/community

According to the on-site investigation results, the population directly affected by

time, there is still a risk of returning to poverty within a certain period of time if their own endogenous development is insufficient.

resettlement in this project does not involve low-income populations. There are 164 low-income people in the 12 project villages, which may be affected by other negative impacts during the project construction period.

6.4.2 Low Income Reasons

Most of the villages involved in the project area are located in the suburbs of Zhengzhou City, with low income reasons including serious illness, medical treatment, disability, education, accidents, elderly disability, and lack of labor ability.

Among them, illness and disability are the main reasons why the low-income population in the project area is included in the subsistence allowance, accounting for 53% of the surveyed low-income population. This portion of the low-income population has a high rigid expenditure for medical and rehabilitation. Limited by their physical conditions, they cannot work normally, their income is low, leading to economic difficulties.

Secondly, poverty is caused by the inability to work and disability at an advanced age, accounting for about 36% of the low-income population surveyed. These groups lack a source of livelihood and can only rely on social assistance to maintain their basic livelihood.

The 7.20 catastrophic flood disaster in Zhengzhou City in 2021 also caused some property losses to residents in the project area, including flooding of houses, damage to vehicles, flooding of farmland, and damage to infrastructure.

Table 6-7Poverty and Low-income Causes

The cause of poverty	Natural disasters	Illness	Physical disability	Labor shortage	Elderly disability	Low education level	Unemployment
Low income	0	7	12	9	4	1	3
Proportion(%)	0.00	19.44	33.33	25.00	11.11	2.78	8.33

Source: field survey

6.4.3 Support Measures of the Project Area

The poverty alleviation measures in the project area mainly include the following aspects:

(1)Solidly carry out dynamic monitoring and assistance to prevent poverty return. Establish and improve three mechanisms for industry sector data sharing, normalized investigation, and precise assistance, build a comprehensive monitoring and assistance network, and achieve early detection, intervention, and assistance. The government have implemented one-on-one assistance measures for low-income households in the project area.

(2)Consolidate the foundation of "two no worries and three guarantees[8]".

[8] Free from worries over food and clothing and have access to compulsory education, basic medical services and safe housing.

Focusing closely on improving the level of "two no worries and three guarantees", relevant industry departments have improved policy measures, strengthened work guidance, strengthened supervision and inspection, and effectively implemented policies such as education, medical care, health, drinking water safety, housing security, and basic security.

(3)Zhengzhou government have vigorously promoted industrial revitalization, ensured stable employment, and conducted training to deepen financial assistance and provide small credit loans. They have successively supported a number of supporting industries such as characteristic planting and breeding, clothing processing, and photovoltaic power generation, and solidly carried out consumer assistance. Explore and implement a new model of consumer assistance led by party building, guided by the government, assisted by trade unions, supported by postal services, and social participation.

6.4.4 Needs of the Low-income Groups for This Project

There are no low-income groups directly affected by resettlement in this project, and 164 low-income people may be affected by other negative impacts during the project construction period.

The ESIA preparation unit conducted on-site investigations through institutional interviews, village discussions, and sampling surveys to gain a comprehensive understanding of the needs of low-income groups in the project village. It was found that these groups have the following needs for the proposed project:

1)Hope to get prioritize opportunities for employment and work. The interviewed low-income individuals expressed their hope that the project construction can provide them with some job opportunities and increase their income sources. For low-income groups with a certain level of labor ability, they may face difficulties in employment due to age, physical condition, and other reasons. They hope to receive priority employment opportunities if they are capable of performing relevant tasks. During the construction and later operation of the project, there will be some non-technical positions, such as cleaners, patrolmen, and security guards. If these positions are suitable, they can be given priority to low-income groups.

2)Hope to get some vocational skills training. For low-income groups with certain labor capabilities, it is hoped that the project can provide practical skill training, such as pre job training for project employment, skills training with high social demand and low educational requirements, to help them increase employment skills and expand their sources of income.

3)They hope that the project design will consider the travel needs of people with disabilities, set up accessible facilities, and minimize the impact on local transportation during the construction process. In the flood prevention road of the project, it is hoped to install accessible facilities to facilitate the daily travel and escape of people with disabilities; During the construction period of the project, some road excavation and bridge restoration projects may cause inconvenience to the daily

travel of disabled people. They hope to set up eye-catching detour signs in appropriate locations and ensure the safety and applicability of temporary transportation methods.

6.4.5 Project Impacts on Low-income Groups

Through on-site investigations and visits, based on a comprehensive analysis of the current situation and needs of low-income groups in the project area, the main negative impacts that the project may have on low-income groups in the project area include: 1) the impact on surrounding facilities and transportation during the project implementation period; 2) In the process of project preparation and implementation, low-income groups have weaker ability to obtain information or express opinions, and are in a disadvantaged position in project information disclosure and public participation activities. 3) The special needs of low-income groups may be ignored.

According to the planning and design objectives of the project and subsequent security measures, the project implementation will not deepen the poverty level of low-income groups or lead to new poverty.

The positive impacts of project implementation on low-income groups include:

(1)Provide direct and indirect employment opportunities to increase economic income. The employment opportunities brought by this project include: 1)Temporary or permanent job positions directly created during the project construction and operation period. During the construction period, some non-technical positions will be provided, such as construction workers, transportation workers, kitchen workers, etc. These employment opportunities will be given priority to the local low-income population to increase their economic income. 2)Another type is the indirect employment opportunities brought by the project. The improvement of infrastructure along the Qili River will create good transportation conditions, attract more outsiders to travel to Zhengzhou, develop local tourism resources, and indirectly create more employment opportunities, such as catering, accommodation, sightseeing tourism, leisure experience, sanitation and cleaning. This will help low-income groups to achieve local employment and increase their economic income.

(2)Improve local transport infrastructure conditions and reduce traffic accidents. The repair and reconstruction of bridges along the Qili River, as well as the construction of flood control roads, will to some extent alleviate traffic problems, reduce the occurrence of traffic accidents, and provide safer transportation conditions for local residents.

(3)Promote social equity and share development achievements with low-income groups. The proposed project will effectively improve the supply level of water related transport infrastructure and public services in Zhengzhou, provide more convenience for the lives of urban and rural residents, and allow residents to share the fruits of social development. After the completion of the proposed project, it will not only provide better living experiences for the low-income population in the surrounding area, such as the beautiful water scenery along the Qili River; It can also bring more

development opportunities to low-income populations.

6.5 Gender Analysis

6.5.1 Population Status of Women

According to the data of the bulletin of the 7th national population census, the sex ratio of the total population of Zhengzhou is 105.44, and the male population accounts for 51.32%; The female population accounts for 48.68%. Please refer to Tables 6-8 for details.

Table 6-8Current Situation of Women's Population in Zhengzhou City and Project Districts and Counties

Region	Year-end total population	Female population	The proportion of female population	Demographic sex ratio
Zhengzhou City	12,600,574	6,133,404	48.68%	105.44
Zhengdongxin District	945,234	474,102	50.16%	99.37
ZEDZ	328,812	144,976	44.09%	126.80
Zhongmou County	702,657	333,223	47.42%	110.87

Source: Announcement of the Seventh National Population Census of Zhengzhou City

6.5.2 Current Status of Women

In order to understand the development status of women in the project area, the ESIA preparation unit conducted questionnaire surveys and interviews with women during on-site investigations. In the questionnaire survey, there were 113 female survey samples, accounting for 43.3% of the 261 survey samples. The project impact on the income of affected women in rural areas mainly comes from the decrease in agricultural income caused by LA, with less impact on the income of affected women in urban areas.

(1) Age structure

From the age distribution of the survey sample, the female sample has the highest number of people in the age range of 50 to 59, accounting for 44.25%; 40-49 years old and over 60 years old are the second, accounting for 23.01%, and 20-29 years old are the least, accounting for 4.42%. As shown in Figure 6-2.

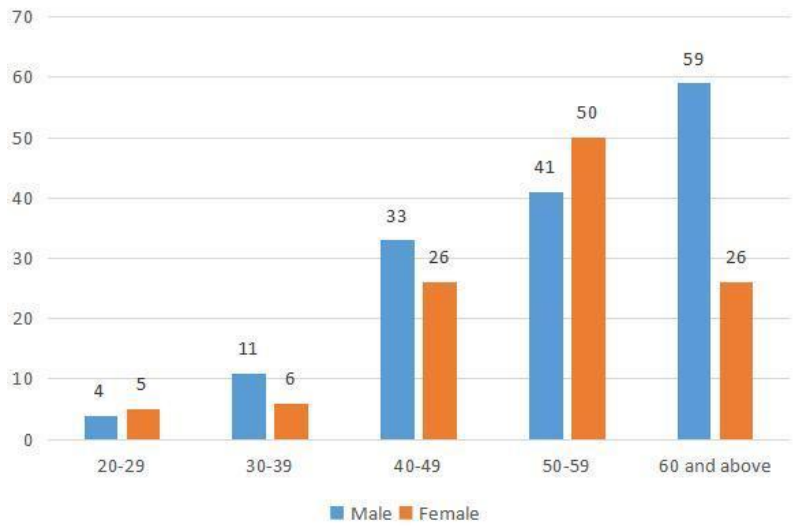


Figure 6-2Sex and Age Distribution of the Respondents

(2)Education level

The survey results show that the overall education level of the surveyed women is lower than that of men. For example, the proportion of males with high school/vocational school education (35.81%) is 3.95 percentage points higher than females (31.86%); Men with a college degree or above (18.24%) are 6.74 percentage points higher than women (11.50%). Women with primary school education and below are 9.28% higher than men. Please refer to Tables 6-9 for specific information.

Table 6-9Educational Level of the Survey Sample

Educational level	Female(%)	Male(%)
Primary school and below	22.12	12.84
Junior high school	34.51	33.11
Senior high school / technical secondary school	31.86	35.81
College degree or above	11.50	18.24
Total	100	100

(3) Occupation

From the perspective of women's occupations, the proportion of surveyed women working in agriculture and enterprises is higher than that of men. According to the survey, most of the surveyed women work in local enterprises, which is convenient for taking care of their families nearby. The project area is located in the suburbs of Zhengzhou City, with convenient employment nearby and fewer women working outside the province. In contrast, men are less likely to work in agriculture, and the proportion of doing business and working in government agencies and institutions is higher than that of women. The proportion of other professions among the surveyed men and women is relatively high, including retirement or home care (16.89% for males and 10.62% for females), freelance or flexible employment (12.16%

for males and 17.71% for females). The occupational composition and gender statistics of the survey sample are detailed in the table below.

Table 6-10Gender Statistics on Occupational of Survey Samples

Occupation	Female(%)	Male(%)
Farmer	23.01	15.54
Enterprise employees	38.05	28.38
Business	2.65	12.16
Work in government agencies and institutions	7.96	14.86
Others	28.32	29.05
Total	100	100

(4)Opinions on the project

Women have a higher level of support for the project than men, and 100% of the surveyed women clearly expressed their support for the construction of this project. When asked about the importance of flood prevention and disaster reduction training, 84.07% of surveyed women believe it is very important, while 70.27% of men believe it is very important, which is 13.80% lower than women. Based on the interview, women prefer to comprehensively enhance their local flood prevention and disaster prevention capabilities through project implementation. They believe that in addition to engineering measures, training and ability enhancement related to flood prevention and disaster reduction, emergency avoidance, and other aspects are equally important.

(5)Participate in public affairs

The increase in opportunities for women to participate in public affairs in the project area helps to promote gender equality. In recent years, with the active efforts of government departments at all levels, WF, and various public welfare organizations (or international organizations), women in the project area have more opportunities to participate in public affairs, and can basically enjoy public services and various supportive policies equally.

6.5.3 Women's Needs and Expectations

During the project preparation stage, the Water Resources Bureau, 3 project districts/counties, as well as the DI and ESIA preparation unit, learned about the needs and suggestions of women in the project area through discussions, interviews, and other means. Field investigations have found that women's needs for this project are as follows:

(1)Women's needs and expectations for transportation and supporting facilities along the Qili River

According to survey statistics, the most common mode of travel for women is

walking (39.8%), followed by riding an electric bike or bicycle (28.3%). After on-site visits, it was found that the main purposes of travel for the surveyed women were commuting, picking up and dropping off children, and daily procurement. Among them, electric vehicles are the most convenient for picking up and dropping off children, so electric vehicles are more commonly used than bicycles. The interviewed women believe that:

1)The road conditions along the river are poor and the facilities are old, requiring renovation or reconstruction.

2)The surveyed women believe that the main issues sorted by severity include: there are traffic safety hazards on roads/bridges along the river, accounting for 53.98%; In case of rainstorm or flood disaster, roads/bridges cannot pass normally, accounting for 34.51%; At present, the road along the river has incomplete facilities and poor road conditions, accounting for 30.08%; Frequent traffic congestion and inconvenient travel, accounting for 18.58%.

3)They hope to implement the project as soon as possible, improve the construction of emergency channels, and facilitate daily travel and emergency evacuation.

(2)Women's views on the berms along the river

From the interviews and focus group discussions, it can be seen that the surveyed women are more supportive of the construction of ecological embankments, believing that while building embankments and improving flood control and drainage capabilities, it can expand green areas, improve riverbank landscapes and ecological environment. In the long run, it is beneficial to improve the living environment and quality of life of residents along the river.

(3)Women hope to obtain more employment and income opportunities in the project

During the construction and operation periods, it is hoped that priority will be given to obtaining employment opportunities and increasing their sources of income. For jobs with low physical requirements, such as cleaning and kitchen assistance, the recruitment age can be appropriately relaxed, and priority should be given to women aged 40 to 50 who are more difficult to find non agricultural employment opportunities. Most of the surveyed women do not want to work too far from home and want to work nearby, so they hope that the implementation of the project can provide women with opportunities for nearby employment.

At the same time, during the project implementation, they hope to provide technical training for women in the project area, and provide support for their transfer of employment or the realization of non agricultural employment in the local area.

(4)Women's perceptions of public engagement and training

In the field investigation, it was found that there are currently no restrictions on

women's participation in major decision-making, skill training, flood control and drainage publicity activities within the project area. However, in general, the participants are still mainly male. The initiative of women in participating is not as high as that of men, and some respondents believe that this is related to women taking on more household chores and having relatively less free time. When informed that the project encourages women to participate in related activities and various types of training, 89.4% of respondents expressed willingness to participate. Women have a high willingness to participate in the project, as shown in Tables 6-11.

The interviewed women believe that they can increase their awareness on disaster prevention and reduction, traffic safety, shelter and escape through community activities, women's congresses, news media, relevant government departments, etc. Especially, attention should be paid to the use of simple, easy to understand, straightforward and convenient methods such as pictures, videos, examples, etc. for education and publicity aimed at women.

Table 6-11Analysis of Women's Willingness to Participate in this Project

Are you willing to participate in project activities?		Quantity	Percentage(%)
Yes		101	89.4
No	I am not in good health, I cannot participate.	3	2.7
	I don't have time.	9	7.9
	I don't want to participate.	0	0
Total		113	100

6.5.4 Project Impacts on Women

AIIB supports its Clients to enhance the design of their Projects in an inclusive and gender-responsive manner to promote equality of opportunity and women's socioeconomic empowerment, particularly with respect to access to finance, services and employment, including equal pay for equal work, and otherwise to promote positive impacts on women's economic status, with particular regard to financial resources and property ownership and control. AIIB also supports its Clients' efforts to identify and address the risks of sexual exploitation and abuse (SEA), sexual harassment (SH), and GBV, including intimidation, in the Projects it supports.

(1) Positive influence

1)Improve safety along the Qili River and provide women with a safer and more convenient travel environment

A large number of residential areas, production areas, and schools are distributed on both sides of the Qili River. Roads and bridges along the river are important channels for residents' daily travel, and the Qili River is also an important checkpoint for flood discharge and drainage in Zhengzhou City. The implementation of the Project will improve the flood control and drainage standards of the river in Zhengzhou, reduce the impact of flood disasters on residents, and make their lives

safer and more convenient.

Women's outings will be more convenient and safe, and transportation along the river will be more comprehensive, which is conducive to reducing travel time for commuting, picking up and dropping off children, daily procurement, and reducing traffic risks caused by poor road conditions. Women in the project area ride electric bicycles to pick up and drop off their children to school more often. After improving transportation conditions, the burden of picking up and dropping off their children to and from school can be reduced, and the time saved can be used for production labor or rest.

2)Providing non-agricultural employment opportunities for women and increasing economic income

During the project construction, a certain number of temporary positions will be provided for women, such as low-skilled labor workers, cleaners, kitchen helpers, green workers, etc. These nearby temporary positions can be given priority to women and low-income groups, allowing them to increase their non-agricultural economic income; After the completion of the project construction, certain non-technical positions will also be provided, such as cleaners and patrolmen along the Qili River. Priority can be given to providing these positions to women with relevant employment intentions among the affected residents along the river, helping them find employment nearby and increase their income.

3)Encourage women's participation and promote their own development

The AIIB project has always encouraged women's participation and focused on protecting their rights and interests. During the project implementation, utilizing existing village committees to encourage women to participate in public affairs and establishing corresponding incentive mechanisms. Each project village committee will encourage women to participate in project discussions and symposiums. This can allow more women to understand and participate in the project, allowing them to fully have a say, recognize their own value, raise their own needs, and strive for more development opportunities. At the same time, the project encourages women to participate in specialized training related to disaster prevention and reduction, flood control and drainage, helping to improve their participation awareness and disaster prevention and reduction capabilities, and promoting women's long-term development.

(2)Negative impact

According to the on-site investigation results, the implementation of the project will benefit women. However, in the process of project design, implementation, and management, if gender sensitivity is lacking and women's project needs and suggestions are ignored, it will reduce project benefits and bring risks to women. The social risks brought by the project to women are mainly manifested in the following aspects:

1)The female public participation rate of the project is low, and the corresponding needs of women are easily overlooked

Due to the lower overall education level of women in the project area compared to men, their access to project related information may be limited to some extent; At the same time, some difficult to understand information may make it difficult for women with low levels of education to understand. Within the project area, women have fewer opportunities to participate in project activities or related meetings than men due to factors such as cultural level, economic status, and family division of labor. This situation often leads to the neglect of women's needs and suggestions during the design and implementation stages of the project. For example, when selecting project locations and routes, the needs of women are easily overlooked.

2)Difficulty in ensuring certain rights such as receiving compensation and obtaining employment opportunities

During the process of distributing compensation, some women may not be able to sign and receive LA compensation because they are not the head of household; During project construction, female workers may be excluded or their rights may not be protected. At the same time, the recruitment of female workers entering the construction site may bring risks to the protection of women's rights and interests, such as whether they can receive equal pay for work with men, and whether they can receive effective job protection and non discriminatory treatment.

3)LA will lead to a decrease in the income

The LA involved in the project may directly affect the living standards of women in HHs who have lost their land. After the LA, the income from the land decreases accordingly. The opportunity to harvest crops (wheat, corn, vegetables, etc.) from the land will decrease, forcing them to be purchased from the market. If women who have lost their land do not find suitable jobs or other sources of income, their income will decrease, which will increase the economic pressure on their families, lower their living standards, or reduce their voice in the family.

4)Be vigilant against GBV

GBV is any harmful behavior that goes against personal will and is based on social attribution of gender differences between individuals. It includes behaviors that cause physical, sexual, or mental harm or pain, threats of such behaviors, coercion, and other deprivation of freedom. These behaviors can occur publicly or privately. Through on-site interviews and investigations into past local construction situations, it has been found that no similar incidents have occurred, and the risk is minimal. During the implementation and operation of this project, contractors must address the risk of GBV, through: 1) Training and raising awareness of all employees and workers to avoid GBV. 2) Informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; 3) Providing regular psychological health counseling for female workers, and cooperating with law enforcement agencies to investigate and handle complaints

about GBV. At the same time, contractors should strengthen supervision of the construction site (to avoid harmful behaviors such as gender violence, sexual exploitation and abuse, sexual harassment, etc.), and establish clear channels for appeals and complaints. The appeal channels for GBV will be consistent with the GRM established by the project for workers. The GRM handling team will include at least two female members and the safety of the members should be ensured (to avoid bias and fear of retaliation). If female employees are subjected to sexual harassment or other behaviors that endanger their personal safety in the workplace, the victim can immediately report or complain to the contractor, and the contractor should handle it in a timely manner and protect the personal privacy of female employees in accordance with the law.

On the basis of full communication and consultation with the Water Resource Bureau, IA, WFs in the project area and relevant institutions, the SMP of the project was formulated. See Chapter 9 ESMP for details.

7 Public Participation and Information Disclosure

7.1 Stakeholder Identification

Stakeholders refer to individuals or groups who can influence or benefit from the achievement of project objectives. Stakeholders can be divided into primary and secondary stakeholders.

Based on the nature of the project construction content, on-site investigation results, and interviews with relevant institutions, it has been identified that the main stakeholders of this project are the direct beneficiaries within the scope of project influence and the groups negatively affected by project construction. The main stakeholders include residents, vulnerable groups, and people affected by LA and HD within the project influence scope. Secondary stakeholders include indirect beneficiaries, project owner, DI, construction units, supervision units, etc., as well as the government and its relevant functional departments.

7.1.1 Key Stakeholders

The main stakeholders of this project include the direct beneficiaries of the project and the groups negatively affected by the project construction.

(1)The beneficiaries of the project. The project river section flows through 12 villages in 4 towns/sub-districts of 2 districts and 1 county in Zhengzhou City. Residents along the line will benefit from the project implementation, including general residents, women, and low-income groups in the project area. It is expected that there will be 381,000 people in 4 towns/sub-districts, including 184,000 women (48.29%), and 379 low-income people (0.1%) will directly benefit from the project. At the same time, the project will promote the social and economic development of 2 districts and 1 county, benefiting a total population of 2.0108 million people, with women accounting for 48.16%. The statistics of direct beneficiaries are detailed in Table 6-1.

(2)Affected vulnerable groups in the project area. The vulnerable groups in the project area refer to low-income hhs, five guarantees hhs(people living in extreme poverty), disabled people, women headed HHs, low-income groups, etc. Their interests and demands need to be taken seriously (LA and demolition in this project do not involve vulnerable groups). According to the current survey results, 379 low-income people are involved in the 4 project towns/sub-districts, including 99 urban and rural MLS people, 61 urban and rural people living in extreme poverty, and 219 poverty alleviation monitoring HHs.

(3)Groups negatively affected by project construction. Including: the groups whose normal production and life are negatively affected due to factors such as project construction, LA and demolition, mainly those affected by permanent LA, HD,

and demolition of ground attachments, including women and low-income groups within the project affected area.

According to the identification survey and statistics of the project's resettlement impact, it is found that the resettlement impact of this project is mainly caused by LA and HD involved in the river management of the project. The LA and HD will affect 4 towns/sub-districts in Zhengdongxin District, ZEDZ, and Zhongmou County, Zhengzhou City, with a total population of 200 HHs and 846 people. Among them, 431 people from 96 HHs are rural residents affected by LA; 13 rural residents from 3 HHs will be affected by HD; 79 HHs with 334 people will be affected by temporary land use; Non-residential demolition will affect 93 HHs/enterprises and 373 people. Please refer to the "Resettlement Plan" of this project for specific details.

7.1.2 Secondary Stakeholders

The secondary stakeholders of this project include: indirect beneficiaries and project owner; DI, construction units, supervision units, involved railway department, etc; the government and its relevant functional departments.

(1)Indirect beneficiaries. The indirect beneficiaries of the project refer to the residents of the entire district/county, including the residents of Zhengdongxin District, ZEDZ, and Zhongmou County, except for the direct beneficiaries. This group has little negative impact from the project and indirectly benefits from the project construction results to varying degrees.

(2)Project owner. The project owner, as the construction and operation and maintenance organization of the project, is specifically responsible for coordinating business relationships between all parties and organizing and managing the owner unit for engineering construction.

(3)The government and its relevant functional departments. The relevant government departments involved in this project mainly include the Municipal Water Resources Bureau, Natural Resources and Planning Bureau, Housing Acquisition Affairs Center, Development and Reform Bureau, Transportation Bureau, Statistics Bureau, Human Resources and Social Security Bureau, WF, Civil Affairs Bureau, Rural Revitalization Bureau, Ecological Environment Bureau, sub-district offices/town government, etc; At the same time, the implementation of the project also involves grassroots staff of specific communities/village committees in the project implementation area. The smooth implementation of the project relies on the coordination and cooperation of various government departments.

In addition, the secondary stakeholders of this project also include the consulting unit responsible for design consulting work and the construction units responsible for engineering construction.

7.2 Completed Information Disclosure and Public Participation

The Qili River Flood Control Improvement and Management Project in the lower

reaches of the Jinshui River is an important component of the Jinshui River flood control system. Since the preparation and operation of the AIIB project, the Zhengzhou Water Resources Bureau and relevant units have collaborated with relevant functional departments at all levels to organize a series of information disclosure and public participation work. At the same time, in the preliminary preparation stage of the project, the FSR preparation unit, the domestic environmental assessment unit, the ESIA&ESMP preparation unit and other units made information publicity and notification, as well as full insider consultation and public participation activities for the relevant information of the project.

7.2.1 Notification and Publicity of Project Information

1)Starting from March 2022, when the FSR preparation unit conducted on-site investigations, the Municipal Water Resources Bureau had already started communicating with the residents of the project area on the Project construction content, necessity and social benefits of the Project, informing them of the project situation, and listening to their attitudes and opinions on the project construction.

2)Since the beginning of 2023, with the assistance of the ESIA preparation unit, relevant departments such as the Zhengzhou Government, Zhengzhou Water Resources Bureau, Zhengdongxin District Government, ZEDZ Management Committee, Zhongmou County Government, and project DI have conducted a series of socioeconomic surveys and public opinion consultations (including about 30% of women participating), namely by holding village/resident representative meetings, party member meetings, and HH head meetings in the affected area, As well as community/village group project information publicity, project notice, distribution of brochures, hanging propaganda banners, outdoor wall slogans, WeChat official account and other ways, the information disclosure and publicity of project construction content and site selection standards were carried out, and residents' needs and wishes were investigated.

3)In March 2023, the ESIA preparation unit conducted on-site surveys one by one in three project districts/counties, visiting towns/sub-districts, and villages involved in project construction. Through questionnaire surveys, symposiums, institutional interviews, and personal in-depth interviews, the production and living conditions, socioeconomic status, river and bridge conditions along the Qili River, project impacts, and construction intentions of the affected residents within the scope of project services were carefully understood, the ESIA preparation unit conducted a socioeconomic sampling survey to understand the potential impact of each project on the PAP. Informed the residents in the project area of the content and social benefits of the project construction; Compensation policies and restoration measures for LA and HD, and the negotiation results will be included in the RP; They consulted in detail with the people in the project area about their needs and wishes for the project, as well as their opinions and suggestions on project implementation, and truthfully recorded and provided feedback.

4)On May 5, 2023, the construction unit conducted the first public announcement

on the national construction project environmental information disclosure platform regarding the environmental impact of this project. During the publicity period, no public opinions or feedback were received.

5) On May 16, 2023, the construction unit conducted the second online publicity of the draft environmental impact assessment report for this project on the national construction project environmental information disclosure platform, and posted a notice at the starting point of the project, with a publicity period of 10 working days. And on May 22 and May 24, 2023, two newspaper announcements were conducted in Henan Commercial Daily.

7.2.2 Institutional Interviews

The ESIA preparation unit conducted institutional interviews and discussions with various institutions and departments involved in the project area, including the Municipal Water Resources Bureau, Zhengzhou Housing Acquisition Affairs Center, Housing and Urban Rural Development Bureau, Natural Resources and Planning Bureau, Ecological Environment Bureau, Emergency Bureau, Statistics Bureau, Human Resources and Social Security Bureau, Rural Revitalization Bureau, People's Committee, WF, Transportation Management Bureau, and collected basic data and literature materials closely related to the project.

7.2.3 Field Investigation

The ESIA preparation unit conducted on-site surveys on the affected towns, sub-districts, village groups, as well as the infrastructure and traffic management along the Qili River, as well as the construction site. They have gained a more practical and objective understanding of the ES impacts of the construction content of each project area on the production and living of surrounding residents, as well as the situation of LA and HD, the socioeconomic living conditions of urban and rural residents and affected people in the project beneficiary area, as well as their suggestions, main concerns, and demands for the FS and supporting facilities of the optimized design of the Project.

Figure 7-1Environmental and Social Field Surveys

7.2.4 Focus Group Discussion

In order to gain a more comprehensive understanding of the needs and suggestions of the affected population in the project area (including urban and rural residents, women, and low-income groups), the ESIA preparation unit adopted the focus group discussion method in the field survey. The ESIA preparation unit conducted 5 resident focus group discussions in different sub-districts and communities of the project area, with a total of 96 participants. Among them, 39 are women, accounting for 40.6%; 13 vulnerable groups, accounting for 13.5%; and 44 other village representatives and village cadres, accounting for 45.8%.

Figure 7-2Focus Group Discussion

7.2.5 Key Insider Interviews

The ESIA preparation unit conducted interviews with key insiders such as districts/counties, towns/sub-districts, villages, enterprises and public institutions to better understand the attitudes of stakeholders towards the project and provide better suggestions for project design and implementation. The interviewees include relevant leaders or staff members from the owner unit, DI, project districts and counties' governments, water resources bureaus, natural resources and planning bureaus, transportation bureaus, WFs, rural revitalization bureaus, town governments, as well as village committees and resident representatives involved in the project. This survey interviewed a total of 30 key informants, including 4 from project owner unit and DI, and 11 people form Zhengdongxin District; 10 people form ZEDZ; 4 people from Zhongmou County; 1 person in the involved railway department.

Figure 7-3Key Insider Interviews

7.2.6 Questionnaire Survey

After holding symposiums with relevant institutions in the project districts/county, the ESIA preparation unit conducted an ES impact questionnaire survey in towns/sub-districts, village groups, etc. affected by the project construction. The ESIA preparation unit adopted a random sampling method in the affected villages of the project and completed a total of 270 ES impact survey questionnaires, of which 261 were valid, with a questionnaire efficiency of 96.7%.

Figure 7-4Questionnaire Survey

Table 7-1List of Public Participation in the Project

Type of participation	Time	Location	Content	Participant
Notification and publicity of project information	March, 2023	Affected villages	Project information disclosure, design optimization, and listening to the willingness, attitude, and opinions of PAP on project construction	Zhengzhou PMO, Zhengzhou Water Resources Bureau, DI, Zhengzhou Natural Resources and Planning Bureau LA Department, District LA and HD Office, Town/Sub-district Cadres, Village Cadres, and Villagers
Field investigation	March, 2023	Affected villages	Conduct socioeconomic and resettlement impact surveys; Understand the opinions and suggestions of residents	Zhengzhou PMO, Zhengzhou Water Resources Bureau, DI, Zhengzhou

Type of participation	Time	Location	Content	Participant
			on project implementation through on-site surveys, questionnaires, interviews, and other methods	Natural Resources and Planning Bureau LA Section, District LA and HD Office, town/sub-district cadres, village cadres, villagers, ESIA investigation team, resettlement investigation team
Questionnaire survey	March, 2023	Project villages	A total of 270 questionnaires were distributed and 261 valid questionnaires were collected, with an effective recovery rate of 96.7%, with males accounting for 56.7% and females accounting for 43.3%.	Villagers in the project villages and ESIA investigation team
Focus group discussions	March, 2023	Project villages	A total of 5 resident focus group discussions were held, with a total of 96 participants. Among them, 39 are women (40.6%); 13 vulnerable groups(13.5%); 44 other village representatives and village cadres (45.8%)	Project village cadres and representatives, ESIA investigation team
Key insider interviews	March, 2023	Related institutions, project towns / sub-districts, and project villages	Interview a total of 29 people, including project owner, DI, and relevant institutional heads/staff from 3 project districts /counties, including 4 from project owner and DI, and 11 people form Zhengdongxin District; 10 people form ZEDZ; 4 people from Zhongmou County.	Heads of relevant departments, village cadres and villagers' representatives, ESIA investigation team

7.3 Stakeholder Analysis

7.3.1 Requirements Analysis

Stakeholders in the project area refer to individuals or groups who can influence or be influenced, or benefited from the achievement of project objectives, including residents in the project area.

(1)The residents in the project area urgently need the project

The flood control standard for the section from Shangdu Road to Wansan Road in the lower reaches of Qili River is low (once every 20 years), which seriously restricts the improvement of the flood discharge capacity of the Jinshui River channel. The 7.20 extremely heavy rainstorm disaster in Zhengzhou caused varying degrees of damage to bank slopes and bridges along the line, increased river siltation, and decreased river water quality. The residents of the project area strongly support this project, and urgently hope to improve the Qili River flood control standards, ensure the safety of life and property of residents around the river, and restore and improve

the infrastructure along the river. Specifically includes:

a.Repair or demolish dangerous bridges to ensure safe passage on both sides of the river;

b.Dredging the river channel, ensuring flood discharge, and improving the flood discharge capacity of the river channel;

c.Repair and improve the infrastructure along the river, such as river gates;

d.Open up emergency channels along the river to ensure smooth flow of emergency channels;

e.Improve the ecological environment along the river, improve the quality of the water environment, beautify the landscape, and appropriately increase leisure places and supporting facilities (such as outdoor fitness equipment) on both sides of the river.

(2)Residents along the river expect to improve and strengthen river management

Inadequate management of some sections of the Qili River has resulted in poor flood discharge and affected flood safety. After the implementation of the project, it is also necessary to strengthen management, consolidate governance achievements, and timely eliminate hidden dangers in the river. Some villagers are willing to participate in river management supervision activities and recognize participatory river management methods.

Interview records 7-1：Ms.Fu (38), Baisha Village, Baisha Town, Zhengdongxin District

The river is not well managed now, with a lot of garbage, weeds, and mud. As soon as the water rises, it washes out garbage everywhere, and the water cannot be discharged. It is all dirty water, and when the water recedes, it becomes sludge and garbage. Cleaning up is very troublesome. For a long time after the 7.20 flood, the riverbank was dirty.

7.3.2 Requirements Analysis of Low-income Group

1)Hope to be given priority for employment and job opportunities. The interviewed low-income individuals expressed their hope that the project construction can provide them with some job opportunities and increase their sources of income. For low-income groups with a certain level of labor ability, they may face difficulties in self-employment due to age, physical condition, and other reasons. They hope to receive priority employment opportunities if they are capable of performing relevant tasks. During the construction and later operation of the project, there will be some non-technical positions, such as cleaners, patrolmen, and security guards. If these positions are suitable, they can be given priority to low-income groups.

2)Hope to receive some vocational skills training. For low-income groups with certain labor capabilities, it is hoped that the project can provide practical skill training,

such as pre job training for employment in the project, skill training with high social demand and low education experience requirements, to help them increase employment skills and expand their sources of income.

3)They hope that the project design takes into account the travel needs of people with disabilities, set up accessible facilities, and minimize the impact on local transportation during the construction process. In the flood prevention road of the project, it is hoped to install accessible facilities to facilitate the travel and flood prevention and risk avoidance of people with disabilities; During the project construction period, some road excavation and bridge restoration projects may cause inconvenience to the daily travel of disabled people. They hope to set up eye-catching detour signs in appropriate locations and ensure the safety and applicability of temporary transportation methods.

7.3.3 Women's Requirements Analysis and Participate Willingness

1)During the construction and operation periods of the project, it is hoped that priority will be given to obtaining employment opportunities and increasing their sources of income. For jobs with low physical requirements, such as cleaning and kitchen assistance, the recruitment age can be appropriately relaxed, and priority should be given to women aged 40 to 59 who are more difficult to find non agricultural employment.

2)Provide technical training for women in the project area, and provide support for their transfer of employment or the achievement of non agricultural employment in the local area.

3)Through community activities, women's congresses, news media, and relevant government departments, efforts should be made to increase the promotion and education of women's knowledge on disaster prevention and reduction, traffic safety, shelter and escape. Special attention should be paid to the use of simple and easy to understand methods such as pictures, videos, and examples for education and publicity aimed at women.

4)Repair roads and bridges along the river to ensure traffic safety and improve traffic efficiency. After the project is completed, it is possible to safely escape and seek refuge in the event of a disaster. It can also save a lot of time on transportation, such as commuting, picking up and dropping off children to school, and purchasing materials.

5)Improving the ecological environment and landscape along the river, increasing entertainment and leisure venues, such as square for dancing, exercise, and walking, can provide more options, and also improve the living environment of surrounding villagers.

7.4 Knowledge and Support of the Project

After the early participation and household survey promotion of the Municipal

Water Resources Bureau, relevant units in various project areas, FS, ESIA, and other units, 90% of the surveyed objects in the project area have "heard" of this project, and the project awareness is high. As for the respondents who have heard about this project, the main way of listening is to participate in relevant meetings or surveys, accounting for 66.8%; The second is media or online promotion, accounting for 20.9%; Related announcement, accounting for 12.3%.

From the attitude of residents in the project area towards the project, 92.7% of the surveyed respondents support the construction of this project.

Table 7-2Analysis of Support for the Project

Do you support the construction of this project?	Quantity	Proportion(%)
Yes	242	92.7
No	0	0
I don't mind	19	7.3
Total	261	100

7.5 Information Disclosure and Public Participation Plan

Information disclosure and public participation will run through the entire project cycle.

The Chinese and English version of the ESMPF has been posted on the website of Henan Provincial Department of Finance(https://czt.henan.gov.cn/2021/11-05/2342160.html ）and the website of the AIIB (China: Henan Flood Emergency Rehabilitation and Recovery Project - Projects - AIIB). The Chinese and English versions of the ESIA and ESMP of this Project, including the GRM, will be published on the website of Zhengzhou Water Resources Bureau and the website of the AIIB before construction. The specific requirements for disclosure will be implemented according to the A-class projects of the AIIB. At the same time, Zhengzhou Water Resources Bureau will prepare the paper version of the ESIA and ESMP for public reference.

Bulletin boards shall be set up at the entrances of the construction sites, indicating the hotline phone numbers and contact names of the engineering contractor, construction supervision unit, construction period, and local environmental, social, and urban management departments. Efforts shall be made to seek understanding of the temporary interference caused by the project construction by the APs, and to facilitate the APs to contact relevant departments when they discover that the construction unit has violated regulations.

The contractors shall cooperate with the requirements of the owner unit and

participate in the public participation meeting held by the owner unit in the affected village. At the meeting, the construction unit shall send personnel to explain the construction activities, the environmental protection measures that have been taken or will be taken, listen to ES issues of public concern, and respond to them.

Based on questionnaire surveys, symposiums, in-depth interviews, and interviews with key informants, the following information disclosure and public participation plans have been developed through participatory observation:

Table 7-3Information Disclosure and Public Participation Plan

Stage	Participate content	Participation way	Unit	Participant	Topics	Sources of funds
Project preparation stage	Disclosure of project basic information	Television, radio, posting notices, distributing leaflets, village meetings, village committee notifications, internet, etc	Water Resources Bureau PMO, Town /Sub-district, Village Committee	Villagers in the project area, especially those in the project implementation area Town/Sub-district Cadres, Village Cadres	Publish project information; Collect opinions and suggestions from villagers; Answer villagers' questions	Project Budget
	LA	Negotiations between town/sub-district and villagers	Town government/sub-district office, village committee, Water Resources Bureau PMO	Villagers, village committees, Water Resources Bureau PMO, natural resources departments	Confirm the land use situation; Negotiations between village committees and the villagers to confirm the compensation fees and payment methods; Sign relevant agreements with villagers and provide compensation according to the agreement requirements.	Project Budget
	Construction information disclosure	Village representative meeting. Posting notices, hanging slogans, broadcasting, etc.	Water Resources Bureau PMO, Construction Units, Village Committees	Villagers, Water Resources Bureau PMO, Construction Units, Village Committees	Publicly disclose the construction schedule; Distribution of construction sites; The main impact of construction; Safety issues that villagers need to pay attention to; Construction units liaison personnel and contact information, etc.	/
Project implementation stage	Reduce the impact of construction	Improve corresponding contingency plans and mitigation measures	Water Resources Bureau PMO, Construction Units, Village level supervision committee	Water Resources Bureau PMO, Construction Units, Transportation Bureau, Traffic Police Force, Environmental Protection Bureau	Provide convenient access for villagers in the project area during road excavation; Take dust and noise reduction measures; Engineering transportation vehicles should avoid the residential and living areas of villagers as much as possible; Try to identify the AHs and quantities involved in temporary land use.	Project Budget

Stage	Participate content	Participation way	Unit	Participant	Topics	Sources of funds
				Village level supervision committee Village representatives		
	Participate in project construction	Villagers' congress, Village Representative meeting	Water Resources Bureau PMO, Construction Units, Village Committees	Villagers, IA, construction units, village committees	Determine the positions that the project construction can provide; Determine the selection criteria for personnel participating in project construction, and prioritize providing them to low-income populations and women; Determine the salary for participating in project construction, as well as the technical training and safety system training for participating personnel.	Internal budget of the construction unit
	Labor input management	Expand safety and health promotion, standardize education and management of construction personnel	Water Resources Bureau PMO, Construction units, health bureau, Village level supervision committee, Villagers	Water Resources Bureau PMO, Construction units, Health Bureau, Township and Community Hospitals, Village committee, village level supervision committee Workers and villagers	Carry out education and publicity on public health, AIDS and COVID-19 prevention, and include them in the contract documents; Strengthen the publicity and education of external personnel on the social culture and traditional customs of the project area. The construction units should provide regular psychological health counseling for female workers, strengthen supervision of the construction site (to avoid harmful behaviors such as GBV, sexual exploitation and abuse, sexual harassment, etc.) and establish clear GRM.	Project Budget
Project operation stage	Flood control safety and water safety education	Knowledge lectures and participatory river management	Water Resources Bureau PMO and Village Committees	Villagers, village committees	Enhance the safety awareness of villagers through flood control safety education and water safety education; Carry out special lectures on flood control and disaster relief knowledge, including flood safety education and training, flood prevention early warning and drilling, taking extremely heavy rainstorm in Zhengzhou as an example; Diversified disaster training content; Pay special attention to the	Special funds from administrative authorities and village collective finance

Stage	Participate content	Participation way	Unit	Participant	Topics	Sources of funds
					proportion of women, the elderly, and children participating in relevant education and training; Implement community participatory river management, improve the river chief system and relevant river management regulations. Establish village river protection teams, clarify the personnel composition, and regularly carry out river patrol work along the river	
	Publish the GRM	TV, radio, posting notices, distributing leaflets, village meetings, village committee notifications, online	Water Resources Bureau PMO, relevant government management departments, and village committees	Water Resources Bureau PMO, relevant government management departments, sub-districts/towns, village committees	Publish project implementation supervision phone numbers at appropriate locations and open appeal handling channels; Regarding the relevant issues reported by villagers during the project operation, accept the complaints through on-site appeals, letters, phone calls, and other means, and provide on-site notification. If on-site notification is not possible, a response should be given within 15 days; Pay attention to listening to the opinions of vulnerable groups such as women and low-income groups, and ensure the openness, fairness, and transparency of project implementation.	/

8 Grievance Redress Mechanism

8.1 GRM Procedure

In the process of project preparation, construction, and operation, in order to timely understand and solve the impact and problems that the project brings to stakeholders, ensure the villagers' demand for information disclosure and the widest possible community participation, combined with the current situation of villagers' complaints in the project area, a project level appeal and complaint channel will be established. All appeal records and resulting resolutions will be kept and reported to the AIIB through a semi-annual ES monitoring mechanism.

The GRM of this project mainly includes two types: the GRM for PAP and the labor GRM:

The first type is the GRM at the project level, which provides an appeal channel for affected villagers, social groups, and entities in the business premises during the implementation and operation of the project.

The second type is a GRM for project workers, including direct workers, contract workers, and the project employees, providing an appeal channel.

(1)GRM established for PAP

The GRM mainly addresses the interference caused by the project, such as dust and construction noise caused by engineering construction, improper disposal of construction waste, safety measures to protect the public and construction workers, and noise and waste generated during operation. At present, villagers in Zhengzhou mainly report problems through the mayor's complaint hotline 0371-12345 and the environmental protection hotline 0371-12369. The improved GRM of this project complies with the regulatory standards of the PRC, which protect citizens' rights from ES impacts related to construction. The State Council of the PRC issued the "No. 431 Petition Regulations" in 2005, which stipulated the complaint acceptance mechanism for governments at all levels and protected them from retaliation. According to this regulation, the former Ministry of Environmental Protection issued the latest "Environmental Letters and Access Measures" (Decree No. 15) in December 2010.

In order to effectively solve problems and ensure the smooth implementation of project construction, the project has established a transparent and effective channel for complaints and appeals. The basic processing procedure is as follows:

Stage 1 (5 days): If there are problems during construction or operation, the affected person can submit written or oral complaints to the contractor. The contractor will: (1) immediately stop relevant activities after confirming the problem (such as on-site construction causing noise impact on nearby villagers); (2) Relevant

activities shall not be resumed until the complaint is resolved; (3) Immediately inform the Zhengzhou Water Resources Bureau of the complaint received and the proposed solution; (4) Provide a clear response to the affected person within 2 days; (5) Try to resolve the issue within 5 days of receiving the complaint as much as possible.

Stage 2 (5 days): If the contractor is unable to determine the implementation plan for the solution, or if the affected person is not satisfied, the Zhengzhou Water Resources Bureau will organize a meeting with the main stakeholders (including the contractor and the affected person). Develop a solution that is acceptable to all parties, including key steps to address this issue. The contractor shall immediately implement the resolution and resolve the issue within 15 days. All measures and results should be documented.

Stage 3 (15 days): If the Zhengzhou Water Resources Bureau is unable to determine a solution or the complainant is not satisfied with the proposed solution, the Zhengzhou Water Resources Bureau will organize a stakeholder consultation within seven days (including the complainant, contractor, local ecological environment bureau, human resources and social security bureau, urban environmental management bureau, and other relevant regulatory departments). At the meeting, a solution that everyone can accept should be determined, including clear steps. The contractor will immediately implement the agreed solution and fully resolve the issue within 15 days. The actions and results of all stages will be documented. At the end of the Stage 3, the project IA will inform the AIIB of the results.

Stage 4: If the complainant is still dissatisfied with the decision of the Zhengzhou Water Conservancy Bureau, they can, after receiving the decision, appeal to the administrative organ with jurisdiction level by level and apply for arbitration in accordance with the Administrative Litigation Law of the People's Republic of China.

Stage 5: If the complainant is still dissatisfied with the arbitration decision, they can file a lawsuit in a civil court in accordance with the Civil Procedure Law after receiving the arbitration decision.

(2)GRM established for workers

The project IA will establish a separate complaint handling center to handle complaints from workers working on construction sites to contractors. These complaints include wages, overtime pay, timely payment of wages, accommodation issues, or facilities related to drinking water, sanitation, and medical services.

At the same time, in GBV management, relying on the guidance and coordination of the Municipal Water Resources Bureau, districts'/counties' WF, towns/sub-districts and Villages/Communities WF organizations, the project IA, project construction units (contractors), etc. are set up to be specifically responsible for the protection of women's rights and interests. In terms of protecting female employees from sexual harassment in the workplace, effective measures are taken based on the work and production characteristics of the unit, prevent and stop female

employees from experiencing sexual harassment in the workplace. And facilitate a rapid response mechanism for female workers and project area women to file complaints or suggestions regarding GBV. If female employees are subjected to sexual harassment or other behaviors that endanger their personal safety in the workplace, the victim can immediately report or complain to the employer. The employer should promptly handle the situation and protect the personal privacy of female employees in accordance with the law.

8.2 Recording and Tracking Feedback

During the implementation of the ESMP, all entry points of the GRM should be registered and managed with complaint materials and handling results, and written materials should be submitted to the Municipal Water Resources Bureau once a month. They will conduct regular checks on the registration of complaint handling.

In order to fully record the complaints and related issues of the PAP, the Municipal Water Resources Bureau and IA have developed a registration form for the handling of complaints and appeals from the PAP. The sample table format is shown in Table 8-1.

Table 8-1Complaint Registration Form

Complainant's name	Time	Location	Institution / unit feedback	Municipal Bureau of Water Resources	External monitoring unit recommendations	Progress in resolving	AIIB opinion
Cause of complaint							
The way of demanding resolution							
Proposed solution							
Actual handling							
Responsible Person (Signature)							
Note: 1) The recorder should truthfully record the complainant's appeal content and requirements. 2) The appeal process should not be subject to any interference or obstacles. 3) The proposed solution should respond to the complainant within the specified time.							

8.3 Contact Information

The IA will arrange for the main responsible person to be specifically responsible for receiving and handling the grievances and appeals of the APs. The names, office addresses, and contact numbers of the confirmed responsible persons are shown in Table 8-2. After the bidding is completed, the construction units and supervision units need to confirm the ES responsible person as their contact person for the GRM.

Table 8-2 Information on Institutions and Personnel Responsible for Receiving Complaints

Institutions / units	Contacts	Tel
Zhengzhou Water Resources Bureau Qili River Project Construction Management Bureau	Yang Baozhan	15838100171
ZEDZ Social Affairs Bureau	Wang Xu	13939096031
Qiancheng Sub-district Office, ZEDZ	Ran Ganghui	13783496855
Jinghang Sub-district Office, ZEDZ	Zhu bingbing	0371-69683601
Zhengdongxin District	Cheng Yanan	0371-68258978
Baisha Town, Zhengdongxin District	Xu Xintai	0371-62361003
Zhongmou County	Li San	0371-62160166
Guanghui Sub-district Office, Zhongmou County	Song Yanfang	0371-56922971

In addition, the AIIB has established a Project-affected People's Mechanism (PPM) for PAP. When PAP believe that the failure of the AIIB project to implement its ESP has had or may have adverse effects on them, and their concerns cannot be satisfactorily addressed through the Project GRM or the AIIB management mechanism, the PPM provides an independent and impartial review opportunity. PPM related information can be obtained by visiting the following link: https://www.aiib.org/en/policies-strategies/operational-policies/policy-on-the-project-affected-mechanism.html.

9 Environmental and Social Management Plan

9.1 Institutional Responsibilities for the ESMP Implementation

Special Team for AIIB Loan Project: The Zhengzhou Municipal Government has established a special team for applying for the AIIB loan project, led by the Deputy Mayor and Deputy Secretary General of the government. The member units include the Municipal Finance Bureau, the Municipal Urban Construction Bureau, the Municipal Water Resources Bureau, the Municipal Development and Reform Commission, the Municipal Natural Resources and Planning Bureau, the Municipal Ecological Environment Bureau, and the Municipal Transportation Bureau.

PMO: Zhengzhou City has set up a PMO under the Special Team for the AIIB loan project. The Zhengzhou PMO is located in the Zhengzhou Finance Bureau, and its personnel mainly come from the Zhengzhou Finance Bureau, Zhengzhou Transportation Bureau, Zhengzhou Urban Rural Development Bureau, Dengfeng Water Conservancy Bureau, etc. The PMO has established five groups: Comprehensive Coordination Group, Bidding and Procurement Group, Financial Audit Group, ES Safeguards Group, and Project Implementation Supervision Group, each of which is equipped with full-time personnel responsible for the daily work of the group.

Under the guidance of the Special Team, the PMO is mainly responsible for the comprehensive coordination of loan projects, bidding and procurement guidance, financial statistics, implementation supervision, and other daily work to ensure the smooth implementation of projects. Each industry regulatory department has also established industry PMOs accordingly. The main responsibilities of the PMO are: responsible for the daily management of the project, organizing and guiding the project implementation units to carry out project preparation, mid-term implementation, and post evaluation work; Implement specific supervision and management of project plans, funds, finance, procurement, training, monitoring, and archives. Clearly designate a dedicated person to be responsible for monitoring and evaluating the Zhengzhou sub project in accordance with the loan agreement and project agreement requirements.

Implementing Agency(IA): The Zhengzhou Water Resources Bureau is the IA for the Qili River Flood Control Improvement and Management Project, responsible for coordinating and promoting the construction of the project content. The project department of the bureau has four departments: Comprehensive Department, Engineering Department, Technical and Measurement Department, and LA and HD Department. Under the guidance of the Zhengzhou AIIB PMO, the Zhengzhou Water Resources Bureau is responsible for (1) designating an ES coordinator for each section, responsible for coordinating the implementation of the ESMP; (2) Ensure the inclusion of ESMP, monitoring plans, and mitigation measures in bidding documents

and construction contracts; (3) Responsible for the operation of the GRM; (4) Handle unforeseeable adverse effects and promptly report to the Zhengzhou PMO and the AIIB.

Contractors: 1) Ensure that sufficient funds and manpower are available throughout the entire construction phase to implement the relevant mitigation measures and monitoring in the ESMP; 2) Responsible for the operation of the GRM during the construction phase.

Construction Supervision: 1) Ensure sufficient funds and human resources to supervise and guide contractors, and require them to implement mitigation measures and monitoring in a timely manner in accordance with the requirements of the ESMP; 2) Supervise construction progress and quality; 3) Appoint qualified personnel responsible for occupational health and safety to conduct regular on-site supervision of contractors; 4) Supervise the implementation performance of the contractor's ESMP.

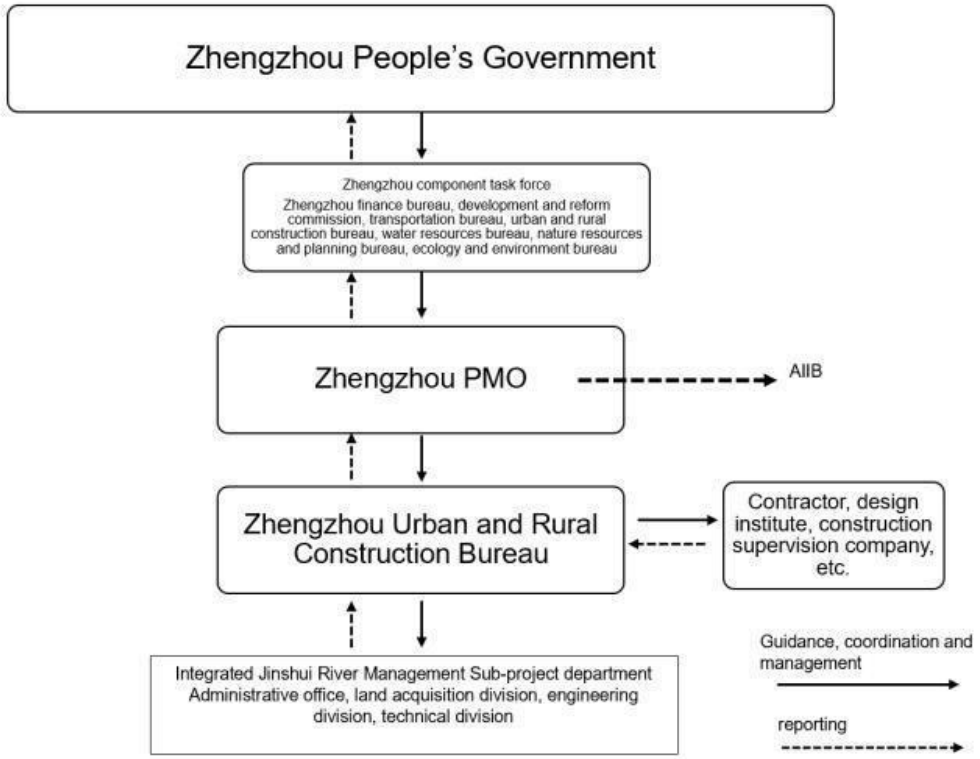


Figure 9-1 Organizational Chart of ES Management

9.2 Environmental and Social Management Plan

Based on the identified ES impacts, corresponding mitigation measures have been developed (Tables 9-1 and 9-2), these mitigation measures are also applicable to associated facilities. The DI and contractors will incorporate mitigation measures into the design, bidding documents, construction contracts, and operational management under the supervision of the IA and supervision company. The effectiveness of these measures will be evaluated based on the monitoring results of the supervision and external monitoring units to determine whether adjustments and improvements are needed to these measures.

Table 9-1 Optimized Design of the Project Environmental Mitigation Measures

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
Exhaust gas	Dust	① At construction sites located on major urban roads, residential areas, and busy locations, erect barriers with a minimum height of 2.5 meters. For other road sections, use barriers with a minimum height of 1.8 meters. This ensures complete separation of the construction area from the surrounding environment. The barriers should have no gaps, be equipped with spill prevention measures at the base, and have spray systems at the top. Maintain a minimum distance of 4 meters between each set of barriers. ② For earth excavation work, it is advisable to schedule operations to avoid dry and windy weather conditions. And shall adopt wet method operation along the excavation and transfer. ③ To control dust emissions effectively, completely cover temporary stockpiles of earth and rock materials with either mesh or impermeable dust-proof cloths, ensuring a 100% coverage rate. For materials prone to generating dust, adopt a slow and controlled unloading approach and utilize enclosed storage methods to minimize dust dispersion. ④ At the construction site, rigorously implement the "Eight 100% Dust Control" requirements. Prohibit on-site concrete mixing and the on-site preparation of mortar, adhering to the "Two Prohibitions." Strictly enforce reopening inspections, the "Three Personnel" management system, dust control budget management, and respond to measures for severe pollution weather events. ⑤ In accordance with the requirements outlined in the "Henan	Table 2 of Comprehensive Emission Standard for Air Pollutants GB16297-1996	356 (Weifang 121, Car Wash 180, Monitor 30, Monitor 20, Fog Cannon 5)	Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban Management Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		Province Severe Air Pollution Emergency Response Plan," when initiating a Level II (Orange) or higher alert or when the wind speed reaches Level 4 or above, all operations that could potentially generate dust, such as earth excavation, filling, transportation, and demolition, must be suspended. Additionally, cover the work areas during such conditions. ⑥ For all outdoor storage areas currently in use, it is imperative to implement measures such as fencing, windbreaks, dust covers, automatic spraying, and dust extraction and cleaning systems. This ensures that material conveyance, material discharge, and entry and exit points remain dust-free. ⑦ Construction site entrances and exits set up automatic vehicle washing device, vehicle washing is appropriate to use recycled water, set up sedimentation ponds, sedimentation ponds do impermeable treatment, washing wastewater after treatment all reuse; washing device should be set up from the date of commencement of the project, and retained until the completion of the project, the damaged equipment should be repaired in a timely manner to ensure normal use. Transport vehicles for construction waste and debris must complete the required documentation or delegate the transportation to qualified waste transport units. Employ sealed transportation methods to prevent the dispersion and spillage of construction materials. All transport vehicles should be equipped with satellite positioning devices and be connected to the relevant authorities for monitoring. ⑧ The construction site should be masonry garbage pile pool, construction waste, household garbage concentrated, classified pile, daily production; construction site is prohibited				

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		on-site mixing concrete, mortar; sand, stone, earth and other bulk materials should be concentrated pile and cover; field loading and unloading, dumping materials should be covered, closed or sprinkled, not overhead throwing, scattering. ⑨ Construction site should set up a person responsible for the cleanliness of the site environment. ⑩ In accordance with the standard installation of remote monitoring cameras, construction site information signs (LED), vehicle access and flushing monitoring equipment, ready-mixed mortar tank storage monitoring equipment, and data access to the corresponding industry competent department platform, and finally aggregated to the Zhengzhou City dust pollution prevention and control management information platform. Arrange for dedicated management and maintenance of monitoring equipment to ensure the normal operation of monitoring.				
	Stench	① After the construction of diversion, the river construction surface needs to be dried for several days to minimize the operation with water; ② Dry desilting configuration of construction machinery, increase the desilting surface, shorten the working period, reduce the impact of time; ③ Protective measures for construction workers include wearing protective masks and face shields; The bottom mud using tank truck closed transport, to prevent scattered along the way; Sediment transport to avoid bustling areas and densely populated areas.			Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban Management Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		④ The dredging is recommended in winter, the smell of dredging is not easy to diverge, and the residents' Windows are closed in winter, which can reduce the impact of the odor on the surrounding residents.				
	Mechanical exhaust	① Increase the proportion of pure electric material transport vehicles and other transport vehicles should meet the National Emission Standards. ② Avoid using low-quality fuels and strictly adhere to the regulations outlined in the automobile emissions monitoring measures to prevent black smoke emissions.			Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban Management Bureau
Construction waste Water		① In the river reaming and slope protection construction, can use half construction, half diversion scheme; River construction process must ensure that the construction machinery without fault, prevent running, taking, dripping, leakage and other phenomena occur, if the use of the process of failure, should immediately drive back to the shore repair; For the machinery that cannot be moved, drip and leakage phenomenon should be immediately collected by containers, and transported back to the shore for proper treatment;	/	60	Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban Management Bureau
		① Establish environmentally friendly toilets at each of the two construction camps, complete with temporary septic tanks that are regularly emptied. ② Create construction vehicle cleaning areas at both construction camps and install oil separation and	No external discharge		Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		sedimentation tanks for wastewater. Treated wastewater should be reused for dust control in the construction and living areas and for vehicle cleaning, with no discharge outside the site. ③ At each construction enclosure, set up a neutralization and sedimentation tank. Water drained from excavations should undergo sedimentation treatment and be reused, with no external discharge.				Management Bureau
Construction noise		① Implement a rational construction schedule and optimize site layout. High-noise equipment should be placed as far as possible from residential areas. Develop a scientifically-based construction plan that minimizes the simultaneous use of high-noise equipment. Additionally, schedule high-noise equipment operations during daylight hours, avoiding nighttime work whenever possible. In cases where nighttime construction is necessary, it should be approved by relevant authorities, and a public notice to nearby residents must be made three days in advance. ② Plan the transportation of construction materials sensibly. Reduce speed and refrain from honking in areas with sensitive points nearby. ③ Opt for low-noise equipment when selecting machinery.	Environmental Noise Emission Standard for Construction Site Boundary (GB12523-2011)	Sound insulation Barrier 72	Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban Management Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		Enhance management to reduce human-generated noise through civilized construction practices, and operate mechanical equipment in accordance with regulations. ④ Strengthen noise monitoring during the construction period. If noise levels exceed limits at sensitive points, consider deploying mobile noise barriers.				
Construction Solid Waste		① Construction waste: priority recyclilng, the remaining portion will be transported to the designated absorption field for treatment. ② Dredging waste: mainly for the river piled up construction waste, after cleaning to the municipal department designated absorption site. ③ The household garbage of the construction personnel is set up in the construction camp, which is collected centrally and handed over to the sanitation department for unified treatment. To avoid littering and discarding, into the river and construction site. ④ The waste oil sludge generated from mechanical equipment washing wastewater, after undergoing oil separation, should be handed over to qualified units for proper treatment.	/	40	Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban Management Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
Environmental Risks During Construction		① Develop emergency plans based on potential sources of risk. ② During the construction period, enhance vehicle management and ensure regular maintenance for transport vehicles, construction machinery, and other equipment.			Contractor	Zhengzhou Water Resources Bureau, Emergency Management Bureau
Ecological protection during the construction period		① Establish strict construction activity boundaries. Construction vehicles should follow the planned construction roads to avoid damaging the surrounding vegetation. Regulate the behavior of construction personnel, limit and minimize the construction work area, set up ecological warning signs within the construction area to delineate the project's land acquisition boundaries, specify the range of activity for construction personnel, prohibit unauthorized land occupation by construction personnel, strictly forbid the indiscriminate felling and destruction of vegetation outside the construction zone, and tightly control other activities outside the construction work area. ② Remove and store the topsoil available in the project-occupied area separately, strengthening the protection and management of this topsoil, which will be used for later greening. ③ Implement soil and water conservation measures as required	/	25	Contractor	Zhengzhou Water Resources Bureau, Ecological Environment Bureau, Urban Management Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		by the erosion control plan. Conduct regular water and soil conservation monitoring and assign supervisory tasks to qualified units with expertise in construction supervision for soil and water conservation projects. ④ Intensify education and awareness efforts to protect wildlife. Increase signage around the construction area and enforce strict regulations against hunting and harming wildlife. ⑤ If surface vegetation is disrupted during construction, ecological restoration measures should be proposed. Consider local ecological conditions, utilize native topsoil and local species, prevent invasive species, and create a plant community that harmonizes with the surrounding ecological environment.				
Material and Cultural Resources		The Contractor shall establish incidental discovery procedures for the discovery of material and cultural resources: If any cultural relics are discovered during the construction process, in accordance with Article 32 of the Law of the People's Republic of China on the Protection of Cultural Relics, (1) the construction shall be stopped;(2) Protect the site and immediately report to the cultural relics administration Department of	/	/	Contractor	Zhengzhou Water Resources Bureau, Cultural Relics Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		Zhengzhou;(3) adjust the construction plan according to the opinions of the administrative department of cultural relics of Zhengzhou;(4) Construction shall not be resumed until approved by the administrative department of cultural relics.				
Traffic management and road safety		① Safety isolation: Closed management of the construction area. Use color steel plate isolation wall to separate construction and access road, to avoid mutual interference between construction and access. At the same time, the construction unit in the condition of permitting as far as possible to reduce the enclosure, reduce the impact of construction on urban traffic. ② Traffic guidance: through the intersection, crossing, overhead passageway, temporary occupation in front of the location of the road sign indication, inform the vehicle to enter the construction site required road conditions, lanes, speed limit, warning, detour plan and other information, guide the vehicle safety through. In order to ensure that the construction section of the road smooth, the construction unit should be responsible for contacting the local public security traffic police department, in the construction section by sending more police, extend the working hours and other ways to increase the traffic dredging, to ensure that there is no obvious congestion. ③ Construction road traffic sign setting: during the construction at both ends of the construction site, the motor vehicle lane on the right side of the vehicle driving direction set up ahead	/	10	Contractor	Zhengzhou Water Resources Bureau, Traffic Management Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		of the construction slow safety (reflective paint) signs and warning signs. ④ Traffic assistance: When entering the main traffic intersections and special working places in the construction area, the construction unit should increase the coordination with the urban traffic department, and send more personnel to command and channel the traffic. Temporary need to enclose the part, should be set up mobile tools type enclosure and safety warning signs, and take isolation measures in the project dangerous place.				
Occupational Health and Safety		① Wear appropriate personal protective equipment (e.g., protective goggles, masks, safety helmets, safety shoes, etc.). ② Train workers in proper handling and handling of materials during project construction and demolition work, including setting a weight limit for one person (after which mechanical assistance or two people are required to work together); ③ And reasonable working hours. Implement a good site clearance system, such as sorting scattered building materials and demolition items; ④ Training workers in the use and practical use of fall prevention devices; ⑤ And post warning signs in areas where safety risks are present. Use temporary fall protection measures, such as handrails and foot baffles, at the edges of scaffolding and other high working surfaces to prevent material from slipping	/	20	Contractor	Zhengzhou Municipal Bureau of Water Resources, Zhengzhou Bureau of Work Safety Supervision

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		off. ⑥ Planning and zoning vehicle traffic, machinery operations, walking areas, controlling vehicle traffic through one-way traffic rules, imposing speed limits, and directing traffic on site by trained signalmen (wearing smart vests or coats); ⑦ Ensure that personnel wear a statement vest or coat for increased visibility while working or walking in heavy machinery operation areas; ⑧ Ensure that mobile devices are fitted with astern alarms; ⑨ Excavate layer by layer according to the designed slope ratio when the river reaming, pay attention to strengthen the support when the site operation; ⑩ Cable line construction shall be operated in strict accordance with the Construction and Acceptance Standard of Cable Line of Electrical Device Installation Engineering (GB 50168-2018).				
Management of Construction Camp		① The construction site should provide necessary living facilities for the construction personnel, including offices, dormitories, dining halls, toilets, shower rooms, etc. ② The passage and stairs of the living area and office area shall be equipped with emergency evacuation, escape indication signs and emergency lights, which shall comply with the provisions of "Technical Specifications for Fire Safety on Construction Site" (GB50720-2011) and fire safety signs (GB13495-92); ③ The construction site shall be equipped with common	/	20	Contractor	Zhengzhou Water Resources Bureau, Safety Production Supervision Administration, Fire Bureau

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		medicines, bandages, tourniquets and other first aid equipment; ④ The necessary living space shall be guaranteed in the dormitory. The indoor net height shall not be less than 2.5 meters, and the width of the passage shall not be less than 0.9 meters, so as to facilitate normal activities and evacuation in case of emergency. The per capita area of the dormitory shall not be less than 2.5 square meters. ⑤ The dormitory on the construction site shall be equipped with heat prevention and cooling facilities such as air conditioning or electric fans; ⑥ Set up enclosed garbage containers in offices and living areas. Classify and store household waste in a timely manner to reduce the breeding of mosquitoes and insects; Regularly disinfect the construction camp to eliminate mosquitoes, flies, and rodents. ⑦ Grease trap in canteen facilities should be cleaned regularly; ⑧ Flush or mobile toilets shall be set up in dormitories and office areas on the construction site. The toilet floor shall be hardened, with complete doors and Windows and good ventilation. Special personnel shall be responsible for cleaning and disinfecting the toilets regularly. Domestic sewage is connected to the municipal sewage network nearby.				
Surface water during operation		There is currently no supporting municipal sewage pipe network near the 8 service stations. The fecal sewage generated from the supporting public toilets in this project is discharged into outdoor	/	Incorporated into the daily management	Zhengzhou Water Resources	Zhengzhou Bureau of Ecological

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		septic tanks for treatment. A total of 8 tanks will be set up, with a volume of 5m³ each. Regularly clean and connect to the municipal sewage pipe network after the subsequent improvement of the municipal sewage pipe network facilities, and finally discharge into the sewage treatment plant in Zhengdongxin District for treatment.		expenses of the implementing unit	Bureau	Environment
Solid waste during operation period		Domestic waste will be collected in garbage bins and promptly transported by the environmental sanitation department to the local waste transfer station.		Incorporated into the daily management expenses of the implementing unit	Zhengzhou Water Resources Bureau	Zhengzhou Bureau of Ecological Environment
Environmental risks during the operation period		Warning signs such as "slow down, safe driving" should be set up on both sides of the traffic bridge, or according to the road function, dangerous goods vehicles should be prohibited from driving on certain road sections.		Incorporated into the daily management expenses of the implementing unit	Zhengzhou Water Resources Bureau	Zhengzhou Bureau of Ecological Environment
Occupational Health and Safety		(1)Fall protection Fixed protection railings shall be set on the side of the fall surface for working platforms and pedestrian passages (parts) with a height of more than 2.00m.Fixed protective railings shall be installed on the side of the falling surface at the slot of the gate of the hydraulic structure. The height of the protective balustrade is 1.05 ~ 1.2m, the spacing of the vertical or transverse bar is not more than 0.25m, and there is enough strength, the bearing capacity of the protective balustrade is designed according to 500N/m. Where the fall height may be formed during maintenance at 2.00m or more holes and pits should be set up to fix temporary		Incorporated into the daily management expenses of the implementing unit	Zhengzhou Water Resources Bureau	Zhengzhou Bureau of Ecological Environment

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		protective railings with slot holes and other measures. Anti-skid measures shall be taken for stairs and platforms. All protective railings, vent wells, hoist hooks and swivel arms shall be marked with safety signs as specified in Safety Signs. (2)Anti-noise and vibration The noise and vibration source of the project mainly comes from the motor, fan, water pump and transformer on all kinds of equipment. In the equipment bidding for this equipment, the manufacturer is required to provide equipment that meets the noise and vibration standards stipulated by the state. The noise limit value of each place is controlled according to the noise limit value of each work place of water conservancy and hydropower project. The design of each place of production and operation requires that natural ventilation can be ensured as well as noise caused by vibration of ventilation equipment can be reduced. To take personal protection for the operators, the use of anti-sound appliances such as anti-sound earplugs, protective ear muffs, etc. In addition, for employees working in a high-noise environment, they should take turns to shorten working hours. (3)Prevention of mechanical injury Equipment purchasing manufacturers should have qualified professional manufacturing certificate, mechanical equipment operators must be trained, passed the examination to obtain a post qualification certificate before Posting, it is strictly prohibited to operate without a license.				

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		The arrangement of the equipment ensures that the parts or cutting materials are not thrown out of the wounding, and the orientation of the arrangement is conducive to lighting. During the repair, various necessary protective tools should be equipped, such as goggles, glasses, welding masks, protective clothes, etc. The machine repair personnel must operate in accordance with the relevant operating procedures. (4)Prevent electrical injury Power equipment is grounded reliably according to the code requirements. All electrical equipment shell and metal structure, underwater steel mesh of hydraulic buildings are required to be welded together into an electrical path. The roof of each building is set up with lightning arrester to prevent the invasion of direct lightning. The total grounding resistance should meet the specification requirements. Switch cabinet with anti-mis operation function should be selected, and electrical equipment should be equipped with electric locking device to prevent accidents. In the external striking part of the electrical equipment, indicate the live mark, such as grounding sign, danger sign, operation sign, etc. The operation handle of the secondary component or the screen of the equipment are provided with a marking frame, so that the electrical operation personnel is easy to identify, as far as possible to prevent mis operation. The voltage of electrical equipment at all levels is equipped with insulation monitoring devices, and equipped with an appropriate number of electrical testing equipment and insulation tools in line with national regulations, such as insulation gloves, insulation				

Categories	Environmental elements	Mitigation measures	Acceptance criteria	Environmental investment (CNY ten thousand)	Implemented by	Supervised by
		boots, electric test rods, portable work lights, etc. Electrical operation and maintenance personnel must strictly abide by the operating procedures and use these tools according to regulations when working, test tools and insulation equipment must be checked regularly, if there is damage must be removed immediately must not be used to ensure safety.				
Total				CNY 6.03 million		

Table 9-2Social Management Plan

Project risk	Specific measures or actions	Actor	Action time	Sources of funds	Monitoring indicators
1 Risks arising from resettlement, LA and HD	a. Develop a detailed RP b.In the RP, special attention should be paid to how vulnerable groups such as women headed households, MLS, and five guarantees households (if any) use resettlement compensation for income recovery; c.During the transitional period of HD and resettlement, payment of transitional fees shall be paid to the APs, shorten the transitional period as much as possible, complete the resettlement as soon as possible.	Zhengzhou PMO, IA, RP preparation unit, External monitoring unit	Preparation stage, construction period	Project budget	a.Detailed RP b.External Resettlement Monitoring Report, will be submitted quarterly in the first year, and based on the results of AIIB's evaluation of its implementation, be submitted semiannually thereafter.
2 Education and training related to flood control and drainage	a.Special lectures on flood control and disaster relief knowledge, including flood control safety education and training, and flood control emergency drills, were held taking the extremely heavy rainstorm in Zhengzhou as an example. b. Diversified disaster training content (such as earthquake disaster protection, urban flood prevention, extreme weather disaster prevention and risk avoidance, etc.) c. When conducting education and training related to flood control and drainage, special attention is paid to the proportion of women, the elderly, and children participating	IA, Emergency Management Bureau, Flood Control and Drought Relief Headquarters, town governments, sub-district offices	Preparation stage, during construction and operation period	Project budget, government finance	a.Education and training related to thematic flood control and drainage, the proportion of female participation should not be less than 30%. b. Diversified disaster training, the proportion of female participation should not be less than 30% c. Check the learning effectiveness of trainees through disaster prevention drills every year.
3 Participatory river	Implement community participatory river management along the Qili River, and create a good atmosphere and governance mechanism for protecting the water	IA, River Chief Office, Emergency	During the operation period	Project budget, government	a Strengthen the management and governance of rivers and lakes along the Qili River, utilize

Project risk	Specific measures or actions	Actor	Action time	Sources of funds	Monitoring indicators
management along the Qili River	environment in residential areas along the river. a. Improve the river chief system and strengthen relevant river management and governance. b. Establish village river protection teams, clarify the personnel composition of the teams, take responsibility for the river channels within the jurisdiction according to the grid, and take action. c. Regularly carry out river patrol work. d. Create a good atmosphere for everyone to participate in the river management, and promote the concept of loving and protecting the river. e. Dissuade residents from occupying the river channel for personal activities.	Management Bureau, Human Resources and Social Security Bureau, towns/sub-districts where the project is located, and village committee		department financial budget	existing information dissemination platforms to release management information b. Establish a "river protection team" in each village, with at least 20% of female members; c. The number and frequency of community river protection teams participating in the river patrol of the river every year d. The willingness and satisfaction of residents along the river to participate in river management
4 Provide employment opportunities for vulnerable groups such as women and low-income groups	a. Ensure that there is at least 1 female member in all levels of project organization and implementation institutions (such as IA, construction units, etc.) to facilitate the implementation of work related to women; b. Hire a certain number of female staff during the project operation period;	Zhengzhou PMO, IA, Labor Bureau, Village Committee	During the project construction and operation period	IA and operator budget	a.Female members and their numbers in project implementation agencies at all levels;
	c. During the project construction process, while fully respecting individual wishes, ensure that non-technical employment opportunities are given priority to women and low-income groups; d. Provide training opportunities for women and low-	Contractors	Construction period	Contractor budget	b.During project operation, 38 job positions will be provided, with women accounting for no less than 20%; c. During the project construction, 243 job positions will be provided,

Project risk	Specific measures or actions	Actor	Action time	Sources of funds	Monitoring indicators
	income groups recruited and hired; e. Provide labor remuneration that is not lower than the local minimum wage standard based on the actual situation of the work, and equal pay for equal work.				with women accounting for no less than 20% and low-income accounting for no less than 10%; d. Provide safety training, pre job training, and other related training for all female employees, and record the training time, location, and number of participants; e. The salary standard for female employees, and whether they receive equal pay for equal work.
5 Promote women's participation and protection of women's rights and interests at all stages of the project (including prevention of GBV)	a.Ensure that the participation rate of women in various public participation activities of the project is not less than 30%; b. When promoting project information, the time, location, and format should fully consider the needs of women and the characteristics of their labor activities, and be carried out during their free time; c. Promote in a way that is easily accepted by women, taking into account their cultural level, cognitive abilities, etc. d. The construction units should provide regular psychological health counseling and rights protection	Zhengzhou PMO, IA, WF	Construction period; operation period	Program budget, government finance	a.Record the content and frequency of public participation activities during the project implementation, ensuring that the proportion of female participants is not less than 30%; b. Project information promotion and training conducted in a time, place, and manner acceptable to women, as well as the number/proportion of female participants;

Project risk	Specific measures or actions	Actor	Action time	Sources of funds	Monitoring indicators
	training for female workers; e. The construction units should strengthen the supervision of the construction site (to avoid the occurrence of harmful behaviors such as GBV, sexual exploitation and abuse, sexual harassment, etc.), establish clear channels for appeal and complaint, establish a construction site appeal and complaint team, including at least 2 female members, and ensure the safety of the members of the appeal and complaint team (to avoid bias and fear of retaliation among team members)	Contractors	Construction period	Contractor budget	c. Provide women's mental health counseling, GBV prevention, and labor rights protection training; d. The number of women participating in skill training. e. The regulatory measures taken by the construction unit to prevent sexual harassment, the establishment and staffing of the appeal and complaint team, and the smooth operation of the appeal and complaint mechanism.
6 Avoiding social risks during project constructio n period	a.The construction units should strengthen health and infectious disease prevention education and publicity, and carry out diversified infectious disease prevention propaganda activities; The prevention of AIDS, COVID-19 and other infectious diseases shall be included in the contract documents; Regularly conduct physical examinations and identify health hazards (such as setting up temporary medical clinics, fully utilizing local medical resources, etc.); b. Regularly conduct civilized construction education and training for construction personnel, and invite prestigious elders or knowledgeable village representatives or village cadres in the project area to carry out promotional activities on local social and cultural customs;	Contractors Supervision and assistance units: Health bureau, IA, town governments/sub-district offices, village	Construction period	Contractor budget, health bureau budget	a.The construction contract includes clauses on infectious disease prevention and monitors their implementation. b. Public security and AIDS, COVID-19 prevention training courses and number of participants. c. Temporary medical room or local medical resource situation d. Publicity of AIDS, COVID-19 and other infectious diseases prevention and control knowledge

Project risk	Specific measures or actions	Actor	Action time	Sources of funds	Monitoring indicators
	c. During the construction period, the contractors should take appropriate risk mitigation measures in accordance with the requirements of the ESMP. For example, during the construction period, safety work should be done well, construction time and site should be arranged reasonably, scientific construction plans should be formulated, surrounding operations should be carried out, and risk warning signs should be set up, etc.; d. Prior to construction, do a good job in river excavation and investigation, and be careful not to have electrical wires, water pipes, and gas pipelines underground at the construction site; e. Post construction information near the outer wall of the construction fence and sensitive points, including project name, construction duration, construction content, etc., and reserve the name and contact information of the person in charge of the site. Assign dedicated personnel to handle complaints and issues raised by residents.	committee			during the project construction stage; e. The promotion and education of local social, cultural, and customary knowledge during the construction phase of the project; f. Measures for promoting and educating the safety awareness of construction personnel; g. The disclosure of construction information during the construction period, the number and effectiveness of warning signs installed; h. Feedback from local village committees or residents
7 Improve the labor force security system and safeguard the legitimate rights and interests of workers	a. Clearly stipulate that in the employment process, the principles of equal opportunity and fair treatment should be adhered to when hiring project staff, and personal characteristics unrelated to inherent job requirements should not be discriminated against; b. Provide appropriate protection and assistance measures for specific groups of workers, such as women, people with disabilities, migrant workers, and children of legal age, to address project staff deficiencies;	Contractors Supervision and units: PMO, IA, Human Resources and Social Security Bureau	Construction period	Contractor budget, government finance	a.The number/proportion of special groups such as women and people with disabilities among the employed workers; b. Protective measures and regulations for women, people with disabilities, and workers aged 16 to 18; c. The establishment and operation of workers'

Project risk	Specific measures or actions	Actor	Action time	Sources of funds	Monitoring indicators
	c. Assist workers in establishing workers' organizations in accordance with national laws and regulations. Workers have the right to establish and join workers' organizations of their choice and ensure that their collective bargaining is not interfered with; d. Suggest signing a labor agreement for temporary workers to protect their labor rights and economic benefits e. Establish and clarify a complaint mechanism for handling labor complaints, clarify the labor protection supervision mechanism, and protect personal privacy in accordance with the law when handling sexual harassment complaints. The labor complaint mechanism is consistent with the GRM of this project.				organizations; d. The establishment and smooth flow of the GRM, preventive measures for handling sexual harassment, and feedback and suggestions from women.
8 Strengthening institutional capacity building	During the project implementation, the Zhengzhou PMO will organize external experts to provide preliminary training on the implementation of the ESMP for the ES commissioners of the project IA, construction units, and supervision units. The training content includes the ESP of the AIIB, good management practices during the construction process, monitoring and reporting, and GRM.	Zhengzhou PMO	Implementation phase	Program budget	Training times, contents, number of participants, and satisfaction

9.3 Monitoring and Reporting

9.3.1 Environmental Monitoring

9.4.1.1Construction Period Monitoring Plan

(1)Surface water monitoring

Setting of monitoring points: Qili River Flood Control and Enhancement Project Upstream 100m、Qili River Flood Control and Enhancement Project Middle Section、Qili River Flood Control and Improvement Project downstream 500m, 3 monitoring sections are set.

Monitoring items: pH, DO, volatile phenols, COD, BOD5, ammonia nitrogen, total phosphorus, total nitrogen, petroleum, high manganese index, sulfide, copper, zinc, lead, mercury, arsenic, selenium, cadmium, hexavalent chromium, anionic surfactants, a total of 20 items.

Monitoring program: In accordance with the "Surface water Environmental Quality Standards" (GB3838-2002) and "Surface Water and sewage Monitoring Technical Specifications" (HJ/T91-2002) the method of implementation.

Monitoring period and frequency: the project construction is completed in a non-flood season, monitoring once before construction as the background value, monitoring 1 time during the construction period, 1 time after the end of construction, continuous monitoring for 2 days per period.

Implementation standard: "surface water environmental Quality Standard" (GB3838-2002) in the Class IV standard.

(2)Noise

In order to protect the health of residents around the construction site, noise monitoring should be carried out on residential areas near the project.

Monitoring sites were set up: County Party school, Dayong Village, Jindi Mingyue;

Monitoring items: equivalent continuous A sound level (LAeq(A));

Monitoring program: "Urban Area Environmental Noise Measurement Method" (GB, T14623-93)

Monitoring period and frequency: monitor once before the construction as the background value, monitor once every quarter during the construction period (the priority is to monitor during the construction peak period), monitor for 2 days in each period, including day and night.

Implementation standard: "Sound Environmental Quality Standard" (GB3096-2008) Class 1 / Class 2.

(3)Environmental air quality monitoring

Select large quantities of engineering and nearby residential sites as representatives for distribution.

Monitoring points: choose one residential community around the construction site.

Monitoring methods: Requirements and provisions of "Environmental Air Quality Standard" (GB3095-2012) and "Environmental Air Monitoring Quality Code" (trial).

Monitoring items: TSP, PM_{10}

Monitoring period and frequency: monitor the background value once before construction, monitor the background value once every quarter during construction (priority is chosen during the construction peak period), and monitor each period for 3 days.

9.4.1.2Operation Period Monitoring Plan

(1)Surface water monitoring

Setting of monitoring points: Qili River Flood Control and Enhancement Project Upstream 100m、Qili River Flood Control and Enhancement Project Middle Section, Qili River Flood Control and Improvement Project downstream 500m, 3 monitoring sections are set.

Monitoring items: pH, DO, volatile phenols, COD, BOD5, ammonia nitrogen, total phosphorus, total nitrogen, petroleum, high manganese index, sulfide, copper, zinc, lead, mercury, arsenic, selenium, cadmium, hexavalent chromium, anionic surfactants, a total of 20 items.

Monitoring period and frequency: Monitor once a year during the period of abundant water, dry water and flat water.

9.3.2 Social monitoring

Monitoring and evaluation is an important mitigation measure to ensure that the project is implemented in accordance with project objectives, to ensure project information disclosure, public participation, and to prioritize and implement the SMP designed in this report. It is also an important error correction and participation mechanism for this project. Therefore, this project has established a supervision and evaluation mechanism, including internal supervision and external monitoring and evaluation.

Internal supervision: The Zhengzhou PMO will monitor and evaluate the implementation progress of the proposed project, the implementation of the SMP, the progress of information disclosure and public participation plans, the use of project funds, and the implementation of rules and regulations, the monitoring report will be submitted quarterly in the first year of the project, and based on the results of AIIB's evaluation of its implementation, be submitted semiannually thereafter.

External M&E: The Zhengzhou PMO will hire an independent monitoring institution recognized by the AIIB and with ten years or more of experience in social and resettlement M&E of international financial organization loan projects such as the AIIB, the World Bank, and the ADB to carry out external monitoring of the implementation of the SMP. Independent M&E units regularly track, monitor and evaluate the implementation activities of the SMP, provide consultation opinions, and submit monitoring reports to the AIIB.

9.3.3 External Monitoring Report

Based on the requirements of the AIIB for ES monitoring, external monitoring agencies should prepare external monitoring reports based on the data obtained from observations and investigations. Its main purposes are: 1) objectively reflect the progress and existing problems of ES related measures to the AIIB and the PMO; 2) Evaluate the effectiveness of measures implementation, propose constructive opinions and suggestions, and improve ES related work.

The ES monitoring report will be submitted quarterly in the first year of the project, and based on the results of AIIB's evaluation of its implementation, be submitted semiannually thereafter.

9.4 Budget

The cost of implementing and managing ES mitigation measures is CNY 6.83 million, including: 1) the cost of measures during the construction period, including barriers, watering, building material covering, drainage ditches, sound barriers, traffic signs, etc., totaling CNY 6.03 million, to be borne by the contractor (as part of the construction contract); 2) ES monitoring costs of CNY 0.50 million; 3) The cost of capacity building and training for project management institutions is CNY 0.10 million, which will be borne by Zhengzhou Water Resources Bureau. 4) Training sessions for women and MLS workers, public participation activities, and complaints, totaling CNY 0.10 million; 5) Other flood prevention publicity, education and training, etc., totaling CNY 0.10 million.

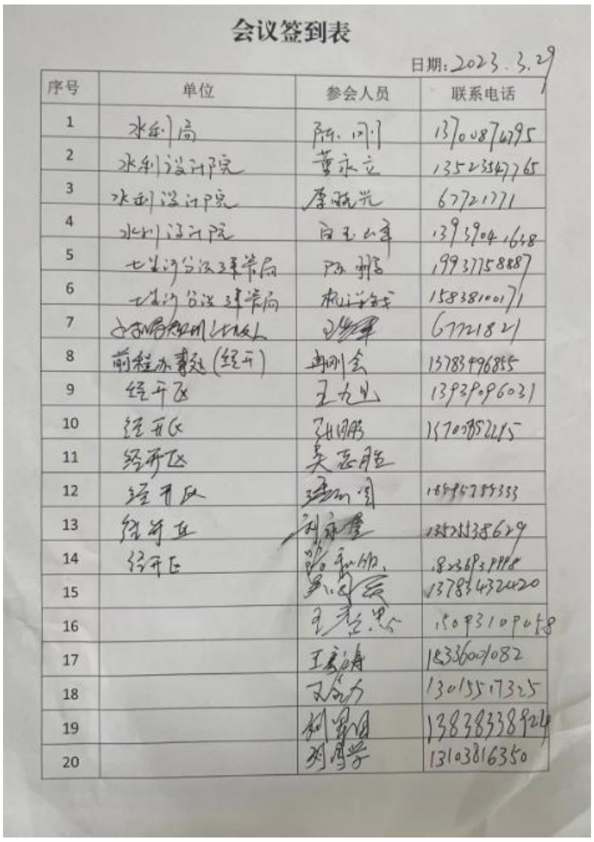
Appendix 1: Partial Focus Group Discussion Record

Districts /counties	Town / sub-district	Village	Meeting Time	Number of participants (including women, the low-income group)	Investigation method and content
Zhengdongxin District	Baisha Town	Baisha Village	2023.3.30	20(10,2)	**Resident symposium and women's focus group discussion:** 1.The Qili River passes through the village with average water quality. In summer, there are many mosquitoes and insects along the river, and there is a foul odor, but it is not very obvious. 2. The silt at the bottom of the river accumulates year-round, and I remember that there was a flood every few years, but the most serious one was the 7.20 flood. There was a lot of land flooded by the river, but there was not much loss in this village. 3. Currently, there are only small roads by the river, which are in poor condition and cannot be used for transportation. It would be much more convenient to build a road by the river while repairing the embankment. 4. Support the comprehensive management of the Qili River by the project. 5. Women: During the implementation of the project, there may be large vehicles passing through the village, hoping to slow down and pay attention to pedestrian safety. 6. Women: I hope to have the opportunity to participate in projects, do some non-technical work, work at home, and increase income.
ZEDZ	Qiancheng Sub-district	Nansi village	2023.3.30	22(13,3)	**Resident symposium and women's focus group discussion:** 1.There is no contracted land by the river and no villagers' housing. There is now a road by the river, but the road condition is not good, and not all the roads in the village

Districts /counties	Town / sub-district	Village	Meeting Time	Number of participants (including women, the low-income group)	Investigation method and content
					have been repaired, making it inconvenient for vehicles to enter and exit; 2. There is a bridge in the village, and during 7.20 flood, the flood had already overflowed and could not be used as an emergency passage. Cannot walk during floods; 3.If the embankment top road can be built, it is best to connect it with other roads to improve transportation in the village. 4. Very supportive of project construction; 5. I hope to build a safe bridge to facilitate the passage of both sides; 6. Women: Looking forward to the project providing new activities and leisure venues for the community; I hope to pay attention to protecting the environment and ensuring the quality of the project during the implementation process; The situation of women affected by the project is no different from that of male villagers.
Zhongmou County	Guanghui Sub-district	Liushenzhuang village	2023.3.31	21(9,3)	**Resident symposium and women's focus group discussion:** 1.The transportation in this village is relatively convenient, with the main roads including Wansan Road and Shangdu Avenue, and there are no regular roads by the river. There are often traffic jams during rush hours on Shangdu Avenue. 2. During the construction period of the project, there may be an increase in engineering vehicles, and traffic congestion may worsen. Special attention should be paid to traffic safety. 3. The frequent traffic of construction vehicles can easily

Districts /counties	Town / sub-district	Village	Meeting Time	Number of participants (including women, the low-income group)	Investigation method and content
					damage village roads. It is necessary to strictly manage them, avoid speeding or overloading, and try to avoid village roads and take main roads. 4. We strongly support the project construction and hope to dredge the river channel to reduce floods. 5. It is necessary to train the villagers in flood control and disaster reduction to let them know how to prepare for disaster prevention or how to escape in case of extremely heavy rainstorm. 6. Women: Looking forward to the project adding riverside greenery to the community, increasing leisure activity venues, and improving the village environment; The situation of women affected by the project is no different from that of male villagers. 7. Women: Willing to engage in some auxiliary and non-technical work in the project. Technical work may not have relevant skills and cannot be done.

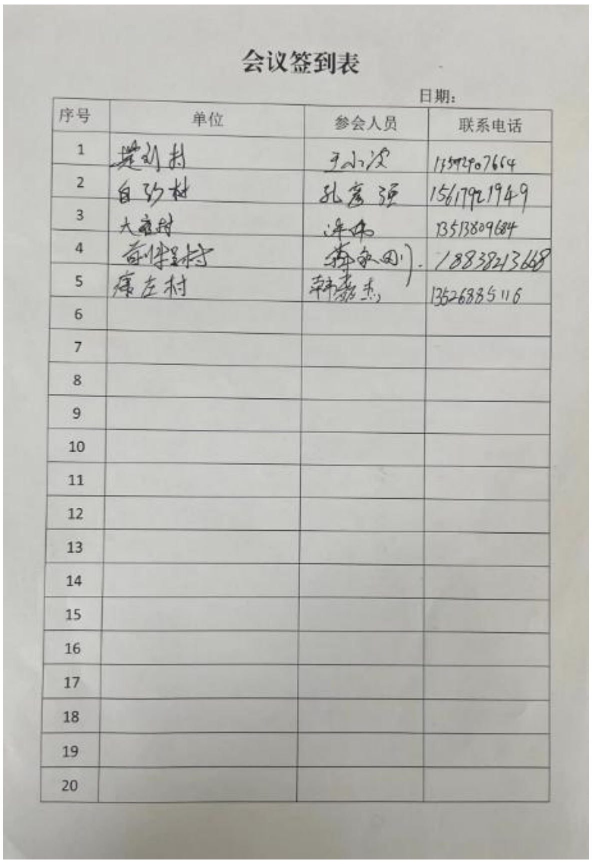
Appendix 2: Registration Form of Interviewees



会议签到表

日期：2023.3.29

序号	单位	参会人员	联系电话
1	水利局	陈刚	13700876295
2	水利设计院	董永立	13523347765
3	水利设计院	李巍光	67721771
4	水利设计院	白玉峰	13939041648
5	七里河分洪工程管局	陈鹏	19937758887
6	七里河分洪工程管局	[illegible]	15838100171
7	[illegible]	[illegible]	67721821
8	前程办事处（经开）	[illegible]	13783496855
9	经开区	王九山	13939096031
10	经开区	张鹏	15700852215
11	经开区	吴[illegible]	
12	经开区	[illegible]	[illegible]
13	经开区	刘[illegible]	[illegible]
14	经开区	[illegible]	[illegible]
15		[illegible]	13783432420
16		[illegible]	[illegible]
17		[illegible]	18336001082
18		[illegible]	13013517325
19		[illegible]	13838338924
20		[illegible]	13103816350



会议签到表

日期：

序号	单位	参会人员	联系电话
1	[illegible]村	王小波	[illegible]
2	[illegible]村	孔[illegible]	15617921949
3	大[illegible]村	[illegible]	13513809684
4	[illegible]村	[illegible]	18838213668
5	[illegible]庄村	[illegible]	13526885116
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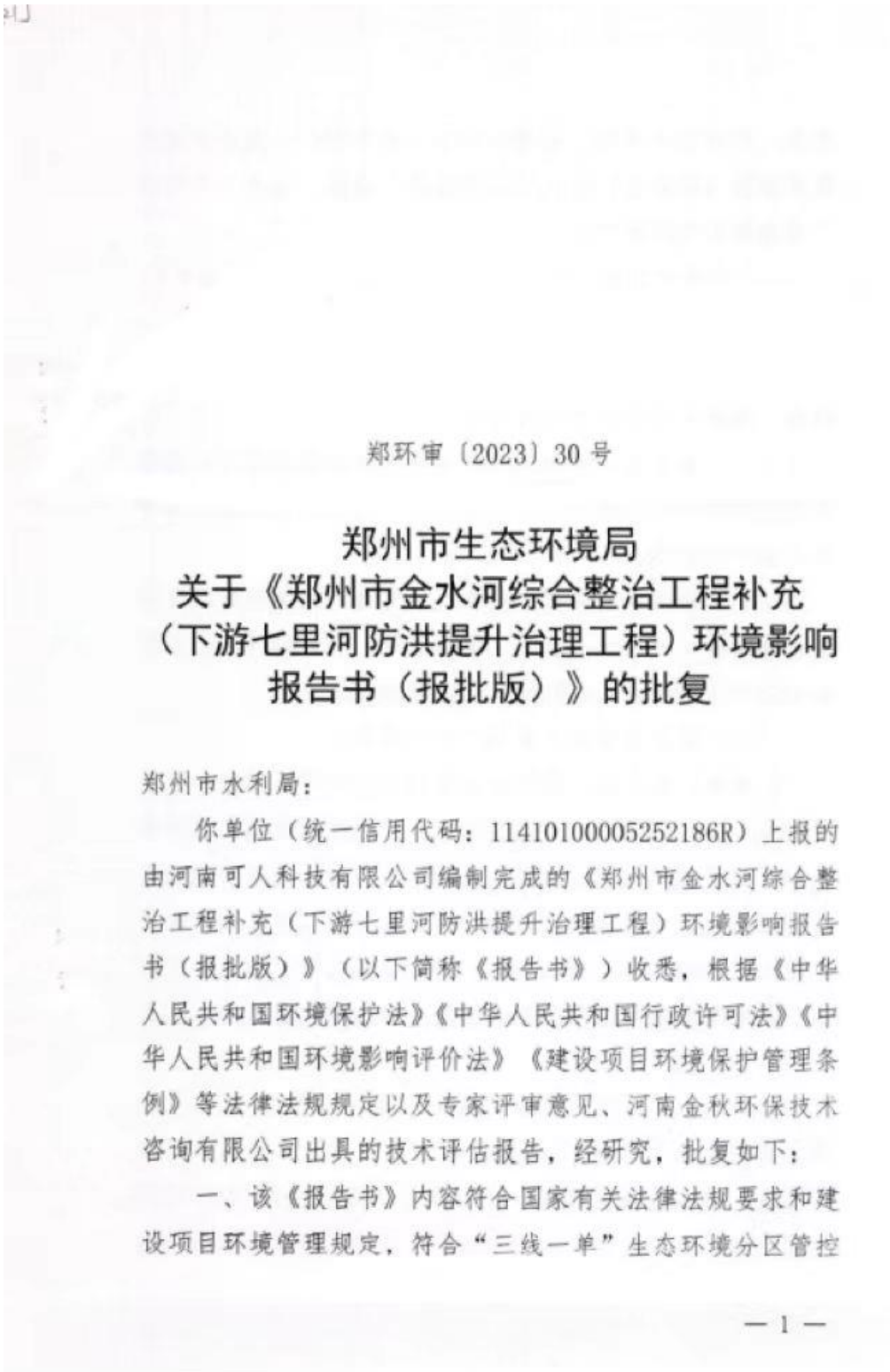
Appendix 3: Approval of the DEIA



郑环审〔2023〕30号

郑州市生态环境局
关于《郑州市金水河综合整治工程补充（下游七里河防洪提升治理工程）环境影响报告书（报批版）》的批复

郑州市水利局：

你单位（统一信用代码：11410100005252186R）上报的由河南可人科技有限公司编制完成的《郑州市金水河综合整治工程补充（下游七里河防洪提升治理工程）环境影响报告书（报批版）》（以下简称《报告书》）收悉，根据《中华人民共和国环境保护法》《中华人民共和国行政许可法》《中华人民共和国环境影响评价法》《建设项目环境保护管理条例》等法律法规规定以及专家评审意见、河南金秋环保技术咨询有限公司出具的技术评估报告，经研究，批复如下：

一、该《报告书》内容符合国家有关法律法规要求和建设项目环境管理规定，符合“三线一单”生态环境分区管控

— 1 —

要求，评价结论可信。我局批准该《报告书》，原则同意你单位按照《报告书》所列项目的性质、规模、地点和环境保护措施进行项目建设。

二、你单位应向社会公众主动公开经批准的《报告书》，并接受相关方的垂询。

三、你单位应全面落实《报告书》提出的各项环境保护措施，确保各项污染物达标排放。

（一）向设计单位提供《报告书》和本批复文件，确保项目设计符合环境保护设计规范要求，落实防治环境污染和生态破坏的措施。

（二）依据《报告书》和本批复文件，对项目建设及运营过程中产生的废水、废气、固体废物、噪声等污染，采取相应的防治措施及生态环境影响减缓措施。

（三）项目污染控制应满足以下要求：

1. 废水。施工期，基坑排水经沉淀池处理后回用于现场洒水降尘；施工设备、车辆清洗废水经隔油沉淀池处理后回用于车辆清洗及施工场地抑尘喷洒，不外排；施工营地施工人员生活污水经化粪池处理后定期清掏肥田。运营期，配套公厕产生的粪污水排入化粪池，定期清掏处理，待后续市政污水管网设施完善后接入市政管网，排入郑州新区污水处理厂。

2. 废气。加强扬尘管控和施工机械尾气管控，严格落实扬尘治理“八个100%”要求，施工场地采取设置围挡、物料覆盖、洒水抑尘等措施，扬尘管控应满足《郑州市2023年蓝天保卫战实施方案》、《城市房屋建筑和市政基础设施

工程及道路扬尘污染防治标准》（DBJ41/T174-2020）、《河南省建筑施工现场扬尘防治管理暂行规定》和《郑州市人民政府办公厅关于印发进一步加强大气污染防治工作十条措施的通知》（郑政办〔2021〕42号）中要求；施工期废气排放应满足《大气污染物综合排放标准》（GB16297-1996）。底泥晾晒恶臭采取加强封闭措施、降低底泥含水率等措施减轻对周围大气环境的影响。

3. 噪声。施工期噪声采取安装临时声屏障、选用低噪声设备、合理布设施工设备和运输路线、加强设备的维护和保养、合理安排施工和运输时间等降噪措施，确保厂界噪声满足《建筑施工场界环境噪声排放标准》（GB12523-2011），周边敏感点噪声应满足《声环境质量标准》（GB3096-2008）2类标准。

4. 固体废物。施工期，剩余土方含疏挖淤泥（晾晒后）运至邻河5块绿地内作为绿地工程生态景观微地形塑造；沉淀池泥浆自然风干后，填埋于沉淀池中；建筑垃圾优先回收利用，不能利用的部分运至政府指定的消纳场；隔油沉淀池废油泥交有资质单位进行清理处理；生活垃圾收集后交由环卫部门统一处理。运营期，游客产生的生活垃圾收集后交由环卫部门处理。各类固体废物贮存、处置应满足满足《一般工业固体废物贮存和填埋污染控制标准》（GB18599-2020）、《危险废物贮存污染控制标准》（GB18597-2023），避免对环境造成二次污染。

5. 落实各项生态恢复措施。施工期严格控制施工范围，统筹规划施工布置，减少施工临时占地，土方临时堆存应进

行遮盖和防护，减少水土流失；施工结束后对施工临时占地进行生态恢复。

（四）认真落实《报告书》提出的环境风险防范措施和要求，防止发生污染事故。

（五）如果今后国家或我省、市颁布污染物排放限值的新标准，届时你单位应按新的排放标准执行。

四、你单位应严格执行环境保护设施与主体工程同时设计、同时施工、同时投产使用的环境保护“三同时”制度。项目建成后，应按规定实施竣工环境保护验收。

五、项目日常环境管理工作由郑州市生态环境局中牟分局、经开分局、郑东新区分局负责，市生态环境综合行政执法支队负责综合行政执法工作。

六、批复有效期为5年。如该项目逾期方开工建设，其环境影响报告书应报我局重新审核；如项目建设发生重大变更，应重新进行环境影响评价。

2023年7月6日

主办：局环评处

郑州市生态环境局办公室　　2023年7月6日印发